SYSTEMATICS WITHIN THE CERYLONID SERIES (COLEOPTERA: CUCUJOIDEA)

by

NATHAN PATRICK LORD

(Under the Direction of Joseph V. McHugh)

ABSTRACT

A molecular phylogenetic analysis was conducted for Latridiidae (Coleoptera: Cucujoidea). Seven genes (18S rDNA, 28S rDNA, 12S rDNA, 16S rDNA, cytochrome oxidase I and II, and histone III) were analyzed. Twenty-seven latridiid species were included, representing both subfamilies. Eight outgroup taxa from other families of Cucujoidea were included. Parsimony and partitioned Bayesian analyses were performed on the combined data set. In both phylogenetic analyses, the enigmatic genus *Akalyptoischion* (Latridiinae) was recovered outside of Latridiidae. A new family, Akalyptoischionidae **fam n.** is erected based on the results of the phylogenetic study and anatomical considerations.

A revision of the genus *Deretaphrus* Newman 1842 (Coleoptera: Bothrideridae) is presented. The majority of the world's holdings for the genus were borrowed and studied. A taxonomic treatment of the genus was conducted. Presented are a key to the species, species descriptions, distribution maps, label data, biological information, and figures and illustrations. Seven new species are described.

INDEX WORDS: Coleoptera, Cucujoidea, Cerylonid Series, Bothrideridae, Latridiidae, Akalyptoischionidae, *Deretaphrus*, *Akalyptoischion*, phylogenetic analysis, taxonomic revision.

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CHAPTER 1

INTRODUCTION

This thesis, written in manuscript style, presents two separate research projects that aim to improve the taxonomic condition of the Cerylonid Series of the beetle superfamily Cucujoidea (Coleoptera). The first study (Chapter 3) is a molecular phylogenetic study of the Minute Brown Scavenger Beetles (Cucujoidea: Latridiidae). The manuscript presenting this work will be submitted to *Systematic Entomology*. The second study (Chapter 4) is a taxonomic revision of the genus *Deretaphrus* Newman (Cucujoidea: Bothrideridae). This manuscript will be submitted to *Zootaxa*.

CHAPTER 2

LITERATURE REVIEW

The superfamily Cucujoidea is a large and diverse assemblage of Coleoptera, currently comprising 34 families and more than 19,000 species. The majority of those families fall into an informal category of taxonomically difficult beetle groups referred to as the "LBBs" (Little Brown Beetles). Cucujoid beetles are generally small, nondescript, brown to black, and lead cryptic lifestyles. Members of the Cucujoidea have been difficult to characterize, and many families are considered "taxonomic dumping grounds" (Crowson, 1955). In comparison to the other large superfamilies of beetles, Cucujoidea has been little studied.

A subgroup of eight of the 34 commonly recognized families of the Cucujoidea, the Cerylonid Series (C.S.), has been hypothesized to form a clade: Alexiidae, Bothrideridae, Cerylonidae, Coccinellidae, Corylophidae, Discolomatidae, Endomychidae and Latridiidae (Sen Gupta and Crowson, 1973; Slipinski, 1990; Slipinski and Pakaluk, 1991). Although representing less than a quarter of the family-level diversity in Cucujoidea, the Cerylonid Series comprises most of the genus and species-level cucujoid diversity (Lawrence and Newton, 1995). Similar to the superfamily as a whole, however, the Cerylonid Series has few discrete characters supporting its monophyly, and much of the group is in serious need of taxonomic revision. The C.S. is generally defined by the following adult characters: reduced tarsal formula (4-4-4 or 3-3-3 in both sexes), anal veins in wing reduced, wing lacking a closed radial cell, and aedeagus of a distinctive "cucujoid ring-form," resting on its side when retracted, tegmen reduced. In addition,

a number of larval features have been given as characteristics of the C.S., such as a unisetose tarsungulus, usually annular spiracles, and the sensory appendage of 2nd antennomere usually as long as the third antennomere (Robertson *et al*., 2008). There have been few studies of the classification of the Cerylonid Series (Paulian, 1988; Sasaji, 1987; Pal and Lawrence, 1986; Sen Gupta and Crowson, 1973; Slipinski and Pakaluk, 1991), and the internal relationships of the group are just beginning to be explored (e.g. Robertson *et al.*, 2008).

In an effort to reduce the taxonomic instability of the Cerylonid Series, two families, Latridiidae and Bothrideridae, were selected to be the focus of taxonomic and revisionary work. These are among the most poorly-understood Cerylonid Series families, with much undescribed diversity. Both families contain enigmatic genera, and several workers have questioned the monophyly of these groups (Fall, 1899; Crowson, 1955).

The family Latridiidae Erichson, commonly known as the "minute brown scavenger beetles," is an obscure, cosmopolitan group with 29 genera and over 1000 species. Latridiidae is divided into two subfamilies, Latridiinae Erichson and Corticariinae Curtis (Andrews, 2002). These beetles are very small (1-3 mm) and live cryptic lifestyles. They are most commonly found in decaying leaf litter and other organic matter. The family is defined by a 3-3-3 tarsal formula, elongate-oval shape, and generally small size. The lack of stronger family-level characters has caused many taxonomic problems within Latridiidae, especially for the internal classification. The placement of certain genera, most notably *Akalyptoischion*, has been questioned (Fall, 1899; Crowson, 1955; Andrews, 1976). Although the family appears natural (Slipinski and Pakaluk, 1991), no formal phylogenetic analysis has ever been performed to clarify the constitution of the group, test the validity of the internal classification, and investigate evolutionary transitions within the family.

Bothrideridae Erichson is a small family of poorly known beetles comprising four subfamilies and more than 400 species. Bothrideridae has been classified as various tribes or subfamilies within the tenebrionoid family Colydiidae. Currently the family is placed within the Cerylonid Series of the Cucujoidea. Bothrideridae is divided into four subfamilies: Bothriderinae Erichson, Teredinae Seidlitz, Anommatinae Ganglbauer, and Xylariophilinae Pal and Lawrence. Bothriderids are found in all major zoogeographical regions of the world and have a very interesting natural history (Philips and Ivie, 2002). Although little is known about their biology, all bothriderids are closely associated with the galleries of wood-boring insects, either as fungus feeders (Teredinae, Xylariophilinae) or ectoparasites and predators (Bothriderinae) in both the larval and adult stages (Lawrence, 1991). Bothriderids are extremely diverse morphologically, exhibiting a broad range of body forms. This wealth of anatomical diversity has led to a great deal of taxonomic instability in the classification of the group. Many genera require taxonomic revision, and the overall constitution of the family remains unclear.

Within Bothrideridae, *Deretaphrus* Newman is particularly problematic. *Deretaphrus* is a moderately large genus (27 nominal species) with an odd distribution. Most species occur in Australia (Carter, 1937); however, one species is widespread in the Western United States (Horn, 1873), and another, newly discovered species, occurs in Bolivia. Morphologically, *Deretaphrus* differs from the rest of Cucujoidea, the Cerylonid Series, and Bothrideridae itself in a number of aberrant characters. The species have nomenclatural problems and there is much undescribed diversity. *Deretaphrus* is in need of a comprehensive taxonomic revision (Heinze, 1943).

Due to their diverse morphology and cryptic lifestyles, large changes likely will be made to many of the families of the Cerylonid Series. Of these families, Bothrideridae and Latridiidae

are prime candidates for focused taxonomic studies. This thesis represents one of the first in a number of works currently underway that are aimed at reforming the Cerylonid Series.

CHAPTER 3

PHYLOGENETIC ANALYSIS OF THE MINUTE BROWN SCAVENGER BEETLES (COLEOPTERA: LATRIDIIDAE), AND RECOGNITION OF A NEW BEETLE FAMILY, AKALYPTOISCHIONIDAE, FAM. N. (COLEOPTERA: CUCUJOIDEA)[1]

[1]Lord, N.P., C.S. Hartley, K.B. Miller, J.F. Lawrence, J.V. McHugh, and M.F. Whiting. To be submitted to *Systematic Entomology*.

Abstract:

The first phylogenetic hypothesis was inferred for Latridiidae (Coleoptera: Cucujoidea), a cosmopolitan family of small, mycophagous and myxomycophagous beetles. Portions of seven genes (18S rDNA, 28S rDNA, 12S rDNA, 16S rDNA, cytochrome oxidase I and II, and histone III) were analyzed. Twenty-seven latridiid species were included, representing both subfamilies and more than half of the currently recognized genera. Eight outgroup taxa from other families of Cucujoidea were included. Parsimony and partitioned Bayesian analyses were performed on the combined data set. In both phylogenetic analyses, the enigmatic genus *Akalyptoischion* (Latridiinae) was recovered outside of Latridiidae. The subfamilies Corticariinae and Latridiinae (without *Akalyptoischion*) were recovered as monophyletic in both analyses. Mycophagy was the ancestral condition in Latridiidae (minus *Akalyptoischion*). Myxomycophagy had at least two independent origins within the family. Reduction of the eyes and wings each occurred at least four times within Latridiidae. A new family, Akalyptoischionidae **fam n.** is erected based on the results of the phylogenetic study and anatomical considerations.

Introduction:

Latridiidae Erichson, commonly known as the “minute brown scavenger beetles,” is an obscure, cosmopolitan group of 29 genera and more than 1050 species divided between two subfamilies, Latridiinae Erichson and Corticariinae Curtis (Andrews, 2002). Latridiids are small (1-3 mm), cryptically colored (brown to black) beetles. The main diagnostic characters used to separate this family from the rest of Cucujoidea are the small size, 3-3-3 tarsal formula, and elongate-oval shape. The lack of clear, convincing, family-level characters has caused instability in the internal classification and membership of Latridiidae. The placement of certain genera,

most notably *Akalyptoischion* Andrews and *Eufallia* Muttkowski, has been questioned, however, no alternative placements were proposed (Fall, 1899; Crowson 1955, Andrews 1976c). The composition of several other genera remains ambiguous. Although Slipinski and Pakaluk (1991) state that the family appears natural, no phylogenetic analysis of Latridiidae has ever been done to address this question or to clarify internal relationships of the family.

Classification: There has been considerable confusion over the valid name for this family. The oldest available family-group name is Corticariidae Curtis, 1829. However, a family group name based on the genus *Latridius* was proposed by Erichson (1842), and it has been used almost exclusively ever since (Hartley & McHugh, in press). Although we recognize that the name Corticariidae Curtis, 1829 has priority over Latridiidae Erichson, 1842, we use the latter (commonly used) name in this paper until the nomenclatural issues can be more thoroughly reviewed and formally addressed.

Since the family was erected, several significant changes have been made to its taxonomic composition. Latridiidae first included four tribes: Dasycerini Reitter, 1877, Merophysiini Seidlitz, 1872, Lathridiini Erichson, 1842, and Corticariini Curtis, 1829. Belon (1898) included the Dasycerini in the Lathridiini. He later circumscribed a fifth tribe (Belon, 1902), Holoparamecini Belon, to include taxa previously placed in the Merophysiini. Crowson (1955) included Latridiidae in the Cerylonid Series of the superfamily Cucujoidea, elevated the tribe Dasycerini to family status (Dasyceridae) within the Staphylinoidea, and elevated Lathridiini and Corticariini to subfamilial status (Lathridiinae and Corticariinae) within the Latridiidae. He also transferred Merophysiini and Holoparamecini from Latridiidae to a new family, Merophysiidae (Crowson, 1955), although they were subsequently placed in

Endomychidae (Lawrence and Newton, 1995). Several other genera (*e.g.*, *Ostomopsis* Scott, 1922) have been included or excluded from Latridiidae.

Several morphological characters diagnose the two currently recognized subfamilies, Latridiinae and Corticariinae (see Andrews 1976c, 2002; Fall, 1899; Watt, 1969). Members of the subfamily Latridiinae have widely separated procoxal cavities that are broadly closed behind. The clypeus is at a lower plane than the frons and is sharply delimited by a deep, transverse suture. Latridiines are generally glabrous and are frequently covered with a waxy secretion. The pronotum of latridiines often has conspicuous grooves and carinal ornamentation. Members of the subfamily Corticariinae have narrowly separated procoxal cavities that are broadly closed behind. The clypeus and frons are on the same plane and separated by a fine transverse suture or with this suture absent. Corticariines are generally pubescent and lack the grooves, carinae, and waxy exudate common in latridiines.

Belon (1898, 1900, 1902) conducted a worldwide treatment of the family and reviewed generic definitions within the Latridiidae. Following this work, several new genera were described, and other genera were reclassified or synonymized. Nomenclatural instability within Latridiidae persists, as outlined by Walkley (1948, 1952).

Biology: Latridiids occur in nearly all major biogeographical regions and terrestrial habitats. Adults and larvae are frequently found in decaying vegetation where they feed predominantly on the spores and conidia of Ascomycetes (Eurotiales, Erysiphales, Pyrenomycetes), Deuteromycetes, and Zygomycetes (Mucorales) (Lawrence, 1977, 1991; Lawrence and Newton, 1980). Two genera (*Enicmus* Thompson, *Revelieria* Perris) feed on the spores of Myxomycetes (Stephenson *et al.*, 1994). Thirty species, representing many genera, have been associated with

stored food products (Hinton, 1941a). *Eufallia seminiveus* Motschulsky is of minor medical significance since it is known to bite humans (Parsons, 1969).

Morphological evolution: Although a small family, Latridiidae exhibits much anatomical diversity. Unusual features include: aptery and brachyptery (*Akalyptoischion, Dienerella* Reitter, *Metophthalmus* Wollaston, *Fuchsina* Fall, *Revelieria*) (Fig. 3.6), fused elytra (*Metophthalmus, Akalyptoischion, Dienerella, Revelieria),* anophthalmy and microphthalmy (*Fuchsina, Akalyptoischion, Dienerella, Metophthalmus, Eufallia, Adistemia* Fall) (Figs. 3.7; 3.8), elongated cylindrical trochanters (*Eufallia*, *Mumfordia* van Dyke, *Eufalloides* Hinton, *Herfordia* Halstead, *Metophthalmus*) (Fig. 3.9), open procoxal cavities (*Akalyptoischion*) (Fig. 3.5), pseudosegmented tarsi (*Akalyptoischion*) (Fig. 3.4), and enlarged, serrate mandibles (*Akalyptoischion*) (Andrews, 1976c; Crowson, 1955; Fall, 1899; Hartley *et al*., 2007). The placement of certain genera, most notably *Akalyptoischion* and *Eufallia*, has been questioned in part due to such departures from the typical anatomy of the family (Fall, 1899; Crowson 1955, Andrews 1976c).

Objectives: Earlier classifications were based on morphology using relatively few characters. These classifications remain untested by a modern phylogenetic analysis. This work generates the first rigorous phylogenetic analysis for this group of beetles in order to achieve the following goals: (1) test the monophyly of the family and subfamilies; (2) evaluate the placement of enigmatic genera; and (3) examine the patterns of anatomical and behavioral evolution for some of the more interesting features that appear in some members of the family.

Materials and Methods:

Taxon Sampling: This analysis included 27 species, representing more than half of the known genera (16/29) and both subfamilies of Latridiidae (Table 1). Of these, 15 are from Latridiinae, and 12 are Corticariinae. Also included were eight outgroup taxa representing six other cucujoid families (Table 1). The tree was rooted to *Pselaphacus nigropunctatus* (Erotylidae), the only taxon included from outside the Cerylonid Series. Several ingroup taxa were not identified below the generic level due to the poor state of taxonomy in those groups and the high probability of encountering undescribed species. Voucher specimens (specimens from which DNA was extracted for analysis) were deposited in the University of Georgia Coleoptera Tissue Collection (UGCA) in Athens, Georgia. DNA extraction vouchers were deposited in the BYU Insect Genomics Collection.

Data Sampling: DNA was extracted using Qiagen (Valencia, California, USA) DNEasy kit for animal tissues. The abdomen was removed prior to extraction, and the whole specimen was placed in buffer. After incubation, the specimen was removed from the buffer, rinsed, and retained as primary voucher specimens deposited in the Coleoptera frozen tissue collection at the University of Georgia. Seven genes were amplified and sequenced: 18S ribosomal DNA (18S), 28S ribosomal DNA (28S), 12S ribosomal DNA (12S), 16S ribosomal DNA (16S), cytochrome oxidase I (COI), cytochrome oxidase II (COII) and histone III (H3). Polymerase chain reaction (PCR) amplification was run on a DNA Engine DYAD™ Peltier Thermal Cycler (Bio-Rad Laboratories, Hercules, CA). PCR product yield, specificity and contamination were monitored using gel electrophoresis. PCR products were purified using Montage PCR_{96} Cleanup Kit (Millipore®). Sequencing reactions were done using ABI Prism Big Dye® (Version 3), and

reaction products were purified using Sephadex™ G-50 medium. Sequencing was done using an ABI 3730xl DNA analyzer (BYU DNA Sequencing Center, Provo, Utah, USA). Data editing and contig assembly was done using Sequencher® 4.0 (Genecodes, 1999).

Analytical Methods: Alignment of COI, COII and H3 was done in Sequencher based on conservation of the codon reading frame. Alignment of 12S, 16S, 18S and 28S was done using Muscle (Edgar, 2004) using the default settings. The original Muscle alignments were examined for ambiguities, but no changes were deemed necessary. The resulting matrix was composed of 9,555 total aligned characters with 2,171 parsimony-informative characters.

A combined molecular analysis was performed in NONA (Goloboff 1995) as implemented by WinClada (Nixon, 1999-2002), with the 'heuristics' option and the commands set to hold 5,000 trees total ('h 5000'), 50 replications ('mu*50'), 40 trees held per replication ('h/40') and multiple TBR + TBR ('max*'). Bootstrap values were calculated in NONA as implemented by WinClada using 1,000 replications, 10 search reps (mults), one starting tree per rep, "don't do max*(TBR)" and saving the consensus of each replication.

A partitioned Bayesian analysis was conducted using MrBayes ver. 3.1.2 (Huelsenbeck & Ronquist, 2001; Ronquist & Huelsenbeck, 2003) with mixed model settings.

Results:

The combined dataset produced an alignment with 9465 bases. Of the variable sites, 2171 were parsimony informative.

The MP analysis resulted in a single most parsimonious tree (Fig. 3.10) (L=12577, C.I.=38, R.I.=40). Partitioned Bremer support values (Table 2) indicate that 28S was the most

influential partition in determining the most parsimonious topology, providing 50.3 percent of total support.

In both analyses (Figs. 3.10; 3.11), Latridiidae was recovered as polyphyletic. *Akalyptoischion*, historically classified within the subfamily Latridiinae, was not recovered within Latridiidae in either analysis. The subfamilies Corticariinae and Latridiinae (without *Akalyptoischion*) were recovered as monophyletic in both topologies. The position of *Eufallia* varied in the results of the Bayesian and parsimony topologies, but both analyses placed it within the subfamily Latridiinae. The internal nodes within the subfamily Corticarinae exhibit considerable incongruence between the two trees.

Discussion:

Character Evolution: Since most latridiids are small, leaf litter dwelling fungivores, apterous and brachypterous species are common. Within the subfamily Latridiinae, the genera *Dienerella*, *Metophthalmus*, *Revelieria* and *Eufallia* all have fused elytra (Fall, 1899; Watt, 1969). Of those, all are apterous except *Revelieria*, which is brachypterous (Fig. 3.6). Within the Corticariinae, the genus *Fuchsina* is apterous. There are additional apterous and brachypterous latridiids that were not included in this phylogenetic analysis. Several species of *Adistemia* and *Corticaria* are apterous or brachypterous (Hinton, 1941a; Johnson 1974a, 1977c, 1985). Many *Corticarina* are brachypterous (Johnson, 1974b, 1979, 1990, 1997), and one species of *Herfordia* is apterous (Johnson, 1971).

Eye reduction (Figs. 3.7; 3.8) and loss also occurs in several members of the family. Within the Latridiinae, all *Adistemia* and *Metophthalmus* species have reduced eyes (Fall, 1899; Andrews, 1976a; Hinton, 1941a, 1941b). The only North American species of *Eufallia* (*E.*

seminiveus) has reduced eyes. Although *Dienerella intermedia* exhibits eye reduction, the character is variable across the genus. Several members of *Cartodere* exhibit eye reduction (Fall, 1899; Walkley, 1948). Within the Corticariinae, the only genus without large, fully developed eyes is *Fuchsina.* Of the two known *Fuchsina* species, one has only one eye facet (*F. arida*, included), and the other (*F. occulta*, Fig. 3.8, included) lacks eyes entirely (Fall, 1899; Andrews, 1976b).

Species of *Eufallia* exhibit long, exposed, cylindrical trochanters (Fig. 3.9), a characteristic shared with few other genera within the family (*e.g.*, *Mumfordia, Eufalloides*, *Herfordia*, *Metophthalmus*) (Fall, 1899; Crowson, 1955; Hinton, 1941b; Halstead, 1967; Andrews, 1976a; Van Dyke, 1932). Their function is unknown.

Two latridiid genera, *Enicmus* and *Revelieria*, have been observed to feed on slime molds (Myxomycetes) (Lawrence & Newton, 1980; Lawrence, 1991; Stephenson *et al.*, 1994). These are the only two latridiids known to exhibit this host food preference. Both phylogenetic analyses indicate that myxomycophagy was derived independently twice from the basal condition of mycophagy within the family.

Taxonomic Implications: The resulting phylogenies (Figs.3.10; 3.11) indicate a polyphyletic Latridiidae. Corticariinae was recovered as being monophyletic. Latridiinae is polyphyletic with respect to *Akalyptoischion*, which is resolved among the outgroup taxa. In a parsimony analysis, the cost of constraining Latridiidae to be monophyletic (i.e., cost of forcing *Akalyptoischion* into the latridiid clade) would be 14 additional steps. Although the evidence supporting the placement of *Akalyptoischion* outside the latridiid clade is strong, the relationships between this genus and the outgroup taxa are not well established. Since the main goal of this study was to determine

the internal relationships of Latridiidae, the taxon sampling is inadequate to rigorously address the specific placement of *Akalyptoischion*.

Within the Latridiinae (without *Akalyptoischion*), the genera *Stephostethus* and *Enicmus* each are monophyletic. *Eufallia*, the other morphologically divergent taxon within the subfamily, showed alternative placements in the parsimony and Bayesian analysis, but was resolved within the Latridiinae in both analyses with strong support.

The subfamily Corticariinae is recovered as monophyletic, and several genera were recovered as paraphyletic; however, bootstrap values showed weak support for many of the internal nodes. *Melanophthalma* is monophyletic, whereas *Corticarina* is paraphyletic. The placement of *Migneauxia, Fuchsina, Cortinicara,* and *Corticaria* was incongruent between the MP and Bayesian analyses. Inclusion of additional exemplars of this subfamily will likely be required to resolve these relationships.

Both the Bayesian and MP analyses recovered a monophyletic *Akalyptoischion* that was resolved outside of Latridiidae with strong support; however, they disagreed about the precise placement of the genus among the other Cerylonid Series families. The placement of *Akalyptoischion* outside Latridiidae has additional support from anatomical sources. Fall (1899) described *Cartodere quadrifoveolata,* a beetle unlike other latridiids in having highly reduced eyes, elytra with six rows of punctures and a narrowed clypeus. Walkley (1948) transferred several *Cartodere* (including *C. quadrifoveolata*) into a new genus, *Microgramme* Walkley. Andrews (1976c) erected *Akalyptoischion* to accommodate *C. quadrifoveolata* along with seven new species. No further work was done on the group until the generic revision by Hartley *et al*. (2007) in which 16 new species were described.

Akalyptoischion (Fig. 3.1) is known only from western North America where it is primarily associated with leaf litter from oak (*Quercus* spp.). Many specimens have also been collected from the litter found in the nests of wood rats (*Neotoma* spp.). The immature stages remain unknown. Adults are flightless and are generally collected through Berlese extraction of leaf litter (Andrews, 1976c; Hartley *et al*., 2007).

Morphological characteristics distinguishing this genus from the rest of the Latridiidae are the posteriorly open procoxal cavities (Fig. 3.5); a large, laterally expanded labrum (1.3.2); small eyes (2-6 facets) located at the posterior angles of the head (Fig. 3.3); and large, heavily sclerotized mandibles. All members of the genus are apterous. On all legs tarsomere I is pseudosegmented (Fig. 3.4), producing a tarsal formula that is intermediate between 3-3-3 (as in Latridiidae) and 4-4-4 (as in several other families of Cucujoidea). This pseudosegmentation, presumed to represent an incomplete fusion of these tarsomeres, is indicated by a clear annulation and by the setation pattern. The antennae are 11-segmented, inserted behind the base of the mouthparts, and end in a weak, 2- or 3-segmented club. The metaventrite bears a round fovea between the mesocoxal cavities and a transverse fovea between the metacoxal cavities. Hartley *et al*. (2007) provided a revision of the genus, including descriptions and a key to the species. Although *Akalyptoischion* species superficially resemble members of the latridiid genera *Adistemia*, *Dienerella* and *Metophthalmus*, the open procoxal cavities, pseudosegmented basal tarsomere, large serrate mandibles, and large, laterally rounded labrum easily distinguish this genus from the rest of Latridiidae.

Both molecular phylogenetic analyses recovered *Akalyptoischion* as monophyletic and provided strong support for its placement outside of the rest of Latridiidae. These findings,

coupled with the compelling morphological evidence, call for the recognition of a new family to accommodate *Akalyptoischion*.

Akalyptoischionidae Lord, Hartley, Miller, Lawrence, McHugh and Whiting, fam.n.

Type genus: *Akalyptoischion* Andrews, 1976 by present designation.

Diagnosis: Akalyptoischionidae is characterized by the following combination of adult characters: 1.) antenna with 11 antennomeres ending in a loose, 2- to 3-segmented club, 2.) eyes reduced, composed of 2-6 facets, 3.) labrum large, laterally expanded, 4.) frontoclypeal suture distinctly impressed, 5.) basal tarsomere pseudo-segmented, 6.) procoxal cavities open posteriorly, 7.) metathoracic wings absent, 8.) mesocoxal cavities narrowly separated, and 9.) with 7 abdominal spiracles.

Included taxa: This family includes the genus *Akalyptoischion* Andrews with 24 species (see Hartley *et al.*, 2007).

Distribution: The genus is known primarily from the western United States. Specimens have been collected from CA, AZ, NV, UT, OR, ID, TX, and Mexico (see Hartley *et al.*, 2007).

Relationships: The molecular data strongly support the placement of the genus *Akalyptoischion* within the Cerylonid Series of Cucujoidea, but outside of the clade that includes the rest of Latridiidae. These results and the combination of morphological features found in

Akalyptoischion effectively exclude it from all other established families in the Cerylonid Series (Table 3).

Comments: The recent revision by Hartley *et al.* (2007) provides an identification key and descriptions for all *Akalyptoischion* species and provides a comprehensive review of the available information about the biology, morphology, distribution and taxonomy of the group.

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Table 1. Taxa included in the analyses with corresponding GenBank accession numbers

Family	Subfamily	Taxon	Voucher numbers	18S	28S	12S	16S	H3	CO1	CO2
Erotylidae		*Pselaphacus nigropunctatus*	CO515	EU164627	EU164657	EU164568	EU164590	EU164744	EU164678	EU164712
Discolomatidae		*Aphanocephalus* sp.1	CO600	EU145628	EU145687	EU164554	EU164591	EU164734	EU164675	EU164711
Endomychidae		*Amphix laevigatus*	CO318	EU164639	EU164646	EU164558	EU164597	EU164731	EU164679	EU164709
Coccinellidae		*Hippodamia convergens*	CO627	EU164617	EU164644	EU164553	EU164588	EU164743	EU164681	EU164707
Coccinellidae		*Olla v-nigrum*	CO70	AY310602	AY310663	EU164552			EU164680	EU164708
Bothrideridae		*Bothrideres geminatus*	CO680	EU145597	EU145658		EU164600	EU164735		
Cerylonidae		*Australiorylon* sp.	CO311	EU145598	EU145659, EU145712	EU164555	EU164589	EU164737	EU164677	EU164710
Cerylonidae		*Philothermus glabriculus*	CO681	EU145601	EU145662	EU164556	EU164586	EU164733	EU164676	
Latridiidae	Latridiinae	*Akalyptoischion anasillos*	CO698	EU164618	EU164658	EU164575			EU164682	
Latridiidae	Latridiinae	*Akalyptoischion sleeperi*	CO697	EU164619	EU164659	EU164561	EU164587	EU164742		
Latridiidae	Latridiinae	*Akalyptoischion atrichos*	CO699	EU164620	EU164660	EU164560		EU164741	EU164684	
Latridiidae	Latridiinae	*Akalyptoischion atrichos*	CO474	EU164621	EU164661	EU164572			EU164683	
Latridiidae	Latridiinae	*Dienerella intermedia*	CO488	EU164638	EU164647	EU164557	EU164603	EU164747	EU164691	
Latridiidae	Latridiinae	*Metophthalmus haigi*	CO480	EU164643	EU164649	EU164569	EU164595	EU164745	EU164694	
Latridiidae	Latridiinae	*Revelieria californica*	CO477	EU164642	EU164648	EU164563	EU164598	EU164736	EU164686	EU164713
Latridiidae	Latridiinae	*Eufallia seminiveus*	CO484	EU164614	EU164645	EU164551	EU164596	EU164746	EU164674	
Latridiidae	Latridiinae	*Aridius nodifer*	CO482	EU164641	EU164656	EU164581	EU164605	EU164751	EU164689	EU164718
Latridiidae	Latridiinae	*Cartodere constrictus*	CO596	EU164640	EU164655	EU164580	EU164606	EU164750	EU164690	EU164714
Latridiidae	Latridiinae	*Stephostethus lardarius*	CO473	EU164625	EU164651	EU164573	EU164608	EU164748	EU164693	EU164729
Latridiidae	Latridiinae	*Stephostethus liratus*	CO476	EU164624	EU164650	EU164559	EU164604		EU164692	EU164730
Latridiidae	Latridiinae	*Latridius crenatus*	CO483	EU164623	EU164654	EU164574	EU164607	EU164749	EU164685	EU164717
Latridiidae	Latridiinae	*Enicmus maculatus*	CO692	EU164628	EU164653	EU164571	EU164585		EU164688	EU164715
Latridiidae	Latridiinae	*Enicmus aterrimus*	CO693	EU164629	EU164652	EU164570	EU164609		EU164687	EU164716
Latridiidae	Corticariinae	*Corticaria ferruginea*	CO593	EU164637	EU164668	EU164582	EU164612	EU164757	EU164703	EU164728
Latridiidae	Corticariinae	*Migneuxia orientalis*	CO590	EU164636	EU164665	EU164579	EU164601	EU164753	EU164704	EU164726
Latridiidae	Corticariinae	*Fuchsina occulta*	CO638	EU164630	EU164667	EU164576		EU164756	EU164701	EU164724
Latridiidae	Corticariinae	*Corticarina* sp. 1	CO486	EU164622	EU164664	EU164577	EU164613	EU164752	EU164702	EU164727
Latridiidae	Corticariinae	*Corticarina* sp. 2	CO579	EU164616	EU164663	EU164584	EU164610		EU164705	
Latridiidae	Corticariinae	*Corticarina* sp. 3	CO580	EU164626	EU164666	EU164578	EU164602	EU164755	EU164697	EU164725
Latridiidae	Corticariinae	*Cortinicara* sp.	CO592	EU164615	EU164662	EU164583	EU164611	EU164754	EU164706	
Latridiidae	Corticariinae	*Melanophthalma* sp. 1	CO481	EU164632	EU164670	EU164564	EU164599	EU164738	EU164696	EU164719
Latridiidae	Corticariinae	*Melanophthalma* sp. 2	CO591	EU164631	EU164669	EU164562	EU164592		EU164695	EU164720
Latridiidae	Corticariinae	*Melanophthalma* sp. 3	CO594	EU164633	EU164672	EU164566	EU164593	EU164739	EU164698	EU164721
Latridiidae	Corticariinae	*Melanophthalma* sp. 4	CO478	EU164634	EU164673	EU164567			EU164699	EU164722
Latridiidae	Corticariinae	*Melanophthalma* sp. 5	CO595	EU164635	EU164671	EU164565	EU164594	EU164740	EU164700	EU164723

Table 2. Results of the partitioned Bremer analysis.

	Support	# aligned base pairs	# informative characters	% informative characters	% Total support	Support/# informative characters	Normalized support
12S	26.7		183	8.4%	3.2%	0.15	5.3%
16S	35.3		224	10.3%	4.2%	0.16	5.8%
18S	125.5		235	10.8%	14.8%	0.53	19.5%
28S	426.1		733	33.8%	50.3%	0.58	21.2%
COI	60		382	17.6%	7.1%	0.16	5.7%
COII	40		283	13.0%	4.7%	0.14	5.2%
H3	133.6		131	6.0%	15.8%	1.02	37.3%
	847.2		2171			2.74	

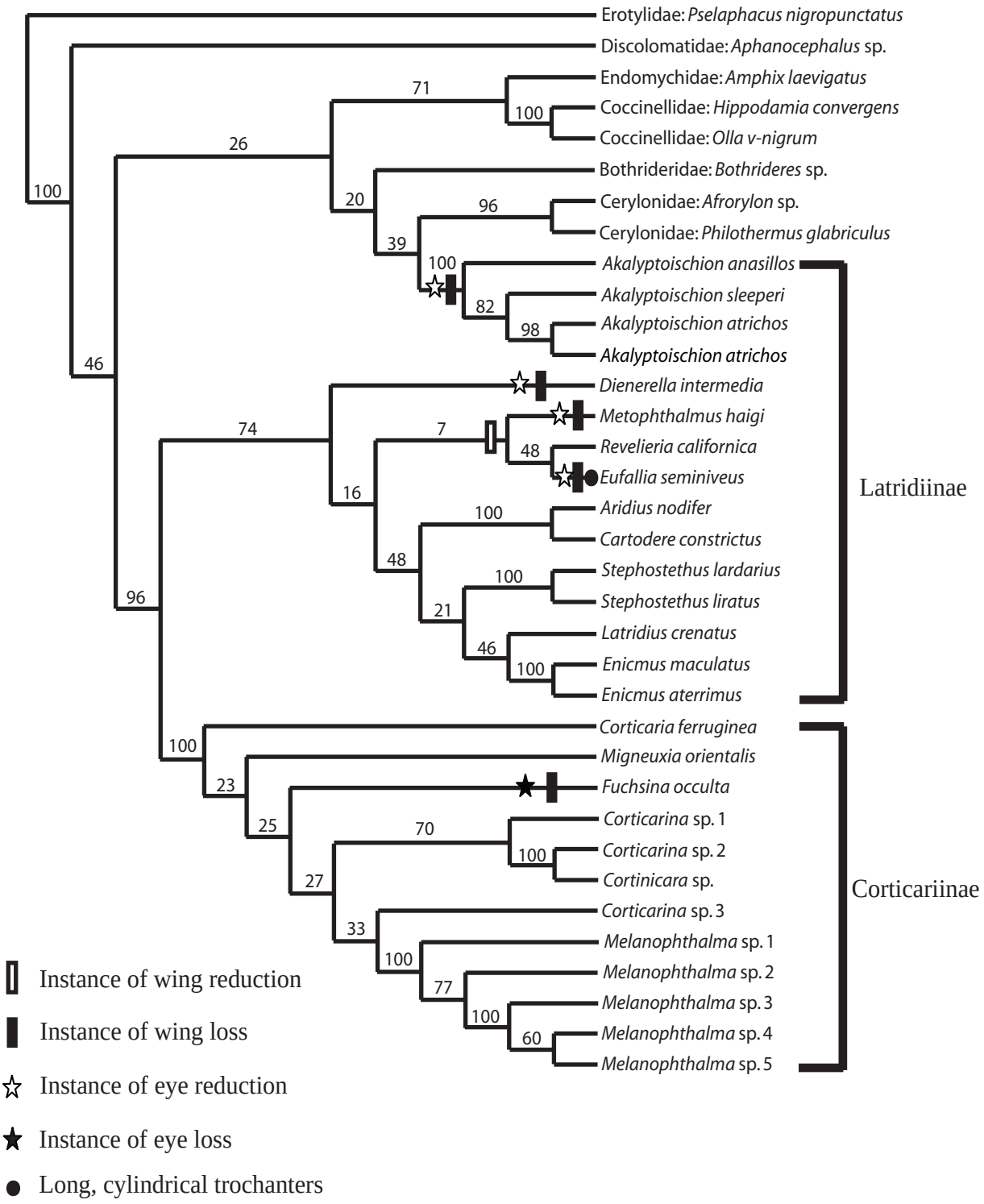


Figure 3.10. Single, most parsimonious tree using the concatenated static alignments of 12S, 16S, 18S, 28S, COI, COII, and H3 data. Length = 12577, CI = 38, RI = 40.

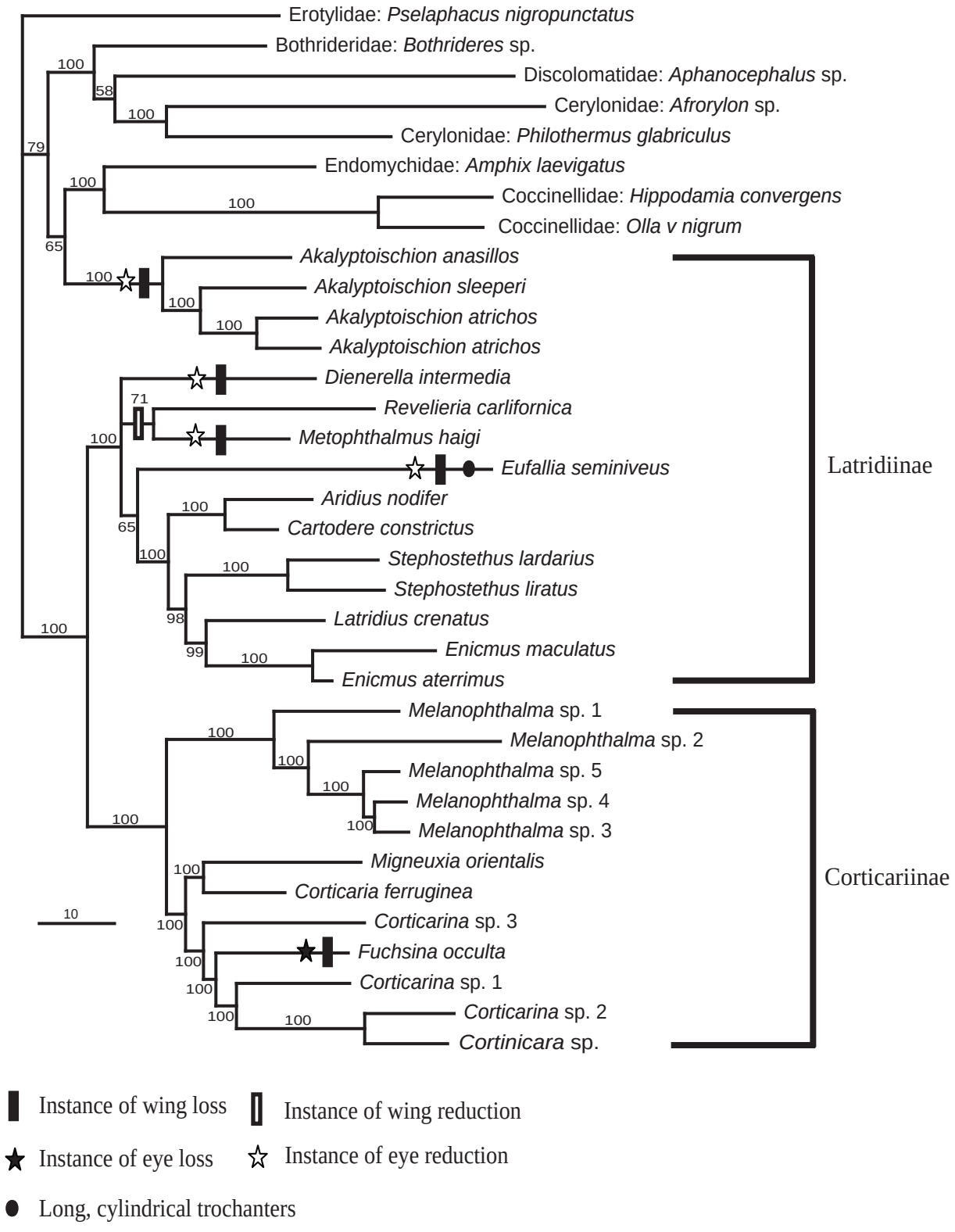
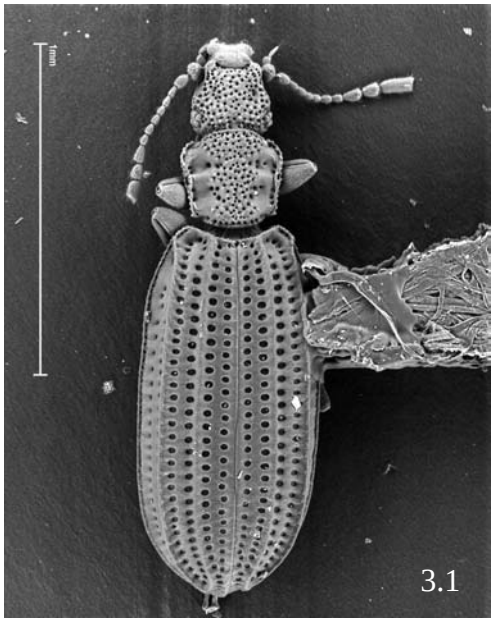
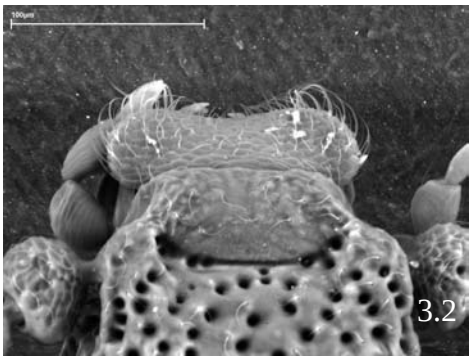
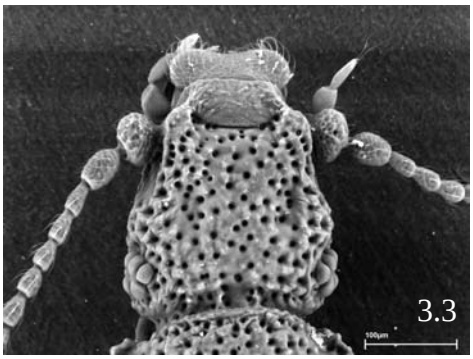
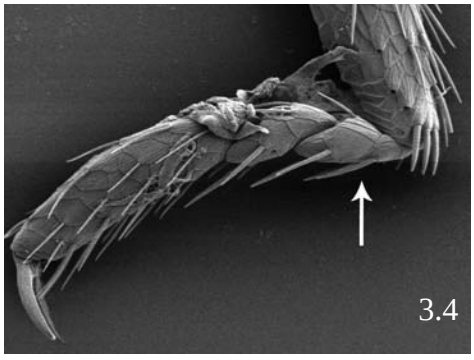


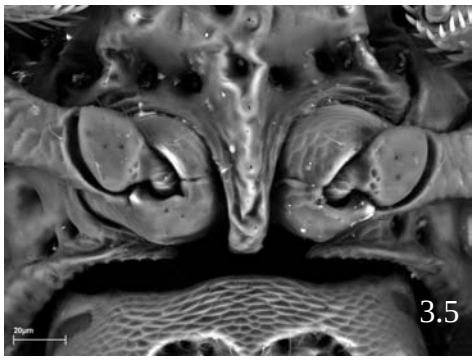
Figure 3.11: Bayesian analysis tree. Posterior probability is located at each node.



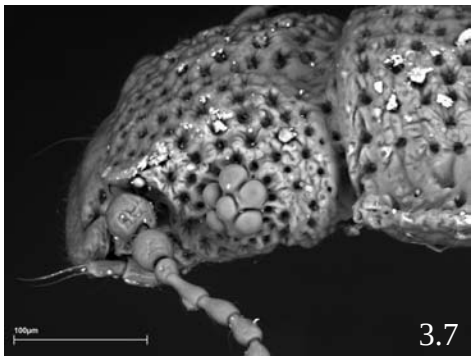


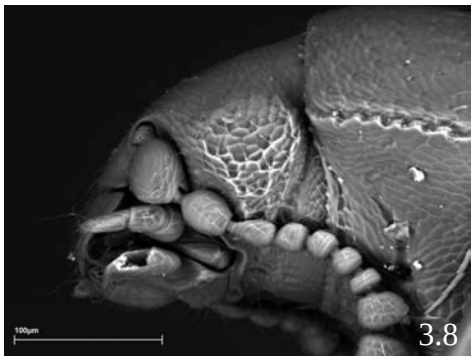


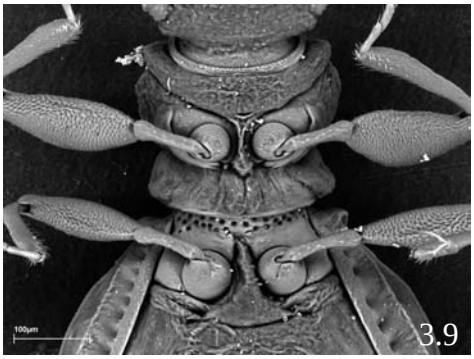




Figures 3.1-3.5. Diagnostic features of *Akalyptoischion* species.
3.1) *Akalyptoischion atrichos*, dorsal habitus; 3.2) Laterally expanded labrum;
3.3) Reduced eyes positioned on posterior corners of head;
3.4) Pseudosegmented basal tarsomere; 3.5) Open procoxal cavities.







Figures 3.6-3.9. Unusual anatomical features within Latridiidae.
3.6) Brachyptery, *Revelieria californica*; 3.7) Microphthalmy, *Dienerella* sp.;
3.8) Anophthalmy, *Fuchsina occulta*;
3.9) Elongate, cylindrical trochanter on meso- and metalegs, *Eufallia seminiveus.*

CHAPTER 4

A TAXONOMIC REVISION OF THE GENUS *DERETAPHRUS* NEWMAN (COLEOPTERA: BOTHRIDERIDAE: BOTHRIDERINAE: DERETAPHRINI)[2]

[2]Lord, N.P., and J.V. McHugh. To be submitted to *Zootaxa.*

A Taxonomic Revision of the genus *Deretaphrus* Newman (Coleoptera: Bothrideridae)

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ABSTRACT

A revision of the genus *Deretaphrus* Newman 1842 (Coleoptera: Bothrideridae) is presented. More than 1,850 specimens were borrowed from 35 collections and museums, representing the majority of the world's total holdings. A taxonomic treatment of the genus was conducted. Presented here are a key to the species, detailed species descriptions, distribution maps, label data, biological information, and figures and illustrations.

This revision treats 34 nominal species: 27 previously described species and seven new species: *Deretaphrus antennatus* **sp. nov.,** *D. boliviensis* **sp. nov.,** *D. carinatus* **sp. nov.,** *D. hoplites* **sp. nov.,** *D. lateropunctis* **sp. nov.,** *D. ocularis* **sp. nov.,** and *D. rodmani* **sp. nov.** All previously named, valid species are redescribed.

Two new junior synonyms are reported: *Deretaphrus cribriceps* Blackburn 1903 is placed under *Deretaphrus viduatus* Pascoe 1862, and *Deretaphrus popularis* Blackburn 1903 is placed under *Deretaphrus viduatus* Pascoe 1862. Two former junior synonyms are returned to valid status: *Deretaphrus bucculentus* Elston 1923, and *Deretaphrus iridescens* Blackburn 1903. Neotypes are designated for two species: *Deretaphrus fossus* Newman 1842 and *Deretaphrus wollastoni* Newman 1855. Lectotypes are designated for four species: *Deretaphrus analis* Lea 1898, *Deretaphrus pascoei* Macleay 1871, *Deretaphrus piceus* (Germar) 1848, and *Deretaphrus xanthorrhoeae* Lea 1898. Paralectotypes were designated for four species: *D. analis* Lea 1898, *D. pascoei* Macleay, *D. piceus* (Germar) 1848, and *D. xanthorrhoeae* Lea 1898.

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INTRODUCTION

General Introduction

Bothrideridae is a small family of poorly known beetles comprising four subfamilies and more than 400 species. Members of the family are found in all major zoogeographical regions of the world. Although little is known about their biology, all bothriderids are closely associated with the galleries of wood-boring insects, either as fungus feeders (Teredinae, Xylariophilinae) or ectoparasites and predators (Bothriderinae) as both larvae and adults. Of the few larvae that have been collected, some are free-living (Teredinae), but most are strongly modified ectoparasites on larvae of wood-inhabiting insects, exhibit hypermetamorphic development, and spin cocoons for pupation (Lawrence, 1991). These developmental and behavioral features are rare among beetles. Due to their host preferences, bothriderids may have use as potential bio-control agents against destructive wood-boring insect pests. In the adult form, bothriderids are extremely diverse morphologically.

Bothrideridae has been classified as various tribes or subfamilies within the tenebrionoid family Colydiidae. Erichson (1845) erected the tribe Bothriderini, within Colydiidae, to include several bothriderid genera. Horn (1878) erected the tribe Deretaphrini (= Teredini) based on the contiguous anterior coxae of its members. Ganglbauer (1899) circumscribed the subfamily Anommatinae containing the enigmatic genus *Anommatus* and also erected the subfamily Ceryloninae (the present-day Cerylonidae) including the tribes Deretaphrini and Bothriderini along with several others. Craighead (1920) did not recognize Deretaphrini, since he included *Deretaphrus* within Bothriderini. Based on larval and adult morphology, Craighead found several major

differences between the Colydiidae and Bothriderini, leading him to place the latter in a separate family, Bothrideridae. Subsequent workers failed to adopt Craighead's new familial classification and Bothriderini and Deretaphrini (including Teredini) remained within Colydiidae (e.g., Hetschko, 1930; Hatch, 1961). Craighead continued to publish works utilizing the family status for Bothrideridae, and gave the taxa a common name, "The Cocoon-Forming Beetles" (Craighead, 1950). Crowson (1955) did not recognize the group as a separate family, instead recognizing the Bothriderinae as a distinct subfamily of the Colydiidae. Lawrence (1980) also found strong evidence for the group to constitute a separate family, but refrained from taking action. Familial status for Bothrideridae was formally adopted by Lawrence (1985), which included three subfamilies: Bothriderinae, Teredinae, and Anommatinae. Pal and Lawrence (1986) further solidified this status by describing a new bothriderid subfamily (Xylariophilinae) and defining the four subfamilies within Bothrideridae.

Currently, Bothrideridae is widely recognized as part of the Cerylonid Series of the superfamily Cucujoidea. Little taxonomic work has been conducted within the family. Although Bothrideridae is relatively small currently, it will likely increase considerably as the bulk of available, but undescribed, species are treated. This project represents the first in a number of revisionary works being conducted by the senior author in an effort to resolve the nomenclatural instability of Bothrideridae.

Taxonomic History

Deretaphrus was first described by Newman (1842) from insects collected at Port Philip in South Australia. Newman closely allied the genus to Ptinidae (currently within Anobiidae). The generic and species descriptions were short and broad in scope. This

paper described four species: *Deretaphrus fossus, Deretaphrus puteus, Deretaphrus illusus,* and *Deretaphrus vittatus.* Erichson (1845) placed the genus in Bothriderini within Colydiidae. He also moved two species (*Deretaphrus illusus* and *Deretaphrus vittatus*) into *Bothrideres.*

Germar (1848) described *Sigerpes,* with one species. Lacordaire (1854) synonymized *Sigerpes* Germar with *Deretaphrus* and provided a more detailed description of the genus.

Wollaston and Newman (1855) supported Erichson's placement of the genus within Colydiidae, but also stated that *Deretaphrus* has several characters potentially allying it with other taxa. Wollaston recognized its close relationship with *Bothrideres* and presented a detailed description of the genus, mentioning several previously undescribed characters to support his hypothesis (Wollaston & Newman, 1855). In the same paper, Newman conceded Erichson's move of two of his original species into *Bothrideres.* He also described two new species, *Deretaphrus wollastoni* and *Deretaphrus erichsoni.* Newman closed the paper with an updated list of the species, noted the Australian distribution, and stated that they are found "…feeding under the bark of trees, principally *Eucalyptus*."

Based on his observation of the type specimen at the British Museum of Natural History, Pascoe (1862) moved *Deretaphrus puteus* (one of Newman's originally described *Deretaphrus* species) into the genus *Bothrideres.* Contrary to Wollaston, Pascoe stated "The affinity of the two genera, *Deretaphrus* and *Bothrideres,* seems to be by no means close…" Pascoe described four new species (*Deretaphrus ignarus, D. viduatus, D. bakewellii,* and *D. colydioides*) but was unable to study *D. wollastoni* and

could not locate the type specimen. Pascoe provided the first key to the species of the genus. Macleay (1871) described *Deretaphrus pascoei.*

In the *Catalogue of the Coleoptera of Australia,* Masters (1872) listed ten species of Australian *Deretaphrus* and their localities, apparently unaware of Pascoe's placement of *Deretaphrus puteus* within *Bothrideres* some ten years prior.

Horn (1873) described *Deretaphrus oregonensis* from the western United States, noting the odd distribution of the genus. Reitter (1877) described *Deretaphrus granulipennis* from New South Wales. Horn (1878) treated the North American Colydiidae and created the tribe Deretaphrini on the basis of a deflexed head and the contiguous (or nearly so) anterior coxae. He included *Oxylaemus, Deretaphrus,* and *Sosylus,* and provided a brief generic description and species description for *Deretaphrus oregonensis,* comparing and contrasting this sole North American representative with the type species, *Deretaphrus fossus.*

Lea (1898) described four new species: *Deretaphrus analis, D. xanthorrhoeae, D. parviceps,* and *D. puncticollis.* Grouvelle (1903) described *Deretaphrus interruptus* from New Caledonia, the only other non-Australian species in the genus at that time. Fauvel (1903) noted *Deretaphrus interruptus* in New Caledonia, and tallied 16 species in the genus.

One of the major works on *Deretaphrus* was by Blackburn (1903), who discussed the ambiguity of several species descriptions preventing confident identifications. He synonymized *Deretaphrus granulipennis* Reitter with *Deretaphrus erichsoni* Newman and indicated that *Deretaphrus wollastoni* probably did not belong in *Deretaphrus*. Blackburn also mentioned that it was difficult to identify the type species, *D. fossus*

Newman, because the original description was inadequate to differentiate it from several congeners. He discussed some variation in taxonomic characters (color, size, elytral punctation) and provided several characters that he believed were better at diagnosing *Deretaphrus* species. He described eight new species (*Deretaphrus thoracicus, D. gracilis, D. iridescens, D. cordicollis, D. popularis, D. aequaliceps, D. sparsiceps,* and *D. cribriceps)* and provided an identification key. Blackburn relied on locality in his delimitation of species, which later resulted in the synonymization of most of his species.

Craighead (1920) addressed the taxonomic position of the Colydiidae based on his study of larval morphology, noting dissimilarity between bothriderine taxa and the rest of the family. Craighead employed the familial name Bothrideridae but formally retained the group within Colydiidae as a "specialized development" of the colydiids due to their parasitic nature. Craighead also described and illustrated the larva, pupa, and cocoon of *Deretaphrus oregonensis.*

Elston (1923) described *Deretaphrus bucculentus*. Perhaps the most significant work on the genus *Deretaphrus* was Carter's (1937) revision of the Australian Colydiidae. Carter mentioned the unfortunate loss of the unique type specimen for the type species, *Deretaphrus fossus* Newman and again discussed the many synonyms that had been created due to ambiguous species descriptions. He suggests several synonymies. He synonymized *D. bakewellii* Pascoe and *D. thoracicus* Blackburn with *D. piceus* (Germar), *Deretaphrus pascoei* Macleay with *D. ignarus* Pascoe, *D. cordicollis* Blackburn with *D. fossus* Newman, and *D. bucculentus* Elston with *D. puncticollis* Lea. Carter also stated that *D. colydioides* Pascoe is probably a small *D. viduatus* Pascoe, and

D. sparsiceps is most likely a junior synonym of *D. viduatus.* Carter described two new species, *Deretaphrus alveolatus* and *D. incultus.*

Heinze (1943) revised the tribe Deretaphrini. He mentioned that *Deretaphrus* needed revision. Heinze considered the species accounts of Blackburn and Carter to be inadequate for correct identifications.

In *The Natural Classification of the Families of Coleoptera* (Crowson, 1955), *Deretaphrus* was classified within Colydiidae. Crowson considered *Deretaphrus* as "possibly the most primitive genus" in the group and allied it with other current bothriderid genera. He also illustrated the mesothorax and metendosternite, representing the first and only detailed morphological study of the genus.

Biological History

Although *Deretaphrus* is the most commonly encountered genus of Australian Bothrideridae (Lawrence and Britton, 1991), the biology of most species is poorly known. Many species are rarely collected and have not been observed in nature. Burke (1919) published a short paper on the biology of an odd cocoon-making colydiid found in the western United States, identified as *Deretaphrus oregonensis.* This work described several hosts of *D. oregonensis* and associations with various trees. Craighead (1920) described and illustrated the larva and pupa of *Deretaphrus oregonensis.* These had been collected in the pupal cells of *Asemum atrum* (Coleoptera: Cerambycidae) in a dead Jeffrey pine. *Deretaphrus oregonensis* was given the nickname "The Buprestid Destroyer" by Essig (1926), who stated that the adult "lives in the burrows and destroys the larvae and pupae…" of a number of wood-boring beetles in California and Oregon.

Böving and Craighead (1931) illustrated the larvae of *Deretaphrus oregonensis* and provided a key to the larvae of the families and subfamilies of many beetle groups. Balduf (1935) summarized the known larval habits and host preferences of a number of entomophagous beetles, including *Deretaphrus oregonensis.* Clausen (1940) discussed the parasitic nature and host preferences of several North American bothriderids and provided a brief description of the larva of *D. oregonensis.* Craighead (1950) described the larvae of *D. oregonensis* as predaceous or parasitic on wood-boring beetle larvae in conifers in Oregon and California. In *Beetles of the Pacific Northwest* (Hatch, 1961), *Deretaphrus oregonensis* was included in the tribe Deretaphrini of the Colydiidae. A key to the genera of Colydiidae was given as well as a distributional summary, brief description, and dorsal habitus illustration of *D. oregonensis.*

In *The Biology of the Coleoptera,* Crowson (1981) suggested that the ectoparasitic nature of the colydiid subfamilies Deretaphrinae (including *Deretaphrus*) and Bothriderinae (remainder of Bothrideridae) developed from close associations between wood-boring beetle larvae and bothriderids inside the fungus-filled galleries where they lived.

Stephan (1989) provided a checklist and biological information about the Bothrideridae of America north of Mexico. He provided a diagnosis and summaries of the distributional and biological data for *D. oregonensis*, the lone North American species of *Deretaphrus.*

Materials and Methods

Taxon Sampling- Most of the world's holdings of *Deretaphrus* were acquired in order to conduct a thorough revision of the genus (see Appendix B). Approximately 1,850

specimens were borrowed from 35 collections around the world, including all major Australian and American museums. The majority of the museum codens used follow the system proposed by Arnett et al. (1993).

Specimen Preparation- Specimens were prepared for dissection. Dirty or greasy specimens were placed in a Branson 1210 ultrasonic cleaner in soapy water for several minutes. Dissected specimens were cleared using a KOH solution. Specimens were studied using a Wild M5, Leica MZ8, and Leica WILD M10 microscope.

Morphometrics- Specimen images were captured with a Sony DKC-5000 camera attached to a Leica WILD M10. Following calibration with a stage micrometer, Auto-Montage Pro, v. 5.01 (Synoptics, Ltd., Frederick, MD, USA), was used to generate the morphometric data.

Imaging- Color images were captured using a Microptics ML-1000 Digital Imaging system (Microptics, Inc., Ashland, VA, USA). Images were montaged in Helicon Focus v. 3.20.3 (Helicon Soft Ltd., Kharkov, Ukraine) and CombineZ v. 5.3 (Alan Hadley, U.K.). SEM images were captured using a Leica 1450 EP Environmental Scanning Electron Microscope. Images were edited with standard procedures in Adobe Photoshop CS, v. 8.0 (Adobe Systems, Inc., San Jose, CA, USA). Line drawings and illustrations were performed in Adobe Illustrator CS2, v. 12.0.1 (Adobe Systems, Inc., San Jose, CA, USA).

Mapping- GPS coordinates for collection localities were referenced using Falling Rain Genomics, Inc. (www.fallingrain.com) and Google Earth/Google Maps (www.maps.google.com). Mapping of localities and the generation of maps was

performed using ESRI ® ArcMap™ 9.2 (Redlands, CA, USA**)**, courtesy of the University of Georgia Department of Geography.

Format of Species Accounts

Title: The heading is the valid name followed by the author for the species. Below the heading is a list of figure numbers that correspond to the species.

Synonymy: Synonyms and misspellings of the valid name are listed, followed by the year, author, and pagination. Following each synonym, the synonymizer, year and pagination are given.

Diagnosis: A detailed description of diagnostic features is given for each species, organized into the following sections: body, head, eyes, antennae, mouthparts, prothorax, pterothorax, elytra, hindwing, legs, abdomen, and genitalia.

Variation: Morphological variation within the species is discussed.

Type material: The label data are given verbatim for the type specimens. Labels are listed individually, with a "/" denoting a new line on the actual label. A unique specimen identification number, given by the authors, is listed in brackets following the label data. The unique specimen identification number is composed of the museum coden, specimen number, and the senior author's initials (e.g., "SAMA 214NL" indicates South Australian Museum, specimen number 214, NL = Nathan Lord).

Specimens examined: This section includes a brief summary of the number of specimens examined. If five or fewer specimens are known for a species, the complete label data are listed for those specimens, followed by the unique specimen identification number in brackets at the end of the label data for that specimen.

Distribution: An account of the known geographic distribution of the species is given. A distribution map also is provided for each species.

Biology: This section includes any biological or life history information that is known. The majority of this information was gathered from the label data.

Etymology: This section discusses the meaning of the specific epithet.

Taxonomic notes: This section includes notes on persistent nomenclatural issues or problems.

Remarks: This section contains information about similar species and how to distinguish them.

References: This section lists the references where the species was described. Any treatments using junior synonyms of the valid name are also listed.

Characters and Terminology

The majority of the general anatomical terms corresponds to the definitions given in *The Torre-Bueno Glossary of Entomology* (Nichols & Schuh 1989). McHugh *et al.* (1997) also was also used as a reference. Terms for the genitalia follow Sharp & Muir (1912). The characters listed below are explained in greater detail.

Body shape (Figures 4.1-4.3): Most species are fairly elongate and dorsoventrally flattened. Some species (*D. antennatus*, *D. oregonensis*) are nearly cylindrical in shape and are much less flattened. The ratios of length and width of various body segments is highly variable.

Head (Figs. 4.8-4.9, 4.149-4.152, 4.168-4.173): Measurements of the head are described as follows: HW = the widest head width, generally near the dorsoposterior margin of the eyes; AIW = shortest distance between the antennal insertions, generally where the

frontoclypeal suture meets the lateral margin of the head; HL = head length, measured in lateral view, from the dorsal posterior margin of the head at the midline to the anterior margin of the clypeus. The setation and sculpturing of the dorsal surface of the head provide few useful characters. The clypeus and anterior portion of the frons may be slightly depressed medially, but this condition may be too variable intra-specifically to be taxonomically informative.

The shape of the frons is a diagnostic character for several species (Figures 4.168-4.173), ranging from straight (most spp.), to laterally angulate and bearing subtriangular (*Deretaphrus bucculentus*, Fig. 168) to evenly convex lateral expansions (*Deretaphrus rodmani*, Fig. 173). These expansions often partially or completely conceal the eyes from above. The head typically is narrowed anteriorly; the distance between the antennal insertions varies between species. The frontoclypeal suture is generally arcuate; however, in some species posterior margin of the clypeus is weakly incised medially. The anterior margin of the clypeus may be straight to arcuate to sharply incised medially (*Deretaphrus interruptus*).

Eyes: In most species, the eyes are evenly convex and slightly protuberant, but in a few (*D. parviceps*, Fig. 4.172; *D. carinatus*, Fig. 4.169), the eyes are strongly protuberant, approaching pointed. In one species, *D. ocularis* (Fig. 4.171), the eye is reniform, excavated posteriorly by a sharp postocular expansion of the head capsule.

Antennae: Antennal setation is moderately variable within the genus. The antennal segments bear minute, small, or long setae. Minute setae are defined as being extremely short, much shorter than (less than 1/8) the height of the segment from which it arises. Antennae bearing minute setae appear glabrous under lower magnifications, the setae

becoming visible only under high magnification. Short setae are defined as being just slightly shorter than the segment from which they arise, visible under lower magnifications. Long setae are defined as at least as long or longer than the segment from which they arise. The density of the setae on the antennae is more or less variable, arranged in one or more rows.

Submentum (Figs. 4.245-4.252): The submentum is often greatly expanded anteroventrally and variously shaped. The submentum may partially or completely conceal the mentum and palpi from view. The submentum may be widely separated, narrowly separated, or fused to the subgenal braces. A group of paired pits bearing long, erect setae occurs on the base of the submentum (Fig. 4.8) in some species.

Mandibles: All species have short, broad, bidentate mandibles. The dorsal, exterior face of the mandible may have a several large punctures or a groove (Fig. 4.9) that bears long, thick setae. When present, the groove is clearly visible. It is important to locate the setal sockets, as the setae may break off over time.

Prothorax (Figs. 4.21-4.45): Measurements for the prothorax are described as follows: PL = pronotal length at dorsal midline from the anterior margin to the base; PW = pronotal width, at widest; PWB = pronotal width at the base, from posterior angle to posterior angle; HWB = head width at the insertion point of the head into the pronotum; APA = distance between the anterior pronotal angles or shoulders, at widest; PTH = maximum prothoracic height, measured, in lateral view, from the highest point on the dorsal surface of the pronotal disc to the ventral surface of the prosternum.

Most *Deretaphrus* species exhibit a characteristic sculpturing of the pronotal disc. The median portion of the pronotal disc frequently bears a longitudinal depression,

groove, or canal. It may be very shallow and wide, here referred to as a median longitudinal depression, or narrow and abruptly impressed, here referred to as a median longitudinal groove or canal. The canal can be shallow to deep, weakly to strongly pronounced, variably narrowed and expanded, and open or closed at the base and apex. The internal area of the canal can be flat to weakly raised, simple or grooved at the lateral borders. In some species, the canal is interrupted anteriorly, forming distinct, long basal portion and short, anterior portion. The anterior portion of the canal can be deeply foveate, a minute slit, or a mere depression.

The punctation of the pronotal disc is highly variable, the puncture sizes range from minute (*D. analis*, *D. piceus*, *D. lateropunctis*) to large (*D. alveolatus*, *D. bucculentus*, *D. parviceps*, *D. puncticollis*). The puncture size of the pronotal disc may be uniform (most spp.) or variable (*D. oregonensis*).

The hypomera are variously angled, from subparallel to greatly deflexed and flattened. The prosternum has few useful characters.

Metaventrite: The metaventrite bears few useful characters. The punctation of the metaventrite is slightly variable, with a few species having much larger punctures at the anterior angles (*D. lateropunctis*).

Elytra: Measurements for the elytra are described as follows: EL = elytral length, at midline from the anterior margin of the scutellum to the apex of the elytra; EW = elytral width at mid-length of elytra. BL (Body length) = EL (elytral length) + PL (pronotal length). BL/EW = ratio of the body length (BL) to the elytral width (EW).

Elytral Interstitial Intervals (Figs. 4.174-4.223): The elytra have several useful characters. The most important is the carination of the elytral interstitial intervals. The

elytral interstitial intervals are the areas between the puncture rows or striae. The sutural interval (immediately lateral to the elytral suture) is counted as 1. Elytral interstitial intervals can be flat, slightly raised, strongly elevated, or carinate, and may be dull or shiny. In *Deretaphrus*, elytral interstitial intervals 3, 5, and 7 are usually raised to carinate for some or the entire length of the interval. In some species, the raised or carinate elytral interstitial intervals fuse into each other near the elytral apex (Figs. 4.214-4.215).

Abdominal Ventrite V (Figs. 4.46-4.55): In most species, abdominal ventrite V is simple. In some, (*D. piceus*, *D. analis*), ventrite V bears two depressions on either side of midline, resulting in a median V-shaped area near the posterior margin (Figs. 4.46-4.47) in both sexes. Other species (*D. erichsoni*, *D. hoplites*, *D. xanthorrhoeae*) have sexual dimorphisms on abdominal ventrite V, involving the punctation, depressions, or an apical swelling (Figs. 4.48-4.55).

Male Genitalia (Figs. 4.224-4.244): The male genitalia are diagnostic for several species. The parameres may be individually articulated to the phallobase or broadly fused to one another. If fused, the parameres are generally short and broadly rounded, often with distinct areas of varying thickness, appearing as lighter or darker patches that are diagnostic at the species level. Setation occurs only near or at the apex of the parameres. If individually articulated, the parameres are generally elongate and narrow, with setation varying from short and sparse (majority) to long and dense (*D. oregonensis*, *D. boliviensis*). In *D. hoplites*, the parameres are greatly enlarged. In several species, each paramere bears a dorsal hook. The dorsal hook is a useful character, varying in size and shape from thickened and nearly touching the opposing hook, to thinner and

distinctly separated and ranging from straight to greatly curved. The phallobase is variable in shape, from simple (most spp.), to complex, with several folds and hooks (*D. piceus, D. analis, D. iridescens, D. gracilis*). The median lobe is long and narrow, ranging from extremely long and thin with long paired anterior struts (*D. piceus, D. analis, D. iridescens, D. gracilis*), to shorter and thicker with shorter paired anterior struts (most spp.), to greatly thickened and variously swollen (*D. bucculentus*).

Female Genitalia (Fig. 4.161): The female genitalia varied little between species, and thus are not discussed in the individual species accounts.

Deretaphrus Newman

Deretaphrus Newman 1842: 403-404. Type species: *Deretaphrus fossus* Newman 1842: 404.

Sigerpes Germar 1848: 222-223. Type species: *Sigerpes piceus*. Synonymized by Lacordaire 1854: 377-378.

Derataphrus Newman, *in* Lacordaire 1854: 377-378 [misspelling].

Diagnosis: Within the Bothrideridae, *Deretaphrus* is characterized by the loose, 3-segmented antennal club, greatly enlarged submentum which partially or completely conceals the mouthparts from view, externally closed coxal cavities, and narrowly separated metacoxae.

Description

Body (Figs. 4.1-4.3): Elongate, parallel, slightly flattened to subcylindrical, reddish-orange to black; surfaces matte to moderately shiny; glabrous except for minute setae that arise from the punctures. In general, adult *Deretaphrus* are heavily sclerotized. The junction of the head/prothorax and the prothorax/meso- metathorax are of a ball-and-

socket type, giving adults the ability to contract. The elytra and abdomen have a tongue-and-groove locking mechanism. The legs and antennae are heavily sclerotized and their respective attachments to the body are tight, with no exposed membrane. The great expansion of the submentum conceals the delicate mouthparts within an oral cavity. Only three species exhibit sexual dimorphisms (*D. erichsoni*, *D. hoplites*, and *D. xanthorrhoeae*), expressed only in the shape of abdominal ventrite V.

Head (Figs. 4.149-4.152, 4.168-4.173, 4.245-4.252): Slightly to moderately declined (Fig. 4.3), evenly convex to flattened, a little narrower than prothorax, elongate; with a weak lateral postocular (transverse) occipital impression that continues laterad and meets the submental suture ventrally, completely separating the vertex from the occiput. Occiput swollen, forming a bulbous posterior portion of the head capsule. Head not abruptly constricted posteriorly to form a neck. Occipital foramen small to moderate in size. Temples very short and shelf-like. Frons and vertex simple; stridulatory file absent. Frons sometimes with transverse, angulate or convex expansions at the lateral margin above the eyes, expansions often partially or completely conceal eyes from above. Frons anterolaterally emarginate (at frontoclypeal suture) to receive antennal scape. Frontoclypeal suture indistinct to distinct, slightly arcuate to sharply incised medially. Clypeus posterolaterally emarginate (at frontoclypeal suture) to receive antennal scape. Anterior edge of clypeus straight to convex to sharply incised medially. Antennal insertions dorsolateral, moderately to widely separated and completely exposed from above. Subantennal groove well developed, deep; present on ventrolateral surface; extending posteriad from the antennal base to the posterior edge of the eye. Mouth cavity anteroventrally oriented. Submentum forms the anterior edge of the head capsule

ventrally. Submentum greatly expanded and highly variable (Figs. 4.245-4.252), slightly to strongly projecting anteroventrally, delimited posteriorly from the submental suture which lies at the bottom of a broad furrow. Laterally, submentum is margined by greatly expanded subgenal braces. Submentum widely to narrowly separated, touching, or partially fused to subgenal braces. Submentum sometimes with paired setose pits anteriad of submental suture, near connection of submentum and subgenal braces (Fig. 4.8). Gena at base of mandibles bearing a distinct pit on each side, most likely the external manifestation of an apodeme for the attachment of the anterior arms of the corporotentorium. Gular sutures widely separated, narrowing anteriorly. Cervical sclerites absent. Corporotentorium narrow; with narrow tentorial bridge; with anterior arms; lacking dorsal arms. Bulbous posterior portion of head capsule usually retracted into anterior region of the prothorax (as ball-and-socket joint). Cephalic membrane with short row of anteriorly projecting setae.

Eyes: Moderately large, coarsely facetted, lacking interfacetal setae. Eyes evenly convex; strongly protuberant, nearly angulate in *D. parviceps* and *D. carinatus*. Posterior edge straight to convex, or emarginate by a cuticular projection of the head capsule (*D. ocularis*).

Antennae: 11-segmented with weak, loose, slightly flattened 3-segmented apical club. Antennal scape moderately large, round, punctate; pedicel narrower and slightly elongate; segments 3-8 short, subcylindrical and subequal. Antennal club asymmetrical, segments 9-11 subtriangular, segment 10 larger than 9 and 11. Apex of segments 9-11 with one or more depressions or cupules, bearing sensilla. Antennal club densely setose with long, erect setae, sparsely setose with short setae, to almost pubescent.

Mouthparts (Figs. 4.153-4.157): Labrum partially concealed beneath clypeus, strongly transverse, apex subtruncate and slightly sclerotized, with a row of long, stiff setae projecting anteriorly. Maxilla with distinct galea and lacinia. Galea subtriangular in shape with apex densely setose, lacking hooks or teeth. Lacinia bears a long, narrow, relatively straight uncus with a bifid apex. Lacinia densely setose, setae stouter and thicker distally near the uncus. Maxillary palpi 4-segmented. Labial palpi 3-segmented. Apical maxillary and labial palpi weakly fusiform. Ligula undivided. Mandible short and broad. Incisor edge of mandible simple. Mola and prostheca absent. Mandibular base punctate; apex smooth, bidentate, some with a subapical tooth on inner medial margin. Some species with median setose groove on dorsal (external) surface.

Prothorax (Figs. 4.21-4.45): With pronotum quadrate to elongate, widest at middle or apical half, pronotum narrows posteriorly. Dorsal surface convex (Fig. 4.33), flattened (Fig. 4.35), or slightly depressed at middle (Fig. 4.41). Pronotal disc punctate, punctures variable in size and density. Anterior margin of pronotum straight or slightly arcuate; anterior angles distinct and obtuse (Fig. 4.29) or rounded and indistinct (Fig. 4.23). Base of pronotum slightly to moderately narrower than elytral bases, weakly to slightly sinuate between basal angles; posterior angles distinct, often with single small denticle. Pronotal disc usually with median longitudinal depression, groove, or canal; canal sometimes interrupted, forming an apical fovea and a basal canal, the two separated by an elevated, usually impunctate portion of the pronotal disc. Sides of prothorax more or less straight (Fig. 4.41), sinuate (Fig. 4.27), or narrowing towards base (Fig. 4.38). Pronotum margined laterally by incomplete carinae with a raised margin or bead; when viewed laterally, carinae gradually to abruptly curved anteroventrally (Fig. 4.3), ending before

apical margin of prothorax. Pronotum strongly deflexed laterally, forming the hypomeron of the prothorax. Hypomeron sparsely punctate. Posteriorly, the hypomeron has long, narrow postcoxal projections that meet and extend under the prosternal process. The tergosternal suture is straight to slightly sinuate, extending dorsally from where the lateral edge of the procoxal cavity transects the posterior extension of the hypomeron, parallel to the posterolateral margin of the prothorax, terminating before the anterior margin. Prosternum with a transverse groove anterior to the procoxae that is abruptly and acutely incised medially, groove extends laterally and ends at tergosternal suture lateral to procoxae, separating prothoracic basisternum from prosternal process. Prothoracic basisternum quadrate to elongate, flat to moderately convex, always longer than prosternal process. Prosternal process complete, narrowed then strongly and abruptly expanded at apex, expansion meeting postcoxal projections. Apex of prosternal process slightly elevated, broadly rounded apically, slightly overlapping mesoventrite. Prosternum bearing row of golden setae at anterior margin that project anteriad opposite the base of the head; margination continues laterally and dissipates near anterior pronotal angles. Posteriorly, prothorax bears row of golden setae that project posteriad. Procoxae narrowly separated. Procoxal cavities circular, narrowly separated at middle. Procoxal cavities internally open, externally broadly closed by postcoxal projections. Prothoracic trochantin concealed.

Pterothorax: With mesoscutellum visible, abruptly elevated, pommel-shaped. Mesoscutum shield-shaped, with fine, crenulate microsculpturing. Mesoscutum with anterolaterally projecting arms and postnotal elytral process. Lateral margin of mesoscutum with a sharp, angulate projection; lateral margin locks into grooves on the

elytral shelf. Mesoscutum with weakly visible longitudinal mesothoracic suture, represented internally by the longitudinal mesothoracic ridge. The internally projecting yolk plates of the mesoscutum are pointed and sclerotized. Anterior edge of mesoventrite at midline on different plane than mesoventral process and metaventrite. Mesothorax usually retracted into posterior region of the prothorax. Mesocoxae circular, countersunk, narrowly separated, closed laterally by meso- and metaventrite. Mesoventrite process extending to middle of mesocoxae. Meso-metaventral junction an overlapping, notched fitting. Mesepisterna distinctly separated, variously punctured. Mesoventrite variously punctured.

Metaventrite discrimen short to moderately long, sometimes extending past middle of metaventrite. Metaventrite longer than first abdominal ventrite, variously punctured. Metepisternum long and narrow. Metepimeron highly reduced, represented only weakly anteriorly in the arm of the notal wing process and completely obsolete posteriorly. Metacoxae ovoid and transverse, countersunk, narrowly separated.

Lateral furcal arms of metendosternite moderately long, apices swollen into a complex structure (Fig. 4.6). Metendosternal laminae well developed, narrowed, projecting slightly posteriad from beneath bases of furcal arms. Ventrolateral processes of metendosternite absent. Metendosternite with well developed metafurcal ventral flange. Anterior tendons widely separated, arising from short, pointed, anteriorly projecting arms. Anterior process of metendosternite absent, apical edge not emarginate.

Elytra (Figs. 4.174-4.223): Elongate, completely concealing abdomen. Elytra with 9 distinct puncture rows. Punctures range from inconspicuous (e.g. *D. analis*, Figs. 4.178-4.179) to deep and strongly marked (e.g. *D. ignarus*, Figs. 4.196-4.197). Interstitial

intervals (interstriae) of the elytra flat, to feebly raised, to strongly carinate. In some, apex of interstitial intervals with micro-punctures, from which short setae usually arise (e.g. *D. puncticollis*, Figs. 4.214-4.215). In most species, interstitial intervals 3, 5, and 7 elevated at base and apex of elytra. In some, elytral interstitial carinae join near apex (e.g. *D. puncticollis*). Carinae of interstitial interval 9 begin at humeral angle, extend posteriorly, and fuse with elytral apex. Inner margin of elytra forms tongue and groove locking apparatus. Basal margin of elytra greatly depressed, forming large elytral shelf. Grooves on inner margin of shelf articulate with and lock into corresponding notches on lateral margin of mesoscutum. Apex of humeral angles with knob-like or finger-like callosities or protuberances, sometimes merging with elytral interstitial carinae. Callosities sometimes extend anterolaterally at the basal margin of elytra to epipleuron. Epipleuron gradually set off from lateral margin of elytron, narrowing posteriorly until it dissipates near the elytral apex. Epipleuron with deep, longitudinal, furrow or groove. Mesal edge of epipleuron delimited by the deep stria, confluent with the sutural and distal elytral carina. Lateral edge of elytra straight. Basal edge of elytra (when viewed laterally), weakly sinuate.

Hindwing (Fig. 4.4): With well developed, elongate radial cell. Inner posterior angle formed at base radial cell right. Median area of hind wing with four free veins. Medial fleck present, weakly developed, partially bisected by a free vein. Wing veins in medial area of wing variable inter- and intra-specifically. Wedge cell weakly developed in some spp., minute or absent in other spp. Anal lobe present.

Legs: With trochanterofemoral attachment of the heteromeroid type, trochanters concealed within excavations in proximal ends of femora, femora nearly touch coxae.

Trochanters and coxae sometimes bearing sparse setae. Femora glabrous, swollen near middle. At the apex, internal and external walls of femora with expanded, downward-projecting semicircular plates, concealing the femorotibial articulation from the sides. Tibia slightly expanded at apex, outer edge with row of small denticles, inner edge sparsely to moderately setose. Outer apical angle of tibia with one large, outwardly facing tooth and crown of smaller teeth. Tibia with two subequal, glabrous tibial spurs; one spur much larger and thicker; curved. Tarsal formula 4-4-4 in both sexes; tarsomere I distinctly longer than II. Tarsomeres sparsely setose, some with pockets of stout, bristle-like setae on ventral surface arising from transverse slits near anterior margin of tarsomeres. Tarsal claws simple and subequal, empodium absent. Procoxae cylindrical, countersunk, not or slightly projecting below prosternum.

Abdomen (Figs. 4.7, 4.46-4.55): With five subequal ventrites. Intercoxal process of ventrite I narrowed, slightly pointed apically, apex notched to interlock with metathorax. Ventrites variously punctate. In most, abdominal ventrite V simple. In some, abdominal ventrite V bears two depressions, one on each side of midline, resulting in median V-shaped area near posterior margin (Figs. 4.46-4.47), present in both sexes. In others, ventrite V is sexually dimorphic, with a bulbous swelling near posterior margin (females of *D. erichsoni*, Figs. 4.51-4.52), or a notched posterior face (males of *D. xanthorrhoeae*, Figs. 4.54-4.55).

Genitalia (Figs. 4.224-4.244): Symmetrical, of cucujoid type. Tegmen moderately long with well-developed parameres. Parameres individually articulated to phallobase, fused to phallobase but free from one another, or broadly fused to one another. Paramere shape variable from short and transverse (e.g. *D. boliviensis*) to broadly rounded (e.g. *D.*

piceus, Fig. 4.239), to narrow and elongate (e.g. *D. oregonensis*, Fig. 4.237). Parameres densely to sparsely setose; dorsal surface simple, or bearing hook-like projections. Aedeagus with very long and narrow anterior ventral strut; median lobe long and narrow, straight, slightly, or greatly curved, bearing short, paired anterior struts or a notched, sclerotized anterior tip. Median lobe unicolored or bicolored. Posterior tip of median lobe narrow and pointed (majority) or swollen and pointed (*D. bucculentus*). Ovipositor long, apex with two short styli bearing sparse setae.

Distribution (Figs. 4.124-4.148): *Deretaphrus* has an odd distribution. The majority of species are Australian, occurring in every state of the country. One species, *Deretaphrus interruptus* Grouvelle, occurs in New Caledonia. One species, *Deretaphrus oregonensis* Horn, is the only described New World species and is moderately common in the western United States (CA, OR, WA, ID, MT, UT, NV) and British Columbia, Canada. The distribution of *D. oregonensis* appears to be limited to the western side of the Rocky Mountains. It is speculated that *D. oregonensis* may occur in other western states (Wyoming, Colorado, Arizona, perhaps New Mexico), but there are currently no records from these localities. There is also a single specimen of a previously undescribed species (*Deretaphrus boliviensis*, herein newly described) collected from the interior of Bolivia. The distribution of the genus is perhaps an old amphipolar distribution, with representatives occurring in both Northern and Southern Hemispheres (Crowson, 1980). However, the Australasian, Nearctic, and Neotropical distribution is very odd. It is possible that *D. boliviensis* occurs in other countries in South and perhaps Central America, although no other specimens have been recorded. The distributions of the Australian *Deretaphrus* species are by no means concrete. Over- and undercollecting in

various regions of the continent have undoubtedly led to skewed distributions. It is highly probable that several species of *Deretaphrus* are much more widespread than current collection records indicate.

Biology (Figs. 4.10-4.20): Little is known about the biology of *Deretaphrus*. The larvae are ectoparasitic on a variety of hosts, predominantly wood-boring beetles in the families Cerambycidae and Buprestidae (Balduf, 1935; Böving and Craighead, 1931). Larvae have also been collected inside the nests of solitary bees (pers. comm., S. A. Slipinski). Parasitism by Coleoptera is rare, with relatively few beetle species from a small number of families exhibiting this behavior (Carabidae, Staphylinidae, Rhipiceridae, Cucujidae, Rhipiphoridae, and Meloidae) (Lawrence and Britton 1991), and even fewer exhibiting ectoparasitism in the larval stage (Passandridae, Meloidae, Rhipiphoridae) (Lawrence and Newton 1982). *Deretaphrus* species have hypermetamorphic development. It has been observed that the larvae are of triungulin form early in their lifecycle (pers. comm. S. A. Slipinski), although no specimens have been collected in that state. The grub-like later instars of *Deretaphrus* have been collected and described (Böving and Craighead, 1931; pers. comm., M. Ivie). This body plan differs greatly from the early-instar triungulin form. The hypermetamorphic lifestyle is consistent with the ectoparasitic nature of the genus. During the last instar stage, the *Deretaphrus* larvae migrate away from the host and spin elongate-oval silken cocoons. The cocoon is of uniform texture, composed of a thread-like, fibrous material (Figs. 4.162-4.167). It is not known whether or not the material is secreted from the buccal cavity or the anal glands of the larvae (Balduf, 1935). The cocoons are attached near or directly to the host, and the larvae pupate within their last larval skin inside the cocoon. The construction of a silken cocoon is uncommon

among Coleoptera, having been reported in only some species of only five other families (e.g. Brachyspectridae, Tenebrionidae, Curculionidae, aleocharinae Staphylinidae, Cerylonidae) (Ashe, 1981; Lawrence and Britton 1991: 559; Leschen, 1991; pers. comm., S. A. Slipinski)

Most adult *Deretaphrus* are collected under the bark of fallen trees, most likely feeding within the galleries of wood-boring beetles. Adults are commonly collected at lights at night. They have also been found crawling on the surface of logs at night (pers. comm. M. Caterino), suggesting a nocturnal lifestyle. Nothing is known about the feeding habits of the adults, although they are thought to be predators of saproxylous insects. In a study of the mandibles of adult *Deretaphrus* utilizing Environmental Scanning Electron Microscopy (ESEM) with backscatter detectors, metals were found incorporated into the tips of the mandibles (NPL, unpublished data). An elemental analysis using energy-dispersive spectroscopy identified the presence of Zinc and Chlorine in the apex of the mandibles of multiple *Deretaphrus* species. This discovery along with the general shape of the mandibles suggests that adult *Deretaphrus* are probably feeding on wood or other plant tissues, as opposed to being predaceous as previously suspected.

There is one record of *Deretaphrus* adults being collected in basidiomycete fungi, sheltering in the galls of *Uromycladium* (rust fungi) on *Acacia* in Australia (*Deretaphrus viduatus*, specimen UGCA 1NL). There is another record of an adult *Deretaphrus* being collected as an inquiline with ants. The tendency of *Deretaphrus* beetles to occur under the bark of dead trees and logs may be a possible explanation for this association.

The New Caledonian species, *Deretaphrus interruptus* Grouvelle, has been collected in association with the larvae of *Agrianome fairmairei* (Cerambycidae: Prioninae), under the bark of *Aleurites moluccana* (pers. comm. C. Mille).

The Australian species have been collected in association with the larvae of several beetles within the family Cerambycidae, including *Paroplites australis, Penthea saundersii,* and *Phoracantha* sp. Adults and pupal cocoon masses have also been discovered inside the pupal cells of a Cetoniine scarab, *Trichaulax philipsii* (Scarabaeidae). *Deretaphrus* have historically been found under the bark of *Eucalyptus* and *Acacia* (e.g. *Acacia bidwillii*), and Australian Saltbrush (*Atriplex semibaccata*). *Deretaphrus* adults have also been collected in various sclerophyll plants and on the dead crowns of *Xanthorrhoea* sp. and *Kingia australis.*

Several *Deretaphrus* species were found to have small mites beneath their elytra. Often, these mites were very small and numbered in the hundreds. These mites are probably phoretic, a common occurrence in many wood-inhabiting beetles (Lawrence and Britton, 1991).

The North American *Deretaphrus oregonensis* is most often collected under the loose, dry bark of trees. The literature and specimen label data indicates that the larvae of *Deretaphrus oregonensis* feed on a variety of hosts and are found under bark of a number of different species of trees. *Deretaphrus oregonensis* has been collected from under the bark of Ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), Sugar pine (*Pinus lambertiana*), Lodgepole pine (*Pinus murrayana*) Douglas fir (*Pseudotsuga mucyanata*), Red fir (*Abies magnifica*), White fir (*Abies concolor*), Western larch (*Larix occidentalis*) and Canyon oak (*Quercus chrysolepus*). Burke (1919) reported that

cocoons had been collected “from the wood of an old fire scar on the side of a living incense cedar (*Libocedrus decurrens*)”. Label data also indicates *Deretaphrus oregonensis* has been recovered from under the bark of burned pines. *Deretaphrus oregonensis* has been associated with the following presumed host beetle species: Curculionidae: *Dendroctonus jeffreyi*, *Dendroctonus monticolae*, Buprestidae: *Buprestis laeviventris*, *Buprestis aurulenta*, *Trachykele opulenta*, *Trachykele nimbosa*, and Cerambycidae: *Asemum atrum* (Burke, 1919; Balduf, 1935; Clausen, 1940; Essig, 1926; Philips and Ivie, 2002). It is hypothesized (Burke, 1919; Balduf, 1935) that *Deretaphrus* parallel the life cycles of their hosts, potentially persisting in the larval stage for over a year.

Etymology: *Der*: Greek for “neck”. *–taphrus*: Greek for “A trench” (Borror, 1961). The name *Deretaphrus* means “trench-neck,” most likely referring to the transverse, postocular constriction of the head capsule forming a bulbous posterior portion.

Remarks: Due to the ectoparasitic lifestyle of this genus, adults are highly variable in size, coloration, and sculpturing. In particular, the ornamentation of the pronotal disc and the carination of the elytral interstitial intervals can vary intraspecifically. The elytral punctures often vary in size and/or depth. The coloration and general appearance also may vary within a species, ranging from pitchy orange/red to black. The luster of various body surfaces varies in appearance from matte to glossy. Smaller specimens become nondescript, their distinguishing characters being much less pronounced than in larger specimens of the same species. This intraspecific variation undoubtedly caused many misidentifications, synonyms, and other nomenclatural issues that are so pervasive within the genus.

References: Balduf 1935: 166; Blackburn 1903: 120-130; Böving and Craighead 1931: 40, 174, pl. 44; Burke 1919: 123-124; Carter 1937: 199-202; Clausen 1940: 572; Craighead 1920: 6-9, 13, pl. 2; Craighead 1950: 208; Crowson 1955: 123, Figs. 142, 145; Crowson 1981: 563; Elston 1923: 212; Erichson 1845: 287-289; Essig 1926: 398-399, 450, 514; Fauvel 1903: 341; Germar 1848: 222-223; Grouvelle 1903: 174; Hatch 1961: 241, 247, 460, pl. LI; Heinze 1943: 87, 89, 119; Hetschko 1930: 70-72; Horn 1873: 146-147; Horn 1878: 579-581; Lacordaire 1854a: 377-378; Lacordaire 1876: 8, pl. 20; Lawrence 1980: 308; Lawrence 1985: 205; Lawrence 1991: 157, 477-478; Lawrence and Britton 1991: 656; Lea 1898: 547-550; Macleay 1873: 165-166; Masters 1871: 78-79; Newman 1842: 403-404; Pal and Lawrence 1986: 199, 205-206; Pascoe 1862: 460-464; Philips and Ivie 2002: 358-361; Reitter 1877: 342; Stephan 1989: 11-13; Wollaston and Newman 1855: Appendix 207-211.

Once the vast majority of the world's holdings were borrowed and examined, it became very apparent that previous workers on this genus were at a serious disadvantage in not having the bulk of the available material before them. A large percentage of *Deretaphrus* specimens were misidentified, even by the authors of the particular species themselves. Multiple species were frequently found mounted in a series on the same card mount, often labeled as a single species. In some especially troubling cases, even multiple type specimens mounted on a single card represented more than one species. At the start of this project, it became readily apparent that previous determinations could not be trusted, even if they had been made by prior taxonomic authorities of this group.

KEY TO SPECIES

1. Eyes reniform, excavated posteriorly by a large angular cuticular expansion of the head capsule (South Australia) ..... ***ocularis*** Lord and McHugh

1'. Eyes not reniform, not excavated posteriorly 2

2(1'). Pronotal disc with a weakly developed, shallow, uninterrupted longitudinal depression or groove, or lacking depression or groove (Figs. 4.22, 4.24, 4.26, 4.28, 4.33, 4.36, 4.39, 4.41, 4.42, 4.44) 3

2'. Pronotal disc with a well-developed, sharply impressed longitudinal canal or groove, canal or groove clearly interrupted, forming distinct apical and basal portions, the apical portion always much smaller than the basal portion (Figs. 4.21, 4.23, 4.25, 4.27, 4.29-4.32, 4.34-4.35, 4.38, 4.40, 4.43, 4.45) 12

3(2). Antennae minutely setose, setae extremely short and almost indiscernible, antennae appearing glabrous unless at high magnification..... 4

3'. Antennae with clearly visible setae 10

4(3). Each elytron with only odd intervals (some or all) distinctly raised or carinate (5 or less intervals raised, not including sutural interval 5

4'. Each elytron with even and odd intervals (some or all) distinctly raised or carinate (5 or more intervals raised, not counting sutural interval)..... 6

5(4). Pronotum evenly convex, without median longitudinal depression/groove (Fig. 4.33); punctures on pronotal disc more or less uniform in size; raised elytral interstitial intervals separate and straight for entire length (Western Australia) ..... ***incultus*** Carter

5'. Pronotum with median longitudinal depression; punctures on pronotal disc larger within median longitudinal depression; at apex, elytral interstitial intervals 3 and 5 curved

inwardly, fusing or nearly fusing; eyes strongly protuberant, approaching pointed (Western Australia)..... ***parviceps*** Lea

6(4’). Raised elytral interstitial intervals not continuous for entire length, repeatedly interrupted to form intermittent raised portions or tubercles.....7

6’. Raised elytral interstitial intervals continuous for entire length, not frequently interrupted.....8

7(6). Interrupted portions of elytral interstitial intervals forming numerous denticles near elytral apex (Figs. 4.188-4.189); median longitudinal depression of pronotal disc extremely weak, only distinctly apparent at base; pronotal width at midlength almost equal to pronotal length (Fig. 4.28); orange to light red in color (eastern Australia) ..... ***erichsoni*** Newman

7’. Interrupted portions of elytral interstitial intervals not forming numerous denticles near elytral apex, instead forming raised or elevated patches (Figs. 4.220-4.221); median longitudinal depression of pronotal disc extending onto anterior 1/3 of pronotum; pronotal width at midlength distinctly less than pronotal length (Fig. 4.44); dark red to brown in color (Australia).....***wollastoni*** Newman

8(6’). Median longitudinal depression of pronotal disc shallow and wide, not distinctly tapering towards anterior margin; punctures within median longitudinal depression of pronotal disc randomly spaced and distinctly larger than on rest of disc (Fig. 4.42) (Western Australia)..... ***rodmani*** Lord and McHugh

8’. Median longitudinal depression of pronotal disc widest at base, distinctly tapering towards anterior margin; median longitudinal depression of pronotal disc impunctate within 9

9(8’). Punctures on pronotal disc large, shallow, closely set, giving pronotal disc an alveolate, or netlike appearance (Fig. 4.22); dorsal surface of the head extremely flat, lateral margins of the frons not expanded; abdominal ventrite V simple (Western Australia)..... ***alveolatus*** Carter

9’. Punctures on pronotal disc smaller, deep, not closely set and more or less evenly spaced; punctures around apex of median longitudinal depression of pronotal disc slightly angled outwards, punctures on rest of disc longitudinal (Fig. 4.24); Dorsal surface of the head convex, lateral margins of the frons above the eyes slightly expanded; apex and posterior face of abdominal ventrite V impressed, slightly upturned (Western Australia) .....***antennatus*** Lord and McHugh

10(3’). Each elytron with three or more sharply raised or carinate interstitial intervals, pronotal disc with large, dense punctures.....11

10’. Each elytron with less than three sharply raised or carinate interstitial intervals (Fig. 4.204-4.205), pronotal disc with small, dense punctures, punctures at lateral margin distinctly larger (eastern Australia).....***lateropunctis*** Lord and McHugh

11(10). At apex, elytral interstitial intervals 3 and 5 curved inwardly, fused or nearly fused (Fig. 4.214-4.215); frons without angulate lateral expansions, eyes completely visible from above (eastern Australia).....***puncticollis*** Lea

11’. Elytral interstitial intervals 3 and 5 separate for entire length (Fig. 4.184-4.185), frons with angulate lateral expansions, partially or completely concealing the eyes from above (Fig. 4.168) (eastern Australia) .....***bucculentus*** Elston

12(2’). Anterior portion of median longitudinal canal distinct, round or oval, forming a deep fovea.....13

12’. Anterior portion of median longitudinal canal weakly developed, represented by a small slit or shallowly depressed area.....18

13(12). Submentum greatly expanded anteriorly, entirely concealing mentum and base of palpi from view (as in Figs. 4.246-4.247, 4.250) 14

13’. Submentum not greatly expanded anteriorly, at least part of mentum and base of palpi visible (as in Figs. 4.245, 4.248-4.249) 15

14(13). Posterior portion of median longitudinal canal gradually narrowing and diminishing posteriorly, closed (Fig. 4.34); anterior portion of median longitudinal canal small, round; denticles at basolateral corners of pronotal disc small; anterior margin of submentum sinuate (Figs. 4.8, 4.247) (New Caledonia).....***interruptus*** Grouvelle

14’. Posterior portion of median longitudinal canal not narrowing or diminishing posteriorly, open; anterior portion of median longitudinal canal large, deep, oval; denticles at basolateral corners of pronotal disc large, each bearing a single seta (Fig. 4.31); anterior margin of submentum arcuate (eastern Australia) .....***hoplites*** Lord and McHugh

15(13’). Abdominal ventrite V with two depressions, one on each side of midline, resulting in a median V-shaped area near the posterior margin (Figs. 4.46-4.47), present in both sexes.....16

15’. Abdominal ventrite V simple, without a depressions on each side of midline, not forming a median V-shaped area near the posterior margin.....17

16(15). Pronotum with minute punctures; elytra lacking distinct punctures; basal portion of pronotal median longitudinal canal closed, rounded (Fig. 4.23) (eastern Australia) .....***analis*** Lea

16’. Pronotum with small punctures; elytra with 9 rows of small punctures (Figs. 4.212-4.213); basal portion of pronotal median longitudinal canal open, narrowing basally (Fig. 4.40) (eastern Australia).....***piceus*** (Germar)

17(15’). Elytral punctures deep, very large; diameter of pronotal punctures variable; basal portion of pronotal median longitudinal canal very deep, narrowing basally (Fig. 4.38) (western USA).....***oregonensis*** Horn

17’. Elytral punctures shallow, small; diameter of pronotal punctures uniform; basal portion of pronotal median longitudinal canal not very deep, narrowed in middle, swollen and rounded at each end (Fig. 4.25) (Bolivia).....***boliviensis*** Lord and McHugh

18(12’). Pronotal disc with small, sparse punctures; when viewed dorsally, anterior angles of pronotum not distinctly deflexed/depressed (Figs. 4.30, 4.35); antennae with moderately long setae, setae greater than half the length of the segment from which they arise.....19

18’. Pronotal disc with medium to large, dense punctures; when viewed dorsally, anterior angles of pronotum distinctly deflexed/depressed; antennae with short, sparse setae, the setae shorter than half the length of the segment from which they arise.....20

19(18). Basal portion of median longitudinal pronotal canal greatly impressed; anterior portion of canal distinct, surrounding area depressed; lateral margins of pronotal disc strongly deflexed; dorsal surface of pronotal disc medially impressed (Fig. 4.30) (Western Australia).....***gracilis*** Blackburn

19’. Basal portion of median longitudinal pronotal canal shallow, not greatly impressed; anterior portion of canal feebly marked, surrounding area weakly depressed;

lateral margins of pronotal disc not strongly deflexed; dorsal surface of pronotal disc very flat (Fig. 4.35) (eastern Australia)..... ***iridescens*** Blackburn

20(18'). Frons with prominent lateral expansions above eyes, forming a thick ridge over the eyes when viewed laterally; eyes at least partially concealed from above (as in Figs. 4.168, 4.173) 21

20'. Frons without prominent lateral expansions above eyes, ridge over eyes not present; eyes entirely visible from above..... 22

21(20). At elytral midlength, elytral interstitial intervals 3-9 distinctly carinate, degree of carination subequal (Figs. 4.186-4.187); eyes strongly protuberant, not evenly convex, nearly angulate/pointed (Fig. 4.169) (Australia)..... ***carinatus*** Lord and McHugh

21'. At elytral midlength, elytral interstitial intervals 3-9 carinate, but intervals 4, 6, and 8 less prominent than 3, 5, 7, 9; interval 8 flat (Figs. 4.196-4.197); eyes evenly convex (eastern Australia) ..... ***ignarus*** Pascoe

22(20'). Anterior angles of pronotum not prominent, rounded; elytral interstitial interval 6 not raised, or raised for entire length 23

22'. Anterior angles of pronotum prominent, obtuse; elytral interstitial interval 6 prominently raised for a short distance in basal half of elytra (Figs. 4.190-4.191) (eastern Australia)..... ***fossus*** Newman

23(22). At elytral midlength, elytral intervals 3, 4, and 6 not distinctly raised; abdominal ventrite V always simple; usually black in color (eastern Australia) 24

23'. At middle, elytral intervals 3,4, and 6 distinctly raised (Figs. 4.222-4.223); posterior face of abdominal ventrite V excised in males (Figs. 4.54-4.55); dark red in color (Western Australia)..... ***xanthorrhoeae*** Lea

24(23). Anterior portion of head with a median longitudinal impression, most prominent near frontoclypeal suture. Basal portion of pronotal median longitudinal canal deeply impressed, nearly parallel sided for entire length; anterior angles of pronotum broadly rounded (Fig. 4.43). Pronotum depressed medially. Elytral interstitial interval 3 only feebly raised at base and apex (Figs. 4.218-4.219) (eastern Australia).....***viduatus*** Pascoe

24'. Anterior portion of head evenly convex. Basal portion of pronotal median longitudinal canal distinctly wider at base and tapering anteriorly, (appearing as an isosceles triangle), shallow. Anterior angles of pronotum pronounced, nearly right angles (Fig. 4.21). Pronotum evenly convex. Elytral interstitial interval 3 distinctly raised for entire length, carinate (Figs. 4.174-4.175) (eastern Australia).....***aequaliceps*** Blackburn

SPECIES ACCOUNTS

Deretaphrus aequaliceps Blackburn

(Figs. 4.21, 4.174-4.175)

Deretaphrus aequaliceps Blackburn 1903: 127.

Diagnosis: Characterized by the anterior angles of the pronotum produced and angulate, elytral interstitial interval 5 and 7 distinctly carinate, median longitudinal pronotal canal wide at base and narrowing to a point anteriorly, submentum truncate and transverse, punctures on pronotal disc large and dense, and generally small size.

Description: Body elongate, parallel, red to black; dorsal surface glabrous, slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head distinctly narrower than pronotum; slightly narrowed apically; frons with slight transverse expansions, dorsolateral margin sinuate; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, significantly denser. Frontoclypeal suture distinct. Clypeus distinctly narrower than head; posterior margin of clypeus slightly incised medially, anterior margin of clypeus slightly arcuate. Submentum moderately expanded anteroventrally, apical segments of palpi visible, part of mentum often visible. Submentum short and transverse, distinctly separated from subgenal braces, anterior margin straight to slightly convex. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose; segments 2-8 with single row of moderately long setae, setae extending to or past antennal segment from which they arise; antennal club segments with sparse setae, setae long and located at or near the apical margin of the segment. Antennal club subsymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.21): Pronotum elongate, widest near anterior ¼, distinctly wider than head. Dorsal surface flattened to slightly impressed at middle, convex laterally. Anterior margin slightly arcuate; anterior angles produced, nearly right angles, slightly rounded. Posterior margin slightly sinuate, distinctly narrower than elytral bases; posterior angles pronounced, with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with small, dense, oval punctures. Median longitudinal pronotal canal well developed, interrupted to form a weakly impressed, apical portion and a basal canal. Interruption of the canal impunctate. Apical fovea a small slit or merely a depression. Basal canal elongate, narrow and triangular (isosceles) widest at base and narrowing to a sharp point anteriorly; internal

lateral margins of canal grooved. Hypomeron minutely punctate; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate; located on lateral wall of prothorax.

Elytra (Figs. 4.174-4.175: Elytron flattened dorsally, convex laterally. Interstitial intervals 5 and 7 carinate for entire length, more pronounced near apex. Interval 3 raised near apex only. Intervals 3, 5, and 7 with micropunctures at crest. Basal elytral margin with intervals 3 and 5 ending in a weak, knob-like protuberance. Elytral shoulder with weakly developed finger-like callosity.

Abdomen: Ventrite V more densely punctured than preceding segments.

Legs: Setation sparse. Inner face of tibia with a double fringe of moderately long setae. Tarsus moderately setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex, rest of tarsi with erect setae that extend past segment of origin.

Aedeagus: Not studied.

Variation: Size and color vary within the species. The width of the median longitudinal pronotal canal is also somewhat variable.

Type Material (Fig. 4.56): HOLOTYPE (original designation) label data: Label 1: "Type / H.T." Label 2: "7204 / Healesville T." Label 3: "Australia. / Blackburn Coll. / B.M.1910-236." Label 4 "Deretaphrus / aequaliceps / Blackb" [BMNH 95NL, examined]. Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

Specimens examined: The holotype and 30 specimens were examined.

Distribution (Fig. 4.124): New South Wales, Queensland, and Victoria, Australia.

Biology: Not known.

Etymology: *aequali*: Latin = Equal, level. *–ceps*: New Latin = head. This species was named for the even surface of its head.

Remarks: This species most closely resembles *Deretaphrus viduatus*. Due to the extreme size variation within members of the genus, small specimens may be very difficult to identify correctly. The impressed anterior portion of the head, median longitudinal pronotal canal distinctly narrowing apically, more well-defined anterior pronotal angles, greatly transverse submentum, and generally smaller shape serve to distinguish this species from *D. viduatus* and all other *Deretaphrus* spp.

References: Carter 1937: 200-201; Heinze 1943: 119.

***Deretaphrus alveolatus* Carter**

(Figs. 4.22, 4.176-4.177, 4.224)

Deretaphrus alveolatus Carter 1937: 201

Diagnosis: Characterized by the large, shallow, extremely dense punctures on the pronotal disc, giving an alveolate appearance, the punctures of the head and pronotum each bearing a single small seta, flat apex of the head, and its genitalic characters.

Description: Length 7.6 mm. Width 2 mm. Body elongate, parallel, dark red; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head distinctly narrower than pronotum; slightly narrowed apically, apex flat; frons without transverse angular expansions; eyes completely visible from above. Punctures on bulbous posterior portion and anterior portion small, sparse, each with a small seta arising from the center. Frontoclypeal suture distinct, arcuate, slightly sinuate

medially. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum narrowly separated from subgenal braces; anterior margin sinuate. Submentum without paired setose pits. Antennal groove well developed, impunctate internally. Antenna appearing glabrous except under high magnifications, segments 3-8 with a single row of minute setae, antennal club segments with minute, sparse setae. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.22): Pronotum elongate, tapering only slightly towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface convex, slightly depressed along midline, more strongly deflexed near anterior angles. Anterior margin arcuate; anterior angles rounded. Base of pronotum slightly narrower than elytral bases; posterior margin weakly sinuate, posterior angles without small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with very large, shallow, round punctures, each with a small seta arising from the center; punctures very dense, closely set, almost confluent, giving the pronotal disc an alveolate pattern. Median longitudinal pronotal depression present, extremely weak and shallow, ending before anterior margin; depression slightly more impressed near basal margin. Hypomeron sparsely punctate than pronotal disc, punctures large and shallow; lateral walls subparallel (subparallel). Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate, located on lateral wall of prothorax.

Elytra (Figs. 4.176-4.177): Elytron slightly flattened dorsally. Interstitial intervals 3-9 raised for entire length, shiny; raised even intervals not as long as odd,

ending before apex; odd raised intervals nearly extending to apical margin; interval 3 raised towards apex; interval 4 raised for apical half. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance on elytral interval 5 fuses with finger-like callosity on elytral shoulder.

Abdomen: Ventrite V simple, puncture become smaller and denser near apex.

Legs: Tibia with short, sparse setae. Inner face of tibia with two setal fringes with short, thick setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of long, dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.224): Phallobase simple. Phallobase with weakly curved, lateral hook-like projections. Parameres moderately short, elongate, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections narrowly separated, parallel medially, slightly shorter than half the length of the parameres, tips of projections slightly swollen. Median lobe short, moderately thick, slightly curved, posterior tip narrowed and pointed, anterior tip slightly expanded, bearing paired anterior struts. Median lobe bicolored, lighter for apical 1/3.

Type Material (Fig. 4.57): HOLOTYPE (♂, original designation, by monotypy) label data: Label 1: "Cue, W.A. / H.W. Brown" Label 2: "Holotype" Label 3: "Deretaphrus / alveolatus / Cart:" Label 4 "S. Aust. Museum / specimen" [SAMA 282NL, examined, dissected]. The holotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

Specimens examined: Only known from the unique holotype, representing the single collection record.

Distribution (Fig. 4.125): Cue, Western Australia, known only from the holotype locality.

Biology: Not known.

Etymology: This species was named for the alveolate, or netlike, punctation of the pronotal disc.

Remarks: This species most closely resembles *Deretaphrus antennatus* **n. sp.** Both species have small setae that arise from the punctures on the head and pronotum, as well as a similar sculpturing of the pronotum. In *D. alveolatus*, the dorsal surface of the head is flat, the punctures on the pronotal disc are round and much shallower, and the segments of the antennal club are more rounded and less angulate. These characters serve to adequately distinguish this species from *D. antennatus* **n. sp.** The carination of the elytral interstitial intervals is similar to the other Western Australian *Deretaphrus* spp., but this species is easily separated from them by the punctation of the pronotal disc.

References: Heinze 1943: 119.

***Deretaphrus analis* Lea**

(Figs. 4.23, 4.178-4.179, 4.225)

Deretaphrus analis Lea 1898: 547

Diagnosis: Characterized by the almost smooth surface of the body, interrupted pronotal median longitudinal canal, the posterior canal rounded and closed at the base, antenna and tarsomeres densely setose with long setae (longer than the segment from which they arise), shape of the submentum, abdominal ventrite V bearing two depressions on either

side of midline, resulting in a median V-shaped area near the posterior margin, and its genitalic characters.

Description: Length 5.4–9.9 mm. Width 1.4–3 mm. Body elongate, parallel, dark brown to black; dorsal surface glabrous, matte to moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion minute, sparse, punctures on anterior portion minute, moderately dense. Frontoclypeal suture distinct, arcuate medially. Anterior margin of clypeus slightly arcuate. Submentum slightly expanded anteroventrally, at least part of mentum visible. Submentum distinctly separated from subgenal braces. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna densely setose; segment 1 with few setae on ventral surface; segments 2-4 with short setae; segments 5-11 with long, golden setae that longer than and extending beyond the antennal segment from which they arise. Antennal club segments with multiple rows of setae. Antennal club subsymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.23): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface flattened down the longitudinal midline, convex laterally. Anterior margin slightly arcuate, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin moderately sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc smooth, with minute, sparse punctures. Median longitudinal pronotal canal well developed, interrupted to form a

deep, apical fovea and a basal canal. Raised interruption of the canal impunctate. Basal canal wide; deeply impressed; rounded and closed at the base. Hypomeron minutely punctate; strongly deflexed medially (towards midline). Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate.

Elytra (Fig. 4.178-4.179): Elytron convex. Elytral surface smooth, punctures weakly impressed, almost indiscernible. Interstitial intervals 3, 5, 7, and 9 feebly raised, more pronounced near apex. Interval 5 meets or nearly meets interval 9 near apex. Intervals 3, 5, and 7 with micropunctures at crest. Apical elytral margin with small, dense punctures. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interstitial interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Abdominal ventrite V more heavily punctured, bearing two depressions on either side of midline, resulting in a median V-shaped area near the posterior margin (Fig. 4.46), present in both sexes.

Legs: Base of femur and trochanter with long, sparse setae. Inner face of tibia with fringe of long, dense setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus (Fig. 4.225): Phallobase with lateral hook-like projections, projections strongly curved, curvature 180 degrees. Phallobase with several folds. Parameres broadly rounded, broadly fused to one another near base, each paramere with two patches of lighter coloration; one light patch at base, oval, extremely transverse, extending from midline to lateral margin; second light patch at apex, broader than basal patch, extending

from midline to lateral margin. Median lobe long, slender; posterior tip narrowed and pointed, anterior tip slightly expanded, bearing long, thin, paired anterior struts.

Variation: *Deretaphrus analis* varies in coloration from light reddish-orange to pitchy black. The shape of the anterior portion of the pronotal median longitudinal canal ranges from elongate to teardrop-shaped to oval. The pronota range from slightly to moderately narrowed near the base. In some specimens, the elytral punctures can be seen, but in most the punctures are absent.

Type Material (Figs. 4.58-4.59): LECTOTYPE (here designated) label data: On card: "TY" Label 1: "analis / Lea TYPE / Richmond R" Label 2: "9562 / Deretaphrus / analis Lea / N.S. Wales / TYPE" Label 3: S. Aust. Museum / specimen" Label 4: "LECTOTYPE / *Deretaphrus analis* / Lea 1898" Underside: SAMA 279NL [SAMA 279NL, examined]. Sex not determined. The lectotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARALECTOTYPE (here designated) label data: On card: "TY" Label 1: "analis / Lea TYPE / Richmond R" Label 2: "9562 / Deretaphrus / analis Lea / N.S. Wales / TYPE" Label 3: S. Aust. Museum / specimen" Label 4: "PARALECTOTYPE / *Deretaphrus analis* / Lea 1898" Underside: SAMA 280NL [SAMA 280NL, examined]. Sex undetermined. The paralectotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARALECTOTYPE (here designated) label data: same as above, except label 4 reads: "PARALECTOTYPE / *Deretaphrus analis* / Lea 1898" Underside: SAMA 281NL [SAMA 281NL, examined]. Sex undetermined. The paralectotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

The lectotype and paralectotypes are mounted on the same card mount and pin. The specimen on the left is the lectotype [SAMA 279NL]. The middle specimen [SAMA 280NL] and right specimen [SAMA 281NL] are paralectotypes.

Specimens examined: The lectotype, two paralectotypes, and 25 specimens were examined.

Distribution (Fig. 4.126): New South Wales and Queensland, Australia.

Biology: One specimen was collected under the bark of *Acacia* sp. Another specimen was collected by fogging vine scrub with pyrethrum.

Etymology: Not known.

Remarks: This species is most similar to *Deretaphrus piceus*, but can be distinguished by the almost impunctate pronotum and elytra and the basal portion of the median longitudinal canal on the pronotal disc distinctly rounded and closed at both ends.

References: Blackburn 1903: 120; Carter 1937: 200.

***Deretaphrus antennatus* Lord and McHugh new species**

(Figs. 4.24, 4.180-4.181)

Diagnosis: Characterized by the apex of abdominal ventrite V slightly to moderately truncate or flattened, the evenly convex surface of the pronotum, punctures of head and pronotum deep, each bearing a single small seta, the body height distinctly greater (dorsoventrally) at abdomen than at prothorax, shape of the submentum, antennal club distinctly asymmetrical with very angular segments, and apical margin of the last antennal segment slightly concave and distinctly pointed.

Description: Length 8.9–9.8 mm. Width 2.5–3 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head distinctly narrower than pronotum; narrowed apically, dorsal surface subtriangular in shape; frons without prominent transverse angular expansions, without thick ridge over the eye, eyes visible from above; eye evenly convex. Punctures on bulbous posterior portion and anterior portion fairly dense. Frontoclypeal suture distinct, slightly sinuate medially. Clypeus distinctly narrower than head. Anterior margin of clypeus slightly arcuate, nearly straight. Submentum greatly expanded anteroventrally, mentum completely concealed, only tips of palpi visible, if at all. Submentum narrowly separated from subgenal braces, anterior margin straight, anterior corners produced into rounded lobes. Submentum without paired setose pits. Antennal groove well developed, impunctate internally. Antenna appearing glabrous except under high magnifications, segments 3-8 with a single row of minute setae, setae much smaller than the segment from which they arise. Antennal club segments with intermittent setae, anterior apical angle of segment 11 with patch of minute, erect setae. Antennal club distinctly asymmetrical, external/anterior edge of club segments straight, internal/posterior edge distinctly curved. Dorsal surface (external face) of mandible without median setose groove.

Thorax (4.24): Pronotum large, slightly impressed medially, distinctly tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface convex, deflexed near anterior and posterior angles. Anterior margin straight; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases;

posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin arcuate, slightly to moderately sinuate, with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with large, deep, circular to oval punctures. Median longitudinal pronotal canal present, weakly developed, not interrupted. Hypomeron sparsely punctate, punctures large, round, and deeper than punctures of pronotal disc. Lateral walls greatly deflexed, subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (4.180-4.181): Elytron slightly flattened dorsally. Elytral interstitial intervals with row of micropunctures at apex. Intervals 3-7, 9 raised for entire length, shiny, interval 8 raised only near apex; even raised intervals not as long as odd, ending before apex; odd raised intervals nearly extending to apical margin; interval 3 raised towards apex; interval 4 raised for apical half. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance on elytral interval 5 fuses with finger-like callosity on elytral shoulder.

Abdomen: Apex of ventrite V slightly to moderately truncate or flattened.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia with two small rows of short, stout setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus: Not studied.

Variation: The general sculpture of the pronotal disc is slightly variable. In some, the pronotal disc bears only a hint of a median longitudinal depression. In others, median longitudinal depression is distinct at base. The punctures of the pronotal disc are also

somewhat variable in depth. The apex of abdominal ventrite V can range from slightly to strongly truncate (flattened).

Type Material (Figs. 4.60-4.63): HOLOTYPE (here designated) label data: Label 1: "W.H. Butler / 22.10.1965 / 25 Miles Nth / Canaroon W. Australia." Label 2: "Western Australian / Museum Entomology / Reg. no. 65227" Label 3: "HOLOTYPE / *Deretaphrus antennatus* / Lord and McHugh" Underside: "WAMP 45NL" [WAMP 45NL, examined]. Sex not determined. The holotype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

PARATYPE (here designated) label data: Label 1: "W.H. Butler / 22.10.1965 / 25 Miles Nth / Canaroon / W. Australia." Label 2: "Western Australian / Museum Entomology / Reg. no. 65228" Label 3: "PARATYPE / *Deretaphrus antennatus* / Lord and McHugh" Underside: "WAMP 46NL" [WAMP 46NL, examined]. Sex not determined. The paratype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

PARATYPE (here designated) label data: Label 1: "W.H. Butler / 30.V.1964 / Barrow Is. / W. Australia." Label 2: "Western Australian / Museum Entomology / Reg. no. 65229" Label 3: "PARATYPE / *Deretaphrus antennatus* / Lord and McHugh" Underside: "WAMP 47NL" [WAMP 47NL, examined]. Sex not determined. The paratype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

PARATYPE (here designated) label data: Label 1: "Tambrey in / nest of tuterus / 3.8.58 / R.P. McMillan." Label 2: "Western Australian / Museum Entomology / Reg. no. 65231" Label 3: "PARATYPE / *Deretaphrus antennatus* / Lord and McHugh"

Underside: "WAMP 49NL" [WAMP 49NL, examined]. Sex not determined. The paratype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

Specimens examined: Known only from the holotype and the three paratypes.

Distribution (Fig. 4.127): Known only from Western Australia.

Biology: One specimen was collected "in nests of Tuterus." It is unknown what "Tuterus" refers to.

Etymology: This species was named for the characteristic shape of the strongly asymmetrical antennal club, segment 11 slightly concave along apical margin with the tip slightly upturned.

Remarks: This species most closely resembles *D. carinatus* **n. sp.**, but we feel this group is distinct enough to warrant a new species. In *D. antennatus*, the median longitudinal pronotal groove is more weakly developed, not interrupted, interstitial intervals of the elytra less strongly carinate, antennal club segments with intermittent setae, anterior apical angle of segment 11 with patch of minute, erect setae, club segments strongly asymmetrical and very angulate, frons without strong lateral expansions, a distinct, thick ridge above eyes not present, eye evenly convex, the height of the body at the abdomen distinctly larger than at prothorax, and apex of abdominal ventrite V truncate (flattened) but lacking dorsal point. These characters serve to adequately separate this species from *D. carinatus* **n. sp.**

Deretaphrus boliviensis Lord and McHugh new species

(Figs. 4.25, 4.182-4.183)

Diagnosis: Characterized by the rugose punctation of the pronotal disc, shape of the interrupted pronotal median longitudinal canal, shape of the submentum, cuticular expansion of the head capsule behind the eyes, Bolivian distribution, and its genitalic characters.

Description: Length 9.8 mm. Width 2.8 mm. Body elongate, parallel, dark red; dorsal surface glabrous, rugose, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, dense. Frontoclypeal suture distinct, arcuate medially. Anterior margin of clypeus slightly arcuate. Head capsule with angulate cuticular expansions at posterior margin of eye; eye slightly emarginate posteriorly. Submentum slightly expanded anteroventrally, a portion of the mentum visible. Submentum distinctly separated from subgenal braces; submentum biangulate, with a deep median impression. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose; segments 3-8 with a single row of short setae. Antennal club segments 9 and 10 with two rows of short setae, one row at midline, the second row arising near apex of the segment. Penultimate segment with a single median row of minute setae. Antennal club slightly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.25): Pronotum elongate. Ratio of pronotal length at midline to greatest pronotal width 1.23 mm. Pronotum widest near anterior ¼. Dorsal surface evenly convex. Anterior margin weakly sinuate, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Base of pronotum with an obtuse groove that extends from the lateral margins and terminates on either side before the midline. The midline is raised; raised portion continues laterad of the basal longitudinal pronotal canal. The portion of the pronotal disc on either side of the basal longitudinal canal is depressed anteriad of the obtuse groove. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with moderately small, dense punctures. Median longitudinal pronotal canal well developed, interrupted to form a deep, apical fovea and a basal canal. Raised interruption of the canal impunctate. Apical fovea oval, not punctured internally. Basal canal deeply impressed, expanded and rounded apically, narrowed medially then expanded and narrowed basally; basal canal closed at base. Hypomeron sparsely punctate, punctures slightly larger than found on pronotal disc; lateral walls nearly parallel-sided. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture weakly sinuate.

Elytra (Figs. 4.182-4.183): Elytron convex. Interstitial intervals 3, 5, 7, and 9 carinate, intervals 3, 5, and 7 shiny. Intervals 3, 5, and 7 carinate for entire length, intervals 5 and 7 fuse and continue distally toward apex, then join with interval 9 and reach the raised apical margin of the elytra. Intervals 3, 5, 7, and 9 with micropunctures at crest. Apical elytral margin with small, dense punctures. Basal elytral margin with

intervals 3 and 5 ending in a knob-like protuberance; protuberance of interstitial interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V with a slightly raised, thickened apical margin.

Legs: Base of femur with short, sparse setae. Inner face of tibia with fringe of long, dense setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus: Phallobase with lateral hook-like projections, projections strongly curved, curvature slightly more than 90 degrees. Parameres extremely short and transverse, with a fringe of long, dense setae arising from apex; parameres distinctly separated and individually articulated to phallobase; dorsal surface without hook-like projections. Median lobe long, straight, moderately thick, with a slightly expanded anterior tip bearing paired anterior struts.

Type Material (Fig. 4.65): HOLOTYPE (♂, here designated, by monotypy) label data: Label 1: "Boyuibe to / Charagua / via. Cueva / Ingri, etc." Label 2: "Bolivia S. Ana. / G L Harrington / Jul. 15-Sept.1 '20" Label 3: "HOLOTYPE / *Deretaphrus boliviensis* / Lord and McHugh" Underside: "USNM 68NL" [USNM 68NL, examined, dissected]. The holotype is deposited in the United States National Collection, Washington D.C., USA (USNM).

Specimens examined: Known only from the unique holotype specimen.

Distribution (Fig. 4.128): Known only from one locality in Bolivia.

Biology: Not known.

Etymology: This species was named for Bolivia, the country in which it was collected, representing the only species of South American *Deretaphrus*.

Remarks: This species is most similar to the North American *Deretaphrus oregonensis*, but is separated by the shape of the basal portion of the longitudinal canal, shape of the submentum, and distinctly smaller elytral punctures.

***Deretaphrus bucculentus* Elston returned to valid status**

(Figs. 4.14, 4.26, 4.168, 4.184-4.185, 4.226)

Deretaphrus bucculentus Elston 1923: 212. F**ormer junior synonym - returned to valid status.**

Diagnosis: Characterized by its almost glabrous antenna, lateral angulate expansion of vertex of the head to partially or completely conceal eyes from above, punctures on pronotal disc bearing minute setae, shape of the submentum, pronotum with a weakly defined, median longitudinal depression, elytral interstitial intervals 3, 5, 7 carinate, straight, not joined near apex, and its genitalic characters.

Description: Length 5.5–9.3 mm. Width 1.5–2.8 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.168): Head distinctly narrower than pronotum; slightly narrowed apically, subtriangular in shape; frons with transverse angular expansions; eyes completely concealed from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion larger (slightly smaller than on pronotal disc), dense. Frontoclypeal suture not distinct, arcuate medially. Clypeus distinctly narrower than head. Anterior margin of clypeus slightly incised, nearly straight. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum fused to subgenal braces; submentum triangulate, anterior margin arcuate and rugose. Submentum without

paired setose pits. Antennal groove well developed, impunctate internally. Antenna sparsely setose; segments 3-8 with a double row of short setae. Antennal club segments 9-11 with two rows of short setae, one row at midline, the second row arising near apex of the segment. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.26): Pronotum quadrate, tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface weakly convex. Anterior margin straight; anterior angles rounded but pronounced. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with medium sized, round punctures, each bearing a minute seta. Median longitudinal pronotal depression present but weak; depression wide, gradually shallower anteriorly. Depression sparsely punctate near base, bordered on either side by a small keel or ridge; closed basally by posterior margin of pronotum. Hypomeron sparsely punctate, punctures large and shallow, each bearing a seta; lateral walls greatly deflexed. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (Fig. 4.184-4.185): Elytron slightly flattened, not evenly convex. Interstitial intervals 3, 5, 7, and 9 carinate for entire length, shiny, straight; 4, 6, and 8 feebly raised. Apical elytral margin carinate. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V simple.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia with small fringe of setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex.

Aedeagus (Fig. 4.226): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, broadly rounded, approaching ovoid, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections transverse, apical portion short; projections narrowly separated, parallel medially, extending only slightly past base of parameres, tips of projections not swollen. Median lobe long, moderately thick, posterior tip greatly swollen, pointed at apex.

Variation: The size and color are variable within the species. The median longitudinal pronotal canal is slightly deeper and more pronounced in some, as are the punctures of the pronotal disc. In a few specimens, elytral interstitial intervals 4 and 6 are feebly raised for a short distance. The lateral margins of the pronotum are generally slightly narrowed posteriorly, but in a few, the lateral margins near subparallel. In a few specimens, the lateral expansions of the frons are more rounded and not distinctly angulate.

Type Material (Fig. 4.66): HOLOTYPE (original designation) label data: On card: "TY." Label 1: "Murray R. / S. Australia / A.H. Elston" Label 2: "1167 / Deretaphrus / bucculentus / Elston, Cotype" ["Co" is crossed out] Label 3 (folded): "Deretaphrus / puncticollis / Lea. / Det. H.J. Carter" Label 4: "Holotype" Label 5: "A.H. Elston / Collection." Label 6: "Australian Museum / K231594" [AMSA 1NL, examined]. Sex not determined.

Specimens examined: The holotype and 16 specimens were examined.

Distribution (Fig. 4.129): Known from New South Wales, Queensland, and South Australia.

Biology (Fig. 4.14): Not known.

Etymology: *bucculentus:* Latin = full cheeks. This species was named for the strong, angulate expansions of the frons directly above the eyes.

Taxonomic notes: In 1937, Carter synonymized *D. bucculentus* with *D. puncticollis*. After examination, it is clear that *D. bucculentus* is indeed a valid species, and is thus here returned to valid status.

Remarks: This species most closely resembles *D puncticollis* Lea and *D. parviceps* Lea. *D. bucculentus* can be distinguished from *D. puncticollis* by the carinate interstitial intervals of the elytra being straight and not curved inwardly or fused near apex. *D. bucculentus* can be distinguished from *D. parviceps* by the more densely and coarsely punctate pronotal disc and the median longitudinal depression of the pronotal disc sparsely punctate near base, bordered on either side by a small keel or ridge. *D. bucculentus* can be distinguished from both *D. puncticollis* and *D. parviceps* by the large, subtriangular expansions of the frons partially to completely concealing the eyes from above.

References: Carter 1937: 200-201.

***Deretaphrus carinatus* Lord and McHugh new species**

(Figs. 4.27, 4.169, 4.186-187)

Diagnosis: Characterized by elytral interstitial intervals 3-9 strongly and evenly carinate at middle, even carinate intervals ending before odd intervals, posterior face of abdominal

ventrite V with a distinct dorsal point when viewed posteriorly, the large lateral expansions of the frons, and the strongly protuberant eyes.

Description: Length 8–11.5 mm. Width 2.4–3.2 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, matte to moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.169): Head distinctly narrower than pronotum; narrowed apically, dorsal surface subtriangular in shape; frons with transverse angular expansions, forming a thick ridge over the eye, partially concealing eyes from above; eye strongly protuberant, not uniformly convex. Punctures on bulbous posterior portion and anterior portion fairly dense. Frontoclypeal suture distinct. Clypeus distinctly narrower than head. Anterior margin of clypeus distinctly angulate. Submentum greatly expanded anteroventrally, mentum completely concealed, only tips of palpi visible, if at all. Submentum narrowly separated from subgenal braces, anterior margin sinuate. Submentum without paired setose pits. Antennal groove well developed, impunctate internally. Antenna minutely setose, appearing glabrous; segments 3-8 with a single row of minute setae. Antennal club segments with minute setae. Antennal club fairly asymmetrical, external edge of club segments distinctly curved, internal/posterior edge straight. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.27): Pronotum large, slightly impressed medially, distinctly tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface convex, deflexed near anterior and posterior angles. Anterior margin straight; anterior angles distinctly pronounced, nearly right angles. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles

with small denticle. Lateral margin arcuate, slightly to moderately sinuate, with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with large, deep, circular to oval punctures. Median longitudinal pronotal canal present, distinct, interrupted to form a small, narrow anterior portion and a long basal portion. Anterior portion a small slit, surrounding area slightly depressed. Basal portion wide, shallow at base, abruptly tapering anteriorly to a narrow, more distinctly impressed canal. Hypomeron sparsely punctate, punctures large, round, and deeper than punctures of pronotal disc. Lateral walls greatly deflexed, subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight. Mesoventrite impunctate medially, punctures increase in size towards posterolateral corners. Punctures on metaventrite increase in size anterolaterally.

Elytra (Figs. 4.186-4.187): Elytron slightly flattened dorsally. Interstitial intervals 3-9 distinctly carinate for entire length, shiny; raised even intervals not as long as odd, ending before apex; raised odd intervals nearly extending to apical margin; interval 3 raised towards apex; interval 4 raised for apical half. Basal elytral margin with interstitial intervals 3 and 5 ending in a knob-like protuberance; protuberance on interval 5 fuses with finger-like callosity on elytral shoulder.

Abdomen: Posterior face of ventrite V with a distinct dorsal point when viewed posteriorly, present in both sexes. Puncture on abdominal ventrite I increase in size and are distinctly sparser anteriorly. Intercoxal process impunctate. Punctures on abdominal ventrites increase in size anteriorly.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia with small setae near apical portion. Tarsus sparsely setose, tarsomeres 1-3 each bearing two

pockets of dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus: Not studied.

Variation: The degree of carination of the interstitial intervals of the elytra varies slightly within this species. The lateral margins of the pronotum range from more or less evenly curved to slightly sinuate. The size of the lateral expansions of the frons and degree of protuberance of the eyes is also variable.

Type Material (Fig. 4.67): HOLOTYPE (here designated) label data: Label 1: "36-3562 / Aarrogin" Label 2: "Western Australian / Museum Entomology / Reg. no. 65194" Label 3: "HOLOTYPE / *Deretaphrus carinatus* / Lord and McHugh" Underside: "WAMP 13NL" [WAMP 13NL, examined]. Sex not determined. The holotype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

Specimens examined: The holotype and 21 specimens were examined.

Distribution (Fig. 4.130): *D. carinatus* is the most widely distributed species, occurring in New South Wales, Northern Territory, South Australia, Victoria, and Western Australia.

Biology: Several specimens were collected from under the bark of *Eucalyptus*.

Etymology: This species was named for the distinct carination of elytral interstitial intervals 3-9.

Remarks: This species most closely resembles *D. antennatus* **n. sp.**, but we feel this group is distinct enough to warrant a new species. In *D. carinatus*, the median longitudinal pronotal groove is more strongly developed, anterior portion slightly depressed, interstitial intervals of the elytra more strongly carinate, antennal club

segments with minute setae, anterior apical angle of segment 11 without patch of minute, erect setae, club segments asymmetrical but not and very angulate, frons without strong lateral expansions, a distinct, thick ridge above eyes not present, eye evenly convex, the height of the body at the abdomen distinctly larger than at prothorax, and the anterior margin of the submentum truncate, lacking two small lobes at apical corners and apex of abdominal ventrite V truncate (flattened) but lacking dorsal point. These characters serve to adequately separate this species from *D. carinatus* **n. sp.**

Deretaphrus erichsoni **Newman**

(Figs. 4.28, 4.188-4.189, 4.227, 4.245)

Deretaphrus erichsoni Wollastoni and Newman 1855: 211.

Deretaphrus granulipennis Reitter 1877: 342. Synonymized by Blackburn 1903: 129.

Deretaphrus ericksoni Newman, *in:* Blackburn 1903: 126, 130 [misspelling].

Diagnosis: Defined by its almost glabrous antenna, elongate pronotum, pronotal disc with a weak median longitudinal depression, shape of the submentum, and elytral interstitial intervals interrupted bear apex, forming numerous granulose denticles, abdominal ventrite V with a bulbous swelling near the posterior margin in females, and its genitalic characters.

Description: Length 6.3–8.5 mm. Width 1.7–2.4 mm. Body elongate, parallel, orange to dark red; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.245): Head distinctly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, dense.

Frontoclypeal suture distinct, arcuate medially. Anterior margin of clypeus slightly angulate. Submentum slightly expanded anteroventrally; inflexed, mentum not visible. Submentum distinctly separated from subgenal braces; submentum arcuate. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna appearing glabrous except under high magnifications, segments 3-11 with a single row of minute setae; setae on antennal club segments arising near the apex. Antennal club slightly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.28): Pronotum quadrate. Pronotum widest near anterior ¼. Dorsal surface greatly convex. Anterior margin straight, slightly wider than head; anterior angles pronounced. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum, producing distinct anterior angles. Pronotal disc with moderately large, dense punctures. Median longitudinal pronotal depression weakly developed, surface of pronotal disc only slightly depressed along midline. Depression widens at base, forming two small keels on either side of midline; with no hint of anterior apical fovea. Hypomeron sparsely punctate, punctures slightly larger than found on pronotal disc; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Prosternum gradually raised posteriorly, then depressed immediately anteriad of procoxae. Tergosternal suture more or less straight.

Elytra (Figs. 4.188-4.189): Elytron convex. Interstitial intervals 3-7 raised from base until apical 1/3, then becoming interrupted into numerous prominent denticles or granules. Apical elytral margin rugose. Basal elytral margin with intervals 3 and 5 not ending in distinct knob-like protuberance; finger-like callosity on the elytral shoulder indistinct.

Abdomen: Ventrite V regular in males, bulbous swelling near the posterior margin in females (Figs. 4.51-4.52). Punctures on ventrite V smaller and denser than on ventrites I-IV.

Legs: Setation sparse. Inner face of tibia glabrous. Ventral apex of tibia with two pockets of dense setae that arise on either side of the large, curved tibial spur. Tarsus sparsely setose, tarsomeres 1-3 with two pockets of setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.227): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, elongate, widely separated, nearly forked, and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections widely separated, parallel medially, slightly shorter than half the length of the parameres. Median lobe short, curved, moderately thick, posterior tip narrowed, pointed at apex; anterior tip slightly expanded, bearing short, paired anterior struts. Median lobe bicolored, lighter for small portion only near anterior tip.

Variation: The color varies from dark orange to dark red, and the surface luster ranges from matte to shiny. In some, the median longitudinal canal of the pronotal disc is slightly more depressed.

Type Material: The type of *Deretaphrus erichsoni* Newman was not examined.

The type of *Deretaphrus granulipennis* Reitter was not examined.

Specimens examined: 140 specimens were examined.

Distribution (Fig. 4.131): New South Wales, South Australia, Tasmania, and Victoria, Australia.

Biology: Several specimens were collected under the bark of *Eucalyptus* sp. (*E. mannifera*). One specimen was collected in a flight intercept window trough trap [ANIC 104NL].

Etymology: This species was named in honor of the late Dr. W. F. Erichson, a prominent coleopterist of the 19th century.

Taxonomic notes: There is a specimen in the Museum fur Naturkunde, Humboldt-Universitat zu Berlin [MNHUB 6NL, examined] bearing the label data: Label 1: "Tasmania" Label 2: "1916 / 26" Label 3: "♀" Label 4: "PARATYPUS" Label 5: "Deretaphrus / erichsoni / tasmanica Hze / det. Dr. E. Heinze 1942" The specimen is correctly identified as *Deretaphrus erichsoni* Newman, the locality and date do not match that given by Newman in his description (Adelaide, South Australia, 1855). There is no description of *D. erichsoni tasmanica* in any of Heinze's works, therefore this name is a nomen nudum and the specimen is not a valid type.

Remarks: This specimen most closely resembles *Deretaphrus wollastoni* Newman. The raised interstitial intervals of both species are numerously interrupted. In *D. erichsoni*, the raised intervals are interrupted to form distinct denticles near the apex of the elytra, the median longitudinal depression of the pronotal disc is only distinctly apparent at the base, and the pronotal width nearly equals the pronotal length. In *D. wollastoni*, the

interrupted portions of the elytral interstitial intervals do not form distinct denticles near apex, instead, interruptions form raised or elevated patches throughout the entire length of the elytra.

References: *Deretaphrus erichsoni* Newman: Blackburn 1903: 120, 129; Carter 1937: 200-201; Masters 1871: 79; Pascoe 1862: 461-462.

Deretaphrus ericksoni Newman: Blackburn 1903: 126, 130.

Deretaphrus granulipennis Reitter: Blackburn 1903: 120, 129; Lea 1898: 550;

***Deretaphrus fossus* Newman**

(Figs. 4.1-4.3, 4.4-4.7, 4.29, 4.149-4.161, 4.190-4.191, 4.228)

Deretaphrus fossus Newman 1842: 403.

Derataphrus fossus Newman, *in* Lacordaire 1854: 377 [misspelling].

Deretaphrus cordicollis Blackburn, 1903: 125. Synonymized by Carter 1937: 200.

Diagnosis: defined by its sparsely setose antenna, strongly produced anterior pronotal angles, lateral margin of the pronotum sinuate when viewed from above, median longitudinal canal of pronotum distinctly interrupted, elytral interstitial intervals 3, 5, and 7 carinate, a portion of the 6th carinate for a short distance on apical half, and its genitalic characters.

Description: Length 6.5–11.7 mm. Width 1.8– 3.3 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Figs. 4.149-4.152): Head distinctly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes completely visible from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior

portion small, denser. Frontoclypeal suture distinct, nearly straight. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally; mentum not visible. Submentum narrowly separated from subgenal braces; submentum slightly inflexed, evenly arcuate; with large punctures. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose, segments 3-7 with a single row of short setae, setae about half as long as the segment from which they arise; setae antennal club segments sparse, short, arising near apex of segments. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.29): Pronotum elongate, tapering towards base. Pronotum widest near anterior ¼, distinctly wider than head. Dorsal surface evenly convex. Anterior margin straight; anterior angles greatly produced, nearly right angles, prominent. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles depressed basally, with small denticle. Lateral margin sinuate, with incomplete carinae, forming a distinct raised margin in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum. Pronotal disc with large, dense, punctures. Median longitudinal pronotal canal well developed; interrupted. Anterior portion of canal a round depression, heavily punctate internally; posterior portion of canal narrow, parallel-sided, deeply impressed, impunctate internally, slightly expanding right at base. Internal lateral margins of basal canal grooved. Pronotal disc on either side of basal canal with slightly raised portion. Hypomeron sparsely punctate than pronotal disc; lateral walls subparallel. Prosternum flat medially, greatly deflexed at

lateral margin. Prosternum depressed immediately anteriad of procoxae. Tergosternal suture more or less straight.

Elytra (Figs. 4.190-4.191): Elytron evenly convex. Interstitial intervals 3, 5, and 7 raised and shiny for entire length, becoming carinate near the apex. Interval 6 raised for a short time near apical third, not reaching apex. Crest of raised intervals with punctures bearing minute setae. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; finger-like callosity on the elytral shoulder short and thick.

Abdomen: Ventrite V simple.

Legs: Setation sparse. Inner face of tibia with one prominent setal fringe with relatively short setae. Tarsus sparsely setose, tarsomeres 1-3 with two pockets of setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Figs. 4.158-4.161, 4.228): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, broadly rounded, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections moderately separated, parallel medially, slightly shorter than half the length of the parameres, tips of projections not swollen. Median lobe short, moderately thick, more or less straight, posterior tip narrowed and pointed, anterior tip slightly expanded, bearing paired anterior struts. Median lobe unicolored.

Variation: The size and color vary greatly within the species. The amount of sinuation of the lateral margins of the pronotum, the convexity of the pronotal disc, and the degree of carination of the elytral interstitial intervals (especially the 6th) is slightly variable

within the species. In some, the anterior portion of the median longitudinal canal is more weakly pronounced.

Type Material (Figs. 4.70-4.72): The holotype of *Deretaphrus fossus* Newman was not examined. The type specimen should be located among Newman's material at the British Museum, but was apparently lost some time ago. Therefore, a neotype is here designated.

NEOTYPE (here designated) label data: Label 1: "2619" Label 2: "Tasmania / A. Simson" Label 3: "S.A. Museum / specimen" Label 4: "NEOTYPE / *Deretaphrus fossus* / Newman 1842" Underside: "SAMA 285NL" [SAMA 285NL, examined]. Sex not determined. The neotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

The male holotype (original designation) of *Deretaphrus cordicollis* Blackburn has the following label data: Label 1: "Type / H.T." Label 2: "Australia. / Blackburn Coll. / B.M.1910-236." Label 3: "Deretaphrus / cordicollis, Blackb" (BMNH 97NL, examined, dissected). The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

The cotype (original designation) of *Deretaphrus cordicollis* Blackburn has the following label data: Label 1: "Bous." Label 2: "described as / ? cordicollis." Label 3: "cotype." Label 4: "Dividing Rge., V. / Blackb's Coll." Label 5: "I.8722 / Deretaphrus / cordicollis Bl / Victoria / Cotype" (SAMA 272NL, examined). Sex not determined. The cotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

Specimens examined: The neotype of *D. fossus*, holotype and cotype of *D. cordicollis*, and 165 specimens were examined.

Distribution (Fig. 4.132): Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania, and Victoria, Australia.

Biology: One specimen was taken at an outside light [ANIC 66NL], another specimen was taken at a mercury vapor light in an open forest [QMBA 4NL]. Several specimens were taken under the bark of *Eucalyptus* [ANIC 112NL, ANIC 249NL].

Etymology: *foss*: Latin = A ditch, trench. This species was named for the sharply impressed median longitudinal canal on the pronotal disc, found in several species of genus.

Taxonomic notes: *Deretaphrus cordicollis* was deemed a junior synonym of *D. fossus* by Carter in 1937. Although the type specimen of *D. fossus* is apparently lost, the synonymization will stand for lack of contrary evidence.

Remarks: This species most closely resembles *D. aequaliceps* Blackburn and *D. viduatus* Pascoe. *D. fossus* can be distinguished from *D. aequaliceps* by the 6th elytral interstitial interval slightly raised to carinate for a short distance, the basal portion of the median longitudinal canal bordered on either side basally by a slightly raised area of the pronotal disc, the pronotum with distinctly sinuate lateral margins and more strongly pronounced and angulate anterior corners, and by the generally larger size. *D. fossus* can be distinguished from *D. ignarus* by the pronotum with distinctly rounded anterior angles and evenly curved lateral margins, distinctly more carinate elytral interstitial intervals, 6th elytral interstitial interval slightly raised to carinate for a short distance, dark red color (*D. ignarus* is generally dark black), and less even and more closely spaced punctures of the elytra.

References: *Deretaphrus fossus* Newman: Blackburn 1903: 120-123, 125-128, 130; Carter 1937: 199-201; Erichson 1845: 288; Heinze 1943: 119; Horn 1878, 581; Lacordaire 1854a: 377-378; Lea 1898: 549-550; Masters 1871: 79; Pascoe 1862: 460-464; Wollaston and Newman 1855: Appendix 208-211.

Deretaphrus cordicollis Blackburn: Carter 1937: 199-201.

***Deretaphrus gracilis* Blackburn**

(Figs. 4.30, 4.192-4.193, 4.229)

Deretaphrus gracilis Blackburn 1903: 124.

Diagnosis: characterized by the pronotal disc slightly convex with moderately sparse, small punctures and a sharply impressed median longitudinal canal, simple abdominal ventrite V, shape of the submentum, distribution confined to Western Australia, and genitalic characters.

Description: Length 5.2–9.9 mm. Width 1.5–2.7 mm. Body elongate, parallel, red; dorsal surface glabrous, matte to weakly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, moderately dense. Frontoclypeal suture distinct, arcuate medially. Anterior margin of clypeus slightly arcuate. Submentum moderately expanded anteroventrally, palpi and a portion of the mentum visible. Submentum distinctly separated from subgenal braces. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna densely setose; segment 1 with few setae on ventral surface; segments 2-8 with a single row of

moderately long setae, setae greater than half the length of the segment from which they arise; antennal club segments with two rows of setae, one row located medially, with short setae, second row at apical margin of segments, with long setae. Antennal club subsymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.3): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface flat, slightly impressed along midline, anterior corners rounded, not distinctly pronounced. Anterior margin slightly arcuate medially, slightly wider than head. Base of pronotum distinctly narrower than elytral bases; posterior margin slightly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a subtle raised margin in dorsal view. Pronotal disc with small, sparse punctures. Median longitudinal pronotal canal present, strongly developed, interrupted apically. Apical portion a weak slit, the surrounding area slightly depressed, more densely punctate; raised interruption of the canal impunctate. Basal canal narrow; strongly impressed; internal lateral margins of canal grooved, slightly tapering basally, open at the base. Hypomeron minutely punctate; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate.

Elytra (Figs. 4.192-4.193): Elytron flattened dorsally. Interstitial intervals 3, 5, and 7 feebly raised near apex. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 narrowly separated from or narrowly joining finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V simple.

Legs: Setation sparse. Inner face of tibia with double fringe of long, dense setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of long, dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.229): Phallobase with lateral hook-like projections, projections very short, strongly curved, curvature 180 degrees. Phallobase with several folds. Parameres broadly rounded, broadly fused to one another near base, each paramere with two patches of lighter coloration; one light patch at base, large, oval, covering the majority of the paramere, extending from midline to lateral margin; second light patch at apex, much smaller than basal patch. Median lobe long, slender, with elongate, thin and tapering paired anterior struts.

Variation: The color and size are slightly variable within the species. The depth of the basal portion of the pronotal longitudinal canal also varies.

Type Material (Fig. 4.73): HOLOTYPE (original designation) label data: On card: "I. / 7200 / W.A." Label 1: "Type / H.T." Label 2: "Australia. / Blackburn Coll. / B.M.1910-236." Label 3: "Deretaphrus / gracilis, Blackb" [BMNH 100NL, examined]. Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

Specimens examined: The holotype and 10 specimens were examined.

Distribution (4.133): Known only from Western Australia.

Biology: Not known.

Etymology: *gracilis*: Latin = slender, thin. This species was named for its slender appearance.

Remarks: This species is most similar to *D. piceus* (Germar) and *D. iridescens* (Blackburn). *D. gracilis* can be distinguished from *D. piceus* by abdominal ventrite V simple, without two depressions on either side of midline, larger and denser punctures on the pronotal disc, anterior portion of median longitudinal pronotal canal less foveate, and the setation of the antennal club less dense. *D. gracilis* can be distinguished from *D. iridescens* by the more strongly impressed anterior and posterior portions of the median longitudinal canal, pronotum slightly depressed medially and deflexed laterally, and a distribution confined to Western Australia.

References: Carter 1937: 200-201.

***Deretaphrus hoplites* Lord and McHugh new species**

(Figs. 4.31, 4.194-4.195, 4.230)

Diagnosis: characterized by the basal pronotal corners with a large, excised denticle (larger than any other *Deretaphrus*), abdominal ventrite V with deep, setose punctures and large lateral depressions, sculpturing of the pronotal disc, and genitalic characters.

Description: Length 7.4–10.4 mm. Width 2.1–3.0 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, moderately dense. Frontoclypeal suture not distinct, arcuate medially. Clypeus distinctly narrower than head; with a medial depression; anterior margin of clypeus angularly incised. Submentum greatly expanded anteroventrally, mentum completely concealed.

Submentum narrowly separated from subgenal braces. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna densely setose; segments 2-8 with a single row of long setae that extend beyond the antennal segment from which they arise. Antennal club segments with multiple rows of long setae. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.31): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface impressed down the longitudinal midline, convex laterally. Anterior margin straight, slightly wider than head; anterior angles rounded. Base of pronotum slightly narrower than elytral bases; posterior margin sinuate, posterior angles with very prominent, large, excised, denticle; denticle upturned, each bearing a single, small seta. Lateral margin with incomplete carinae, margin of carinae deeply grooved forming a distinct raised margin in dorsal view. Pronotal disc with small to large oval puncture; punctures increasing in size nearing lateral margin. Median longitudinal pronotal canal well developed, interrupted to form a deeply impressed, apical fovea and a basal canal. Raised interruption of the canal impunctate. Apical fovea narrows anteriorly. Basal canal wide, deeply impressed, impunctate, broadly open at base; internal lateral margins of canal simple Base of pronotal canal bordered by strongly raised portion of pronotal disc, raised portion delimited laterally by deep impressions, base of impression with a small tubercle (bump, swelling) (Fig. 4.31). Hypomeron minutely punctate; strongly deflexed medially (towards midline), walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate. Metaventrite with small punctures, punctures significantly larger at apex and anterolateral corners.

Elytra (Figs. 4.194-4.195): Elytron convex. Interstitial interval 3 feebly raised basally, strongly raised near apex. Intervals 5, 7, and 9 strongly raised for entire length. Intervals 3, 5, and 7 with micropunctures at crest. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses finger-like callosity on the elytral shoulder; callosity on elytral shoulder greatly pronounced, distinctly forked.

Abdomen: Ventrites with large punctures, ventrite V with deep punctures, each bearing a long seta. In females, ventrite V with a large depression on either side of midline (Fig. 4.49), creating a median raised ridge that narrows apically. Males with ventrite V slightly depressed at apical margin (Fig. 4.48).

Legs: Base of femur and trochanter with long, sparse setae. Inner face of tibia with a double fringe of long, dense setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus (Fig. 4.230): Phallobase simple. Phallobase without lateral hook-like projections. Parameres greatly enlarged, elongate, truncate apically, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; parameres with median convex dark patch; dorsal surface with short hook-like projections located at base of parameres; projections greatly reduced; projections moderately separated, parallel medially. Median lobe moderately long, moderately thick, straight, with a slightly expanded tip bearing, paired anterior struts. Median lobe unicolored.

Variation: The size and color are variable within the species.

Type Material (Figs. 4.74-4.78): HOLOTYPE (here designated) label data: Label 1: "NSW McArthurs clearing / nr. Kempsey. Dry / sclerophyll. 4 Jan 1963 / P. Aitken" Label 2: "S.A. Museum / Specimen" Label 3: "HOLOTYPE / *Deretaphrus hoplites* / Lord and McHugh" Underside: "SAMA 193NL" [SAMA 193NL, examined]. Sex not determined. The holotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARATYPE (here designated) label data: Label 1: "Brooklana, / E. Dorrigo, N.S.W. / W. Heron May 1929" Label 2: "Deretaphrus / piceus / Germ / Det. H.J Carter / = bakewelli Pasc" Label 3: "Australian Museum / K231642" Label 4: "PARATYPE / *Deretaphrus hoplites* / Lord and McHugh" Underside: "AMSA 55NL" [AMSA 55NL, examined]. Sex not determined. The paratype is deposited in the Australian Museum, Sydney, Australia (AMSA).

PARATYPE (here designated) label data: Label 1: "NEW S. WALES / Dorrigo. / W. Heron. / B.M. 1935-46" Label 2: "PARATYPE / *Deretaphrus hoplites* / Lord and McHugh" Underside: "BMNH 84NL" [BMNH 84NL, examined]. Sex not determined. The paratype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

PARATYPE (here designated) label data: Label 1: "SEQ: 26˚08'Sx151˚58'E / Nangur State For., / 24Nov1995 G.Monteith / Pyrethrum, trees, 320m" Label 2: "PARATYPE / *Deretaphrus hoplites* / Lord and McHugh" Underside: "QMBA 2NL" [QMBA 2NL, examined]. Sex not determined. The paratype is deposited in the Queensland Museum, Brisbane, Australia (QMBA).

PARATYPE (here designated) label data: Label 1: "Dorrigo / N.S. Wales / W. Heron" Label 2: "S.A. Museum / Specimen" Label 3: "PARATYPE / *Deretaphrus hoplites* / Lord and McHugh" Underside: "SAMA 208NL" [SAMA 208NL, examined]. Sex not determined. The paratype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

Specimens examined: The holotype, paratypes, and 19 specimens were examined.

Distribution (Fig. 4.134): New South Wales and Queensland.

Biology: One specimen was taken from dry sclerophyll [SAMA 193NL], three specimens were taken from *Acacia* sp. [ANIC 273-275NL]. Three specimens were taken from fogging trees with pyrethrum [QMBA 2NL, QMBA 9NL, and QMBA 12NL].

Etymology: *hoplites***:** Greek = armed, or a man in armor. This species was named for the heavily armored nature of *Deretaphrus.* This species is particularly well-protected.

Remarks: This species most closely resembles *D. interruptus* Grouvelle. *D. hoplites* can be distinguished based on the basal portion of the median longitudinal canal parallel-sided, denticles on posterior angles of pronotum large, each bearing a single seta, elytral interstitial interval 3 carinate for entire length, the arcuate anterior margin of the submentum, dark red color, and Australian distribution.

***Deretaphrus ignarus* Pascoe**

(Figs. 4.32, 4.4.196-4.197, 4.231, 4.246)

Deretaphrus ignarus Pascoe 1862: 462.

Deretaphrus pascoei Macleay 1871: 165. Synonymized by Carter 1937: 200.

Deretaphrus ignarius Pascoe, *in* Lea, 1898: 548, 550 [misspelling].

Diagnosis: characterized by its almost glabrous antenna, shape of the submentum, elytral interstitial intervals 3, 5, and 7 strongly carinate and raised near apex, and genitalic characters.

Description: Length 6–10.5 mm. Width 1.7–2.8 mm. Body elongate, parallel, dark orange to dark red; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.246): Head distinctly narrower than pronotum; slightly narrowed apically; frons with sinuate transverse expansions; eyes partially concealed from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, very dense. Frontoclypeal suture distinct, slightly arcuate medially. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally; mentum not visible. Submentum narrowly separated from subgenal braces; submentum slightly inflexed, evenly arcuate; with large punctures, smooth at anterior margin. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose, appearing glabrous except under high magnifications, segments 3-8 with a single row of short setae; setae on antennal club segments extremely sparse. Antennal club slightly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.32): Pronotum elongate, tapering towards base. Pronotum widest near anterior ¼, distinctly wider than head. Dorsal surface evenly convex. Anterior margin straight; anterior angles rounded but prominent. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles depressed basally, with small denticle. Lateral margin with incomplete carinae, forming a distinct

raised margin in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum. Pronotal disc with medium, dense, shallow punctures. Median longitudinal pronotal canal well developed; interrupted. Anterior portion of canal a narrow slit, surrounding area slightly depressed; posterior portion of canal narrow, deeply impressed, impunctate internally, abruptly expanding right at base. Posterior margin of canal appearing rounded, bordered on either side by a raised portion of the pronotal disk. The external, laterobasal margins of the raised portions bear a distinct impression (Fig. 4.32). Hypomeron densely punctate, punctures shallow and larger than found on pronotal disc; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Prosternum depressed immediately anteriad of procoxae. Tergosternal suture more or less straight.

Elytra (Figs. 4.196-4.197): Elytron evenly convex. Interstitial intervals 3, 5, 7 and 9 raised and shiny for entire length; intervals 3, 5, and 7 becoming very prominent, carinate near the apex. Intervals 4 and 6 weakly raised medially, interval 6 more prominent than 4. Crest of raised intervals with punctures bearing minute setae. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V simple. Punctures on ventrite V smaller and denser than ventrites I-IV.

Legs: Setation sparse. Inner face of tibia with two prominent setal fringes with relatively short setae. Ventral apex of tibia with two pockets of dense setae that arise on either side of the large, curved tibial spur. Tarsomeres 1-3 with two pockets of setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.231): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, broadly rounded, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections moderately separated, parallel medially, slightly shorter than half the length of the parameres, tips of projections slightly swollen. Median lobe short, moderately thick, with a slightly expanded tip bearing, paired anterior struts. Median lobe bicolored, lighter at basal quarter.

Variation: The size and color are variable within the species. In some, the anterior angles of the pronotum are slightly more pronounced and the posterior portion of the median longitudinal pronotal canal may be slightly wider and less tapered. The degree of carination of the elytral interstitial intervals 4, 6, and 7 is variable, those intervals slightly more pronounced in some specimens.

Type Material (Figs. 4.79, 4.102-4.103): HOLOTYPE (by monotypy) label data: Label 1: **"**Type" Label 2: "N.S.W." Label 3: "Deretaphrus / ignarus / Pasc" Label 4: "Pascoe / Coll. / 93-60" Label 5: "HOLOTYPE? / *Deretaphrus ignarus* Pascoe / det. N.P. Lord 2008" Underside: "BMNH 104NL" [BMNH 104NL, examined]. Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom.

LECTOTYPE (here designated) label data: Label 1: "Gayndah" Label 2: "SYNTYPE" Label 3: "On permanent loan from / MACLEAY MUSEUM / University of Sydney" Label 4: "Deretaphrus / Pascoei, Macl. / Gayndah" Label 5: "LECTOTYPE / *Deretaphrus pascoei* / Macleay 1871" Underside: "ANIC 2NL" [ANIC 2NL,

examined]. Sex not determined. The lectotype is deposited in the Australian National Insect Collection, Canberra, Australia (ANIC).

PARALECTOTYPE (here designated) label data: Label 1: [orange dot], Label 2 (folded): "Deretaphrus / Pascoei McL.W." Label 3: "HOLOTYPE" Label 4: "K27386" Label 5: "Australian Museum / K 231598" Label 6: "PARALECTOTYPE / *Deretaphrus pascoei* / Macleay 1871" Underside: "AMSA 3NL" [AMSA 3NL, examined]. Sex not determined. The paralectotype is deposited in the Australian Museum, Sydney, New South Wales, Australia (AMSA).

PARALECTOTYPE (here designated) label data: same as above, except label 6 reads: "PARALECTOTYPE / *Deretaphrus pascoei* / Macleay 1871" Underside: "AMSA 4NL" [AMSA 4NL, examined]. Sex not determined. The paralectotype is deposited in the Australian Museum, Sydney, New South Wales, Australia (AMSA).

Specimens examined: The holotype of *D. ignarus*, lectotype and paralectotypes of *D. pascoei*, and 112 specimens were examined.

Distribution (Fig. 4.135): Australian Capital Territory, New South Wales, Northern Territory, Queensland, South Australia, Victoria, and Western Australia

Biology: One specimen was taken under the bark of *Eucalyptus* sp. [ANIC 246NL]. Two specimens were taken at a mercury vapor light [ANIC 17NL, ANIC 21NL]. Nine specimens were taken found near the pupa of *Paroplites australis* (Coleoptera: Cerambycidae) [SAMA 73-81NL].

Etymology: *ignarus*: Latin = dull, ignorant. This species is possibly named for the dull surface of the body.

Taxonomic notes: *Deretaphrus ignarus* Pascoe: The type specimen of *Deretaphrus ignarus* Pascoe was found to be a unique type (by monotypy). Although the specimen does not bear a holotype label, Pascoe's collection was deposited in the British Museum of Natural History (BMNH), and after a thorough search, no other collections were found to hold any of Pascoe's types. Therefore, the type specimen of *Deretaphrus ignarus* will be considered the holotype.

Deretaphrus pascoei Macleay: There are three syntypes for *Deretaphrus pascoei* Macleay. The lectotype (here designated) of *D. pascoei* [ANIC 2NL] is the true *D. pascoei* (jr. synonym of *D. ignarus*). The other two "type" specimens for *Deretaphrus pascoei* [AMSA 3-4NL] are card-mounted together. Although these specimens bear a "HOLOTYPE" label, neither specimen is truly the holotype, both specimens are paralectotypes (here designated). Unfortunately, both specimens are not conspecific. The specimen on the left is *D. viduatus* Pascoe and the specimen on the right is *D. puncticollis* Lea. Although all three specimens bear a determination label in Macleay's handwriting, the single specimen [ANIC 2NL] was chosen as the lectotype to prevent any further nomenclatural confusion. Because the other two specimens were members of the syntypic series, they, by default, become paralectotypes, although they should be ignored if viewed for any taxonomic purposes.

Remarks: *D. ignarus* most closely resembles *D. xanthorrhoeae* Lea and *D. viduatus* Pascoe. *D. ignarus* can be distinguished from *D. xanthorrhoeae* and *D. viduatus* by the evenly arcuate edge of the submentum, elytral interstitial intervals 3, 5, and 7 strongly carinate at apex, distinctly more than other intervals, and the antennal setae extremely minute, appearing glabrous except under high magnifications.

References: *Deretaphrus ignarus* Pascoe: Blackburn 1903: 120-122, 128, 130; Carter 1937: 199-201; Masters 1871: 79.

Deretaphrus ignarius Pascoe: Lea 1898: 548, 550.

Deretaphrus pascoei Macleay: Blackburn 1903: 120; Carter 1937: 200-201; Lea 1898: 549-550; Masters 1871: 79.

***Deretaphrus incultus* Carter**

(Figs. 4.33, 4.170, 4.198-4.199, 4.232)

Deretaphrus incultus Carter 1937: 201.

Diagnosis: characterized by the complete absence of a median longitudinal depression or groove on the pronotal disc, almost glabrous antenna, elytral interstitial intervals 3, 5, and 7 weakly carinate, not meeting near apex, elytra not convex, Western Australian distribution, and its genitalic characters.

Description: Length 6.5–8.6 mm. Width 2–2.8 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.170): Head distinctly narrower than pronotum; slightly narrowed apically, subtriangular in shape; frons with transverse angular expansions; eyes partially concealed from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, dense. Frontoclypeal suture not distinct, arcuate medially with a weak median impression. Clypeus distinctly narrower than head. Anterior margin of clypeus slightly angulate, nearly straight. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum fused to subgenal braces; submentum triangulate, anterior margin arcuate. Submentum without paired setose pits. Antennal

groove well developed, punctate internally. Antenna minutely setose, appearing glabrous except under high magnifications, segments 3-8 with a single row of minute setae. Antennal club segments with minute setae. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.33): Pronotum quadrate, tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface weakly convex, more strongly deflexed near anterior angles. Anterior margin straight; anterior angles rounded but pronounced. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with medium sized, ovoid punctures, each bearing a minute seta. Median longitudinal pronotal depression absent; Pronotum slightly flattened near base. Hypomeron sparsely punctate, punctures large and shallow, each bearing a seta; lateral walls greatly deflexed. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (Figs. 4.198-4.199): Elytron flat, not evenly convex. Interstitial intervals 3, 5, 7, and 9 weakly raised, more pronounced near apex. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; callosity on elytral shoulder long and projecting dorsolaterally.

Abdomen: Ventrite V simple.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia with small fringe of setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.232): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, broadly rounded, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly, tips of projections not swollen; projections narrowly separated, oriented diagonally, parallel medially only near apex, projections extending from near middle of phallobase to just past base of parameres. Median lobe short, moderately thick, posterior tip slightly swollen, pointed at apex; anterior tip slightly expanded, bearing paired anterior struts. Median lobe colored bicolored, lighter only near anterior tip.

Variation: The color and size are variable within the species. In one specimen, a small area in the center of the pronotal disc is impunctate.

Type Material (Figs. 4.80-4.82): HOLOTYPE (original designation) label data: Label 1: "Coolgardie / W.A" Label 2: "Holotype" Label 3: "Deretaphrus / incultus / C + 3. / Det. H.J. Carter" Label 4: "HOLOTYPE" Label 5: "Australian Museum / K231597" [AMSA 2NL, examined]. Sex not determined. The holotype is deposited in the Australian Museum, Sydney, Australia (AMSA).

PARATYPE (original designation) label data: Label 1: "Kalgoorlie / W.A. H.J.C." Label 2: "Lea" Label 3: "Paratype" Label 4: "Deretaphrus / incultus / Cart" Label 5: "PARATYPE" [ANIC 1NL, examined]. Sex not determined. The paratype is deposited in the Australian National Insect Collection, Canberra, Australian Capital Territory (ANIC).

PARATYPE: label data: Label 1: "Kellerberrin / WA" Label 2: "Paratype" Label 3: "Deretaphrus / incultus / Cart." Label 4: "S. Aust. Museum / specimen"

[SAMA 273NL, examined]. Sex not determined. The cotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

Specimens examined: The holotype, paratype, cotype, and 5 specimens were examined.

Distribution (Fig. 4.136): South Australia and Western Australia

Biology: One specimen was taken at a light [SAMA 231NL], and one specimen was taken under the bark of *Eucalyptus* sp. [WAMP 66NL].

Etymology: *incultus*: Latin = untilled, unpolished. This species was possibly named for the absence of a median longitudinal pronotal canal or depression on the pronotal disc, or the matte surfaces of the body.

Remarks: This species most closely resembles *D. parviceps* Lea, but can be distinguished evenly convex surface of the pronotum, lacking a median longitudinal depression or groove, and the raised elytral interstitial intervals straight and separate from one another for their entire length.

References: Carter 1937: 200; Heinze 1943: 119.

***Deretaphrus interruptus* Grouvelle**

(Figs. 4.8, 4.34, 4.200-4.201, 4.233, 4.247)

Deretaphrus interruptus Grouvelle 1903: 184.

Diagnosis: characterized by its New Caledonian distribution, shape of the submentum, and its genitalic characters.

Description: Length 6–11.9 mm. Width 2.5–3.3 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Figs. 4.8, 4.247): Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, moderately dense. Frontoclypeal suture not distinct, arcuate medially. Anterior margin of clypeus slightly incised (angulate) medially. Clypeus with a row of long erect setae. Submentum greatly expanded anteroventrally, mentum completely concealed. Lateral margins of submentum reaching and narrowly separated from subgenal braces, not fused. Anterior margin of submentum sinuate. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna moderately setose; segments 2-4 with a single row of short setae; segments 5-11 with long, golden setae that extend beyond the antennal segment from which they arise. Antennal club segments 9-10 with two rows of setae, penultimate segment with a single row of setae arising near the apex. Antennal club subsymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.34): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface flattened down the longitudinal midline, convex laterally. Anterior margin slightly sinuate, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin slightly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with small, relatively dense punctures. Median longitudinal pronotal canal well developed, interrupted to form a small, apical fovea and a basal canal. Raised interruption of the canal impunctate. Apical fovea ovoid, deepest posteriorly. Basal canal wide, deeply impressed, smooth; internal lateral margins not grooved; basal canal rounded and closed anteriorly, open

posteriorly. Hypomeron with large, shallow, dense punctures in middle, margins smooth; strongly deflexed medially (towards midline). Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (Figs. 4.200-4.201): Elytron convex. Punctures of elytral puncture rows 2, 3, and 4 abruptly increasing in size towards the apex. Interstitial intervals 3 and 5 feebly raised, more pronounced near apex. Intervals 7 and 9 raised for entire length, interval 7 more prominent. Raised intervals with micropunctures at crest. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V simple.

Legs: Base of femur and trochanter with long, sparse setae. Inner face of tibia with fringe of long, dense setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus (Fig. 4.233): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, elongate, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections narrowly separated, parallel medially, slightly shorter than half the length of the parameres, tips of projections slightly swollen. Median lobe short, moderately thick, straight, posterior tip narrowed and pointed, anterior tip slightly expanded, bearing paired anterior struts. Median lobe bicolored, lighter for apical 1/3.

Variation: Other than the expected differences in size, this species varies little. Because there are so few specimens of this species, it would not be surprising to see some variation if more specimens were collected.

Type Material (Figs. 4.83-4.84): LECTOTYPE (original designation) label data: Label 1: "Coll. R.I.Sc.N.B. / Nouvelle Calédonie / Ourail / rec Lécard / ex. coll. Fauvel" Label 2: "Coll. A. Fauvel / Deretaphrus / interruptus Grouv." Label 3: LECTOTYPE / Deretaphrus / interruptus Gr / S.A. Slipinski 1989" [ISNB 1NL, examined]. Sex not determined. The lectotype is deposited in the Museum fur Naturkunde, Humboldt-Universitat zu Berlin, Berlin, Germany (MNHUB).

PARALECTOTYPE (original designation) label data: Label 1: "Coll. R.I.Sc.N.B. / Nouvelle Calédonie / Kanala / rec Bougier / ex. coll. Fauvel" Label 2: "Coll. A. Fauvel / Deretaphrus / interruptus Grouv. / R.I.Sc.N.B. 17.673" Label 3: "PARALECTOTYPE / Deretaphrus / interruptus Gr / S.A. Slipinski 1989" [ISNB 2NL, examined]. Sex not determined. The paralectotype is deposited in the Museum fur Naturkunde, Humboldt-Universitat zu Berlin, Berlin, Germany (MNHUB).

Specimens examined: The lectotype, paralectotype, and 14 specimens were examined.

Distribution (Fig. 4.137): New Caledonia.

Biology: Eleven specimens were collected in association with the larvae of *Agrianome fairmairei* (Coleoptera: Cerambycidae) under the bark of dead *Aleurites moluccana* (Euphorbiaceae). The larvae of *D. interruptus* fed on the larvae of *Agrianome fairmairei* and then travelled a short distance to pupate.

Etymology: *interruptus*: Latin = broken apart. This species was named for the distinctly interrupted median longitudinal canal of the pronotal disc, forming distinct anterior and posterior parts.

Remarks: This species most closely resembles *Deretaphrus hoplites* **n. sp.** in the ornamentation of the pronotal disc and *Deretaphrus viduatus* Pascoe in its overall appearance. *D. interruptus* can be distinguished by its strictly New Caledonian distribution, sinuate anterior margin of the submentum, and posterior portion of the median longitudinal pronotal canal tapering basally.

References: Fauvel 1903: 341; Heinze 1943: 119.

Deretaphrus iridescens Blackburn returned to valid status

(Figs. 4.35, 4.202-4.203, 4.234)

Deretaphrus iridescens Blackburn 1903: 126. **Former junior synonym - returned to valid status.**

Diagnosis: Characterized by the dorsoventrally flattened appearance, greatly flattened dorsal surface of the pronotal disc, pronotal disc with shallow median longitudinal canal with weak interruption, elytral interstitial intervals nearly smooth, abdominal ventrite V simple, shape of the submentum, and genitalic characters.

Description: Length 6.3–9.1 mm. Width 1.5–2.5 mm. Body elongate, parallel, dark brown to black; dorsal surface glabrous, matte to weakly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, moderately dense.

Frontoclypeal suture not distinct, arcuate medially. Anterior margin of clypeus slightly arcuate. Submentum moderately expanded anteroventrally, a portion of the mentum visible. Submentum distinctly separated from subgenal braces. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna densely setose; segment 1 with few setae on ventral surface; segments 2-4 with short setae; segments 5-11 with long, golden setae that extend beyond the antennal segment from which they arise. Antennal club segments with multiple rows of setae. Antennal club subsymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.35): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface flattened, anterior corners convex. Anterior margin slightly arcuate, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with small, sparse punctures. Median longitudinal pronotal canal present, weakly developed, interrupted apically. Apical portion a weak slit, the surrounding area slightly depressed; raised interruption of the canal impunctate. Basal canal narrow; weakly impressed; internal lateral margins of canal grooved, gradually tapering basally, open at the base. Hypomeron minutely punctate; lateral walls subparallel. prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate.

Elytra (Figs. 4.202-4.203): Elytron flattened dorsally. Interstitial intervals 3, 5, and 7 feebly raised near apex. Interval 5 meets or nearly meets interval 9 near apex. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; finger-like callosity on the elytral shoulder weakly developed.

Abdomen: Ventrite V simple.

Legs: Setation sparse. Inner face of tibia with fringe of long, dense setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus (Fig. 4.234): Phallobase with lateral hook-like projections, projections very short, strongly curved, curvature more than 90 degrees. Phallobase with several folds. Parameres broadly rounded, broadly fused to one another near middle, each paramere with a single patch of lighter coloration, light area extending from base of paramere to apex, slightly narrowing towards apex. Median lobe long, slender, with elongate, thin and tapering paired anterior struts.

Variation: The size and coloration are variable within the species. In some, the anterior portion of the median longitudinal pronotal depression is more well-developed. In a few specimens, the basal portion of the median longitudinal pronotal depression is slightly more impressed, in others the canal gradually narrows towards the base.

Type Material (Fig. 4.85): HOLOTYPE (♀, original designation) label data: On card: "I. / 7201." Label 1: "Type / H.T." Label 2: "Australia. / Blackburn Coll. / B.M.1910-236." Label 3: "Deretaphrus / iridescens, Blackb" [BMNH 101NL, examined, dissected]. The holotype is deposited in the British Museum of Natural History, London, United Kingdom.

Specimens examined: The holotype and 27 specimens were examined.

Distribution (Fig. 4.138): New South Wales, South Australia, and Victoria, Australia.

Biology: Not known.

Etymology: *irid*: Greek = a rainbow. *–escens*: Latin = becoming; slightly. This species was named for the slightly iridescent sheen of the body surfaces, most noticeable on the pronotal disc.

Taxonomic notes: *D. iridescens* Blackburn was synonymized under *D. gracilis* Blackburn by Carter (1937). After viewing the types and specimens of both species, we feel that the species are in fact distinct and are hereby returning *D. iridescens* Blackburn to valid status.

Remarks: This species is most similar to *D. piceus* (Germar) and *D. gracilis* (Blackburn). *D. iridescens* can be distinguished from *D. piceus* by abdominal ventrite V simple, without two depressions on either side of midline, larger and denser punctures on the pronotal disc, anterior portion of median longitudinal pronotal canal less foveate, and the setation of the antennal club less dense. *D. iridescens* can be distinguished from *D. gracilis* by the more weakly developed anterior and posterior portions of the median longitudinal canal, pronotum more or less flat medially and less distinctly deflexed laterally, and a distribution restricted to the Eastern states of Australia.

References: Carter 1937: 200-201.

Deretaphrus lateropunctis **Lord and McHugh new species**

(Figs. 4.36, 4.204-4.205, 4.235)

Diagnosis: Characterized by the large punctures along the dorsolateral margin of the pronotal disc, sculpturing of the pronotal disc, large punctures at anterolateral corners of metaventrite, almost smooth elytra, shape of the submentum, and genitalic characters.

Description: Length 7.6–11.5 mm. Width 2.1–3.3 mm. Body elongate, parallel, dark orange to dark red; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons with sinuate transverse expansions; eyes partially concealed from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, very dense. Frontoclypeal suture distinct, slightly arcuate medially. Anterior margin of clypeus angulate. Submentum greatly expanded anteroventrally; mentum not visible. Submentum narrowly separated from subgenal braces; anterior margin of submentum sinuate, inflexed medially at apex; with large punctures. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna moderately to densely setose, segments 3-8 with a single row of medium-length setae, setae slightly longer than half the length of the segment from which they arise; antennal club segments with two rows of moderately long setae. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.36): Pronotum quadrate, tapering slightly towards base. Pronotum widest near anterior ¼, distinctly wider than head. Dorsal surface evenly convex. Anterior margin straight; anterior angles rounded. Base of pronotum slightly narrower than elytral bases; posterior margin weakly sinuate, posterior angles depressed basally, with small denticle. Posterior angles depressed basally, with a small denticle at laterobasal corner. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum. Pronotal disc with minute, dense punctures. Pronotal disc with large

punctures along dorsolateral margin. Median longitudinal pronotal canal present, weakly developed, not interrupted; canal terminates anteriorly at midline, widens into a large, oval depression basally; pronotal disc with two prominent circular depressions on either side of basal portion of median canal. Hypomeron sparsely punctate, punctures much larger than those found on pronotal disc; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Prosternum depressed immediately anteriad of procoxae. Tergosternal suture more or less straight. Metaventrite with small punctures, punctures significantly larger at anterolateral corners.

Elytra (Figs. 4.204-4.205): Elytron evenly convex. Interstitial intervals smooth, intervals 3, 5, and 7 minutely raised near apex. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 narrowly fuses with finger-like callosity on the elytral shoulder. Callosity on elytral shoulder large and globular.

Abdomen: Ventrite V simple. Punctures on ventrite V smaller and denser than ventrites I-IV.

Legs: Setation sparse. Inner face of tibia with two prominent setal fringes with relatively long setae. Tibial crown moderately setose. Ventral apex of tibia with two pockets of dense setae that arise on either side of the large, curved tibial spur. Tarsus moderately setose, tarsomeres 1-3 with two pockets of setae on ventral surface at the apex.

Aedeagus (Fig. 4.235): Phallobase simple. Phallobase with lateral hook-like projections, projections only slightly curved (less than 45 degrees). Parameres moderately short, broadly rounded, distinctly separated and individually articulated to

phallobase; internal lateral margins of parameres excavated for basal half; parameres sparsely setose with medium-length setae (setae slightly less than half the length of parameres) at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly, tips of projections not swollen; projections narrowly separated, almost touching, parallel medially from middle of projections to apex, projections extending from near middle of phallobase to just before middle of parameres. Median lobe short, curved, moderately thick, posterior tip narrowed, pointed at apex; anterior tip slightly expanded, bearing short, paired anterior struts. Median lobe colored bicolored, lighter for anterior 1/3.

Variation: The size is variable within the species. The color ranges from orange to dark red. The depth of the prominent basal circular depressions on either side of the median longitudinal pronotal groove varies, as well as the depth of the groove itself. In some, the larger lateral punctures of the pronotal disc are much more apparent.

Type Material (Figs. 4.86-4.88): HOLOTYPE (here designated) label data: Label 1: "Dorrigo / N.S. Wales" Label 2: "Deretaphrus / analis / Lea / Det. H.J. Carter" Label 3: "1936-389" Label 4: "HOLOTYPE / *Deretaphrus lateropunctis* / Lord and McHugh" Underside: "BMNH 60NL" [BMNH 60NL]. Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

PARATYPE (here designated) label data: Label 1: "Rivertree, NSW / 10.VIII.1924" Label 2: "PARATYPE / *Deretaphrus lateropunctis* / Lord and McHugh" Underside: "QMBA 42NL" [QMBA 42NL, examined]. Sex not determined. The paratype is deposited in the Queensland Museum, Brisbane, Australia (QMBA).

PARATYPE (here designated) label data: Label 1: "Tamb Mt Q. / Davidson" Label 2: "PARATYPE / *Deretaphrus lateropunctis* / Lord and McHugh" Underside: "ANIC 153NL" [ANIC 153NL, examined]. Sex not determined. The paratype is deposited in the Australian National Insect Collection, Canberra, Australian Capital Territory (ANIC).

Specimens examined: The holotype, 2 paratypes, and 10 specimens were examined.

Distribution (Fig. 4.139): New South Wales and Queensland, Australia.

Biology: Not known.

Etymology: This species was named for the enlarged punctures located along the lateral margin of the pronotal disc.

Remarks: This species most closely resembles *D. analis* in the almost impunctate surface of the pronotal disc, but is easily distinguished by the uninterrupted median longitudinal canal of the pronotal disc and the punctures of the pronotal disc much larger at the lateral margin.

***Deretaphrus ocularis* Lord and McHugh new species**

(Figs. 4.37, 4.171, 4.206-4.207, 4.236)

Diagnosis: characterized by the distinct reniform shape of the eyes, excavated posteriorly by a large, subtriangular cuticular expansion of the head capsule, sculpture of the pronotal disc, and genitalic characters.

Description: Length 7.2–8.5 mm. Width 2.3–2.8 mm. Body elongate, parallel, dark red; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.171): Head slightly narrower than pronotum; slightly narrowed apically, subtriangular in shape; frons with sinuate transverse expansions; eyes partially concealed from above. Eye reniform, excavated posteriorly by a large, subtriangular cuticular expansion of the head capsule. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, very dense. Frontoclypeal suture distinct, slightly arcuate medially. Clypeus distinctly narrower than head, anterior margin nearly straight. Submentum greatly expanded anteroventrally; mentum not visible. Submentum meeting subgenal braces; anterior margin of submentum arcuate, weakly sinuate, inflexed medially at apex. Submentum with large punctures, without paired setose pits. Antennal groove well developed, impunctate. Antenna appearing glabrous except under high magnifications, segments 3-8 with a single row of minute setae. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.37): Pronotum elongate, tapering only slightly towards base. Pronotum widest near anterior ¼. Dorsal surface evenly convex. Anterior margin slightly arcuate, wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum. Pronotal disc with medium, shallow, oval punctures. Median longitudinal pronotal canal present, weakly developed, not interrupted; canal terminates anteriorly near apical 1/3, very narrow, weakly impressed, widening into a depression basally. Hypomeron sparsely punctate, punctures larger than those found on pronotal disc; lateral walls greatly

deflexed. Prosternum flat medially, greatly deflexed at lateral margin. Prosternum depressed immediately anteriad of procoxae. Tergosternal suture more or less straight.

Elytra (Figs. 4.206-4.207): Elytron evenly convex. Interstitial intervals 5 and 7 weakly raised for entire length, more pronounced near apex. Interval 9 fuses with apical elytral margin. Interval 3 raised near apex. Raised intervals with micropunctures at crest. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 joining finger-like callosity on the elytral shoulder. Callosity on elytral shoulder distinctly forked.

Abdomen: Ventrite V simple. Punctures on ventrite V smaller and denser than ventrites I-IV.

Legs: Setation sparse. Inner face of tibia with two prominent setal fringes with relatively long setae. Tibial crown moderately setose. Ventral apex of tibia with two pockets of dense setae that arise on either side of the large, curved tibial spur. Tarsus sparsely setose, tarsomeres 1-3 with two pockets of setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.236): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, elongate, widely separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections transverse and thickest at base, narrowing anteriorly; projections narrowly separated, parallel medially, shorter than half the length of the parameres. Median lobe short, curved, moderately thick, posterior tip narrowed, pointed at apex; anterior tip slightly expanded, bearing short, paired anterior struts. Median lobe bicolored, lighter for small portion only near anterior tip.

Variation: Other than the expected variation in size, this species varies little. In one specimen [SAMA 188NL], the median longitudinal pronotal groove appears to be weakly interrupted near the apex.

Type Material (Figs. 4.89-4.92): HOLOTYPE (♂, here designated) label data: Label 1: "S. AUST. Pinkawillinie CP / 16km NNW Koongawa / 33˚02'93" S 135˚49'63"E / 24 Nov. 1995 / J.A. Forrest" Label 2: "S. Aust. Museum / specimen" Label 3: "HOLOTYPE / *Deretaphrus ocularis* / Lord and McHugh" Underside: "SAMA 171NL" [SAMA 171NL, examined, dissected]. The holotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARATYPE (here designated) label data: Label 1: "S. AUST. Danggali CP 3km N / Tomahawk Dam pitfalls / 33˚19'39"S 140˚42'50"E / 24-26 Nov. 96 / JA Forrest" Label 2: "S. Aust. Museum / specimen" Label 3: "PARATYPE / *Deretaphrus ocularis* / Lord and McHugh" Underside: "SAMA 172NL" [SAMA 172NL, examined]. Sex not determined. The paratype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARATYPE (here designated) label data: Label 1: "S.AUST. dead on Sinclair Gap / salt lake 7 Sept. 1996 / 33.1250˚S 137.0522˚E / P. Hudson" Label 2: "S. Aust. Museum / specimen" Label 3: "PARATYPE / *Deretaphrus ocularis* / Lord and McHugh" Underside: "SAMA 173NL" [SAMA 173NL, examined]. Sex not determined. The paratype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARATYPE (here designated) label data: Label 1: "S. AUST Munyaroo CP, / 9.5km SSW Murninnie / 33˚23'38"S 137˚20'33"E / 23-30 September 2002 / beat

MUN002 / SEG Munyaroo Survey" Label 2: "Low sand dune, / open low Mallee" Label 3: "S. Aust. Museum / specimen" Label 4: "PARATYPE / *Deretaphrus ocularis* / Lord and McHugh" Underside: "SAMA 188NL" [SAMA 188NL, examined]. Sex not determined. The paratype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

Specimens examined: Known only from the holotype and the three paratypes.

Distribution (Fig. 4.140): known only from South Australia.

Biology: one specimen was collected on a sand dune in open low Mallee.

Etymology: This species was named for the reniform shape of the eyes, excavated posteriorly by a large, subtriangular cuticular expansion of the head capsule.

Remarks: This species most closely resembles *D. wollastoni* Newman and *D. xanthorrhoeae* Lea, but is easily distinguished by the reniform shape of the eye.

***Deretaphrus oregonensis* Horn**

(Figs. 4. 38, 4.208-4.209, 4.237, 4.248)

Deretaphrus oregonensis Horn 1873: 146.

Diagnosis: characterized by its New World distribution confined to the western United States, punctation of the pronotal disc, shape of the interrupted median longitudinal canal, shape of the submentum, and its genitalic characters.

Description: Length 6.4–12.9 mm. Width 1.8–3.6 mm. Body elongate, parallel, dark brown to black; dorsal surface glabrous, rugose, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.248): Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on

bulbous posterior portion small, sparse, punctures on anterior portion small, dense. Frontoclypeal suture distinct, arcuate with a weak median impression. Anterior margin of clypeus almost straight. Submentum moderately expanded anteroventrally, a portion of the mentum visible. Submentum distinctly separated from subgenal braces; submentum bilobed. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose; segments 6-8 with a single row of moderately long setae, setae nearly as long as segment from which they arise. Antennal club segments with a single row of setae, arising near apex of each segment. Antennal club slightly asymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.38): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface evenly convex. Anterior margin straight, slightly wider than head; anterior angles not developed. Base of pronotum distinctly narrower than elytral bases; posterior margin slightly sinuate, posterior angles with minute denticle, if any. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. In lateral view, carinae are slightly curved near base, extend anterodorsally, ending only slightly past midline. Pronotal disc with well pronounced, deep punctures of varying sizes. Median longitudinal pronotal canal well developed, interrupted to form a deep, apical fovea and a basal canal. Raised interruption of the canal impunctate. Apical fovea oval, punctured heavily internally. Basal canal narrow; deeply impressed; internal lateral margins grooved; gradually narrowed to an open point at the base. Hypomeron strongly punctate with shallow punctures, larger than found on pronotal disc; lateral walls nearly parallel-sided. prosternum evenly convex. Tergosternal suture more or less straight.

Elytra (Figs. 4.208-4.209): Elytron convex. Interstitial intervals 3, 5, 7, and 9 carinate. Intervals 3 and 5 carinate for entire length, fused to a point near elytral apex. Intervals 7 and 9 weaker at base, more pronounced near apex. Intervals 3, 5, 7, and 9 with micropunctures at crest. Apical elytral margin with small, dense punctures. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V with a slightly raised, thickened margin.

Legs: Base of femur and trochanter without long, sparse setae. Inner face of tibia with fringe of sparse setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus (Fig. 4.237): Phallobase without lateral hook-like projections. Parameres very long and narrow; with a fringe of long, dense setae arising from apex to middle of lateral margins; parameres distinctly separated and individually articulated to phallobase; dorsal surface with long, narrow slightly curved hook-like projections that extend past midline, nearing length of parameres. Median lobe long, slender, slightly curved; posterior tip narrowed, pointed at apex; anterior tip slightly expanded with truncate, broadly rounded paired anterior struts. Median lobe unicolored.

Variation: The size and coloration is variable within the species. The degree of carination of the elytral interstitial intervals ranges from strongly raised to carinate. The sculpturing of the pronotal disc is also slightly variable, the punctures variously sized and the lateral margins of the basal portion of the median longitudinal pronotal canal slightly narrowed to subparallel.

Type Material (Figs. 4.93-4.100): LECTOTYPE (original designation) of *Deretaphrus oregonensis* Horn has the following label data: Label 1: "Or." Label 2: "LectoTYPE / 3198" Label 3: "HornCol / 3281" Label 4: "Deretaphrus / oregonensis / Horn" [MCZ 44NL, examined]. Sex not determined.

PARATYPE (original designation) label data: Label 1: "Or." Label 2: "Para-Type / 3198" Label 3: "HornColl / H3281" [MCZ 45NL, examined]. Sex not determined.

TYPE (original designation) label data: Label 1: "Or." Label 2: "HornColl / H3281" [MCZ 46NL, examined]. Sex not determined.

TYPE (original designation) label data: Label 1: "Or." Label 2: "HornColl / H3281" [MCZ 47NL, examined]. Sex not determined.

TYPE (original designation) label data: Label 1: "Or." Label 2: "Type 8042" Label 3: "Deretaphrus / oregonensis / Horn" Label 4: "Aug.-Dec. 2004 / MCZ Image / Database" [MCZ 40NL, examined]. Sex not determined.

TYPE (original designation) label data: Label 1: "Cal" Label 2: "42" [MCZ 41NL].

TYPE (original designation) label data: Label 1: "Or" [MCZ 42NL, examined]. Sex not determined.

TYPE (original designation) label data: Label 1: "Or" [MCZ 43NL, examined]. Sex not determined.

Type specimens MCZ 44-47NL (lectotype, paratype, two types) are part of the Horn Collection. Type specimens MCZ 40-43NL (four types) are part of the LeConte

Collection. The type specimens are deposited in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Specimens examined: The lectotype, paralectotype, 6 types, and 469 specimens were examined.

Distribution (Fig. 4.141): Western United States: WA, OR, CA, ID, NV, UT, MT; Canada: British Columbia.

Biology: *Deretaphrus oregonensis* has been collected from under the bark of Ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), Sugar pine (*Pinus lambertiana*), Lodgepole pine (*Pinus murrayana*) Douglas fir (*Pseudotsuga mucyanata*), Red fir (*Abies magnifica*), White fir (*Abies concolor*), Western larch (*Larix occidentalis*) and Canyon oak (*Quercus chrysolepus*). *D. oregonensis* has been associated with the following beetles, as presumed ectoparasites: Curculionidae: *Dendroctonus jeffreyi*, *Dendroctonus monticolae,* Buprestidae: *Buprestis laeviventris, Buprestis aurulenta, Trachykele opulenta*, *Trachykele nimbosa,* and Cerambycidae: *Asemum atrum.*

Etymology: This species was named for the state from which it was first collected.

Remarks: This species most closely resembles *D. boliviensis* **n. sp.,** but is easily distinguished by the deep elytral punctures, punctures on pronotal disc of varying size, basal portion of the median longitudinal canal not variously narrowed and expanded, and the strictly western North American distribution.

References: Balduf 1935: 166; Böving and Craighead 1931: 40, 174, pl. 44; Burke 1919: 123-124; Clausen 1940: 572; Craighead 1920: 6-9, 13, pl. 2; Craighead 1950: 208; Essig 1926: 398-399, 450, 514; Hatch 1961: 241, 247, 460, pl. LI; Heinze 1943:

119; Horn 1878: 579-581; Lawrence 1991: 478; Philips and Ivie 2002: 358-361; Stephan 1989: 11-13.

Deretaphrus parviceps Lea

(Figs. 4.39, 4.172, 4.210-4.211, 4.238)

Deretaphrus parviceps Lea 1898: 548.

Diagnosis: Characterized by the almost glabrous antenna, extremely convex, almost angulate eyes, head at base much narrower than prothorax at apex, very weak median longitudinal depression of the pronotum, punctation of the pronotal disc, elytral interstitial intervals 3, 5, and 7 moderately carinate, carina on intervals 3 and 5 fusing near apex, Western Australian distribution, and its genitalic characters.

Description: Length 8.5–9.3 mm. Width 2.5–2.7 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.172): Head distinctly narrower than pronotum; narrowed apically; frons without transverse angular expansions; eyes pointed, not evenly convex, visible from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, dense. Frontoclypeal suture not distinct, arcuate medially. Clypeus distinctly narrower than head. Anterior margin of clypeus slightly angulate. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum fused to subgenal braces; submentum triangulate, anterior margin arcuate. Submentum without paired setose pits. Antennal groove well developed, impunctate internally. Antenna sparsely setose, appearing glabrous except under high magnifications. Antennal club

distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.39): Pronotum quadrate, slightly tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface nearly flat, deflexed near anterior and posterior angles. Anterior margin straight; anterior angles broadly rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct, large raised margin in dorsal view. Pronotal disc with large, deep, circular to oval punctures. Median longitudinal pronotal depression present but very faint, punctures largest within depression, oval anteriorly, round posteriorly. Hypomeron sparsely punctate, punctures large and shallow, each bearing a seta; lateral walls greatly deflexed. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (Figs. 4.210-4.211): Elytron flat, not evenly convex. Interstitial intervals 3, 5, 7, and 9 weakly raised, more pronounced near apex. Interval 5 curves inward and fuses with interval 3 near the apex. Crest of interstitial intervals with micropunctures bearing minute setae. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses with finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V simple.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia with small fringe of setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.238): Phallobase simple. Phallobase with lateral hook-like projections, projections slightly curved (less than 90 degrees). Parameres moderately short, broadly rounded, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly, tips of projections not swollen; projections widely separated, tips curved outwards slightly, parallel medially, projections extending from near base to shortly before middle of parameres. Median lobe short, very thick, posterior tip slightly swollen, abruptly narrowed and pointed at apex; anterior tip not slightly expanded, bearing long, narrow, paired anterior struts. Median lobe colored unicolored.

Variation: The punctures in the center of the pronotal disc are sometimes less dense, and the puncture shape on the elytra varies from round to slightly irregular.

Type Material (Fig. 4.101): HOLOTYPE (♀, original designation) label data: Label 1: "parviceps / Lea TYPE / Swan R" Label 2: "9560 / Deretaphrus / parviceps Lea / W. Australia / TYPE" Label 3: "S. Aust. Museum / specimen" Label 4: "HOLOTYPE? / *Deretaphrus parviceps* Lea / det. N.P. Lord 2008" Underside: "SAMA 278NL" [SAMA 278NL, examined, dissected]. The holotype is deposited in the South Australian Museum, Adelaide, South Australia.

Specimens examined: Known only from the holotype and one other specimen. Label data: Label 1: "R.P. McMillan / DATE 16.6.51 / Culham" Label 2: "Western Australian / Museum Entomology / Reg. no. 65202" [WAMP 21NL].

Distribution (Fig. 4.142): Western Australia

Biology: Not known.

Etymology: *Parvus*: Latin = little. *-ceps*: Latin = head. This species was named for the small size of the head in relation to the rest of the body.

Taxonomic Notes: The type specimen of *Deretaphrus parviceps* Lea was found to be a unique type (by monotypy). Although the specimen does not bear a holotype label, Lea's collection was deposited in the South Australian Museum (SAMA), and after a thorough search, no other collections were found to hold any of Lea's types. Therefore, the type specimen of *Deretaphrus parviceps* will be considered the holotype.

Remarks: This species most closely resembles *D. bucculentus* Elston, *D. puncticollis* Lea, and *D. incultus* Carter. *D. parviceps* can be distinguished from *D. bucculentus* by elytra interstitial interval 5 curving inward, fusing or narrowly fusing with interstitial interval 3 near the apex and frons lacking large, lateral angular expansions. *D. parviceps* can be distinguished from *D. puncticollis* Lea by the less densely and coarsely punctate pronotal disc and the median longitudinal depression of the pronotal disc more strongly punctate near base, not bordered on either side by a small keel or ridge. *D. parviceps* can be distinguished from *D. incultus* Carter by the pronotum with a weakly developed, but present, median longitudinal depression, and elytra interstitial interval 5 curving inward, fusing or narrowly fusing with interstitial interval 3 near the apex. *D. parviceps* can be distinguished from its congeners by the small size of the head in relation to the pronotum.

References: Blackburn 1903: 120; Carter 1937: 200; Heinze 1943: 119.

***Deretaphrus piceus* (Germar)**

(Figs. 4.9, 4.40, 4.212-4.213, 4.239, 4.249)

Deretaphrus piceus (Germar) 1848: 223.

Sigerpes piceus (Germar) 1848. Synonymized by Lacordaire 1854: 377.

Derataphrus piceus (Germar), *in* Lacordaire 1876: 8, pl. 20 [misspelling].

Deretaphrus bakewellii Pascoe 1862: 463. Synonymized by Carter 1937: 200.

Deretaphrus bakewelli Pascoe, *in* Masters 1871: 78; Lea 1898: 547, 550; Blackburn 1903: 123, 129; Carter 1937: 200-201 [misspelling].

Deretaphrus thoracicus Blackburn 1903: 122. Synonymized by Carter 1937: 200.

Diagnosis: Characterized by the sparsely punctate surface of the pronotal disc, interrupted pronotal median longitudinal canal, densely setose antenna, shape of the submentum, abdominal ventrite V bears two depressions on either side of midline, resulting in a median V-shaped area near the posterior margin, and its genitalic characters.

Description: Length 5.6– 12.1. Width 1.6–2.9 mm. Body elongate, parallel, dark brown to black; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Figs. 4.9, 4.249): Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, moderately dense. Frontoclypeal suture not distinct, arcuate medially. Anterior margin of clypeus slightly arcuate. Submentum moderately expanded anteroventrally, a portion of the mentum visible. Submentum distinctly separated from subgenal braces. Submentum with paired setose pits. Antennal groove well developed, impunctate. Antenna densely setose; segment 1 with few setae on ventral surface; segments 2-4 with short setae; segments 5-11 with long, golden setae that extend beyond the antennal segment from

which they arise. Antennal club segments with multiple rows of setae. Antennal club subsymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.40): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface flattened down the longitudinal midline, convex laterally. Anterior margin moderately arcuate, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin slightly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with small, sparse punctures. Median longitudinal pronotal canal well developed, interrupted to form a deep, apical fovea and a basal canal. Raised interruption of the canal impunctate. Apical fovea narrows to a point anteriorly. Basal canal wide; deeply impressed; internal lateral margins of canal grooved; abruptly narrowed and open at the base. Hypomeron minutely punctate; strongly deflexed medially (towards midline). Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate.

Elytra (Figs. 4.212-4.213): Elytron convex. Interstitial intervals 3, 5, 7, and 9 feebly raised, more pronounced near apex. Interval 5 meets or nearly meets interval 9 near elytral apex. Intervals 3, 5, and 7 with micropunctures at crest. Apical elytral margin with small, dense punctures. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 narrowly separated or slightly touching finger-like callosity on the elytral shoulder.

Abdomen: Ventrite V more heavily punctured, bearing two depressions on either side of midline, resulting in a median V-shaped area near the posterior margin (Fig. 4.47), present in both sexes.

Legs: Base of femur and trochanter with long, sparse setae. Inner face of tibia with fringe of long, dense setae. Tarsus densely setose with long setae that extend beyond the segment from which they arise.

Aedeagus (Fig. 4.239): Phallobase with lateral hook-like projections, projections strongly curved, curvature nearly 180 degrees. Phallobase with several folds. Parameres broadly rounded, broadly fused to one another near base, each paramere with two patches of lighter coloration; one light patch at base, extremely transverse, extending from midline to lateral margin; second light patch at apex, distinctly smaller and more rounded than basal patch, extending from midline to lateral margin. Median lobe long, slender, curved; posterior tip narrowed and pointed, anterior tip slightly expanded, bearing long, thin, paired anterior struts.

Variation: Size and color are variable within the species. The degree of carination of the raised interstitial intervals is variable, ranging from only slightly raised to distinctly raised. The lateral margins of the pronotum may be slightly to greatly narrowed. The base of the median longitudinal pronotal canal is generally narrowed posteriorly, but may be more or less parallel-sided. The anterior portion of the pronotal canal ranges from narrowed apically (in most) to oval.

Type Material (Figs. 4.64, 4.104-4.105, 4.119): LECTOTYPE (here designated) label data: Label 1: "43683" Label 2: "Adelaide" Label 3: (folded): "piceus Germ." Label 4: "Hist. –Coll. (Coleoptera) / Nr. 43683 / Deretaphrus piceus Germ. / typ / Adelaide, Coll. Schaum / Zool. Mus. Berlin" Label 5: "LECTOTYPE / *Deretaphrus piceus* / (Germar) 1848" Underside: "MNHUB 19NL" [MNHUB 19NL, examined]. Sex not determined. The lectotype is deposited in the Museum fur Naturkunde, Humboldt-

Universitat zu Berlin, Berlin, Germany (MNHUB).

PARALECTOTYPE (here designated) label data: Label 1: "Adelaide" Label 2: "Hist. –Coll. (Coleoptera) / Nr. 43683 / Deretaphrus piceus Germ. / typ / Adelaide, Coll." Label 3: "piceus / Germ. / vid. Dr. E. Heinze 1942" Label 4: "SYNTYPUS / Sigerpes / piceus Germar, 1848 / labeled by MNHUB 2007" Label 5: PARALECTOTYPE / *Deretaphrus piceus* / (Germar) 1848" Underside: "MNHUB 20NL" [MNHUB 20NL, examined]. Sex not determined. The paralectotype is deposited in the Museum fur Naturkunde, Humboldt-Universitat zu Berlin, Berlin, Germany (MNHUB).

The syntype (original designation) of *Deretaphrus bakewellii* Pascoe has the following label data: Label 1 (folded): "Deretaphrus / Bakewellii / Pascoe" Label 2: "Hist.-Coll. (Coleoptera) / Nr. 43683 / Deretaphrus Bakewellii / Pasc. / Zool. Mus. Berlin" Label 3: "piceus Germ. / vid. Dr. E. Heinze 1942" Label 4: "Original specimen / or Syntype of Deretaphrus / bakewellii Pascoe, 1862? / labelled by MNHUB 2007" (MNHUB 21NL, examined). Sex not determined. The syntype is deposited in the Museum fur Naturkunde, Humboldt-Universitat zu Berlin, Berlin, Germany (MNHUB).

The holotype (♂, original designation) of *Deretaphrus thoracicus* Blackburn has the following label data: Label 1: "Type / H.T." Label 2: "Australia. / Blackburn Coll. / B.M.1910-236" Label 3: Deretaphrus / thoracicus, Blackb." (BMNH 102NL, examined, dissected). The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

Specimens examined: The lectotype and paralectotype of *D. piceus*, syntype of *D.* bakewellii, holotype of *D. thoracicus*, and 248 specimens were examined.

Distribution (Fig. 4.143): Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania, and Victoria, Australia.

Biology: One specimen was found in the galleries of *Phoracantha* (Coleoptera: Cerambycidae) in *Eucalyptus viminalis* [ANIC 65NL]. Several specimens were collected under bark [ANIC 253NL, SAMA 239NL]. Several specimens were taken at lights [ANIC 125NL, ANIC 133NL, ANIC 169NL]. One specimen was taken at a mercury vapor light in an open forest [QMBA 3NL].

Etymology: *piceus*: Latin = pitchy, pitch black. This name refers to the dark black color of most specimens.

Remarks: This species most closely resembles *Deretaphrus analis* Lea, from which it can be differentiated by the much more prominently punctate pronotal disc, the basal portion of the median longitudinal pronotal canal open and narrowed posteriorly, the more prominent elytral punctures, and the shape of the aedeagus.

References: *Deretaphrus piceus* (Germar): Blackburn 1903: 121-123, 125, 129; Carter 1937: 200-201; Lacordaire 1876: 8, pl. 20; Lea 1898: 550; Masters 1871: 79; Pascoe 1862: 462-463.

Sigerpes piceus Germar: Lacordaire 1854a: 377-378; Pascoe 1862: 461.

Deretaphrus bakewelli Pascoe: Blackburn 1903: 123, 129; Carter 1937: 200-201; Lea 1898: 550; Masters 1871: 78; Lea 1898: 547.

Deretaphrus thoracicus Blackburn: Carter 1937: 200-201.

***Deretaphrus puncticollis* Lea**

(Figs. 4.15-4.20, 4.41, 4.214-4.215, 4.240, 4.250)

Deretaphrus puncticollis Lea 1898: 549.

Diagnosis: characterized by the almost glabrous antenna, shape of the submentum, pronotal disc densely punctate with a large, deep punctures, pronotum with a weak median longitudinal depression in which the lateral margins are slightly carinate near the base, elytral interstitial intervals 3, 5, and 7 moderately carinate, carina on intervals 3 and 5 meeting near apex, and its genitalic characters.

Description: Length 5.5–8.8 mm. Width 1.6–2.6 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, moderately shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.250): Head distinctly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, dense. Frontoclypeal suture distinct, arcuate medially with a weak median impression. Clypeus distinctly narrower than head. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum fused to subgenal braces; submentum triangulate, anterior margin arcuate. Submentum without paired setose pits. Antennal groove well developed, punctate internally. Antenna sparsely setose, setae shorter than half the length of the segment from which it arises; segments 3-8 with a single row of short setae. Antennal club segments 9 and 10 with two rows of short setae, one row at midline with sparse setation, the second row arising near apex of the segment. Penultimate segment with a single median row of short setae. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.41): Pronotum elongate, tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface rugose. Anterior margin straight; anterior angles pronounced. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with large, dense punctures, each bearing a minute seta. Median longitudinal pronotal depression well developed; depression wide, gradually shallower anteriorly. Depression sparsely punctate near base, bordered on either side by a small keel; closed basally by posterior margin of pronotum. Hypomeron sparsely punctate, punctures larger than found on pronotal disc; lateral walls nearly parallel-sided. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (Figs. 4.214-4.215): Elytron convex. Interstitial intervals 3, 5, 7, and 9 carinate for entire length, shiny. Intervals 3 and 5 fuse to a point near elytral apex. Intervals 3, 5, 7, and 9 with micropunctures at crest bearing minute setae. Apical elytral margin of elytra slightly flanged, flange sinuate. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; protuberance of interval 5 fuses with finger-like callosity on the elytral shoulder. Callosity on elytral shoulder distinctly forked.

Abdomen: Ventrite V simple.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia without fringe of setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.240): Phallobase simple. Phallobase with lateral hook-like projections, projections curved about 90 degrees. Parameres moderately short, elongate, widely separated, nearly forked, and individually articulated to phallobase, sparsely setose with short setae at apical margins; each paramere with a large area of lighter coloration, extending from internal to external lateral margin for almost entire length of paramere. Dorsal surface of parameres with extremely short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections widely separated, extending from base of parameres to basal 1/5 of the parameres. Median lobe long, slender, straight; posterior tip narrowed and pointed, anterior tip slightly expanded, bearing long, thin, paired anterior struts.

Variation: Size and coloration vary within the species. In some, the interstitial intervals 3 and 5 do not quite meet at apex, but nearly so.

Type Material (Fig. 4.107): HOLOTYPE (original designation) label data: Label 1: "puncticollis / Lea TYPE / Queanbeyan" Label 2: "9561 / Deretaphrus / puncticollis Lea / N.S. Wales / TYPE" Label 3: "S. Aust. Museum / specimen" Label 3: "HOLOTYPE? / *Deretaphrus parviceps* Lea / det. N.P. Lord 2008" Underside: "SAMA 278NL" [SAMA 277NL, examined]. Sex not determined. The holotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA). This specimen is labeled as a "type," but is the only type specimen known to exist. This specimen should be regarded as the holotype for *D. puncticollis* Lea.

Specimens examined: The holotype and 57 specimens were examined.

Distribution (Fig. 4.144): New South Wales and Queensland, Australia.

Biology (Figs. 4.15-4.20): 54 of the 58 specimens [QMBA 46-80, ANIC 254-267, SAMA 138-143] of *Deretaphrus puncticollis* were collected from within the earthen pupal chambers of several Rose Chafer scarab larvae, *Trichaulax philipsii* (Coleoptera: Scarabaeidae: Cetoniinae). The larvae of *D. puncticollis* parasitized the scarab larvae. After feeding, the *Deretaphrus* larvae spun and attached dozens of silken cocoons to the host (Figs. 4.18-4.20). This is easily the largest series of *Deretaphrus* ever collected.

Etymology: -*collis*: Latin = mound. In entomology, -*collis* refers to the pronotum. This species is named for its densely punctate pronotum.

Taxonomic Notes: The type specimen of *Deretaphrus puncticollis* Lea was found to be a unique type (by monotypy). Although the specimen does not bear a holotype label, Lea's collection was deposited in the South Australian Museum (SAMA), and after a thorough search, no other collections were found to hold any of Lea's types. Therefore, the type specimen of *Deretaphrus puncticollis* will be considered the holotype.

Remarks: This species most closely resembles *D. bucculentus* Elston. *D. puncticollis* Lea can be distinguished from *D. bucculentus* by elytral interstitial intervals 3 and 5 curved inwardly, fusing at apex, or nearly so. *D. bucculentus* has large, angular expansions of the frons as the lateral margin, a character lacking in *D. puncticollis.*

References: Carter 1937: 200-201.

***Deretaphrus rodmani* Lord and McHugh new species**

(Figs. 4.42, 4.173, 4.216-4.217, 4.241)

Diagnosis: Characterized by the much larger, angled punctures found within the median longitudinal depression of the pronotal disc, sparsely punctate antenna, rounded lateral expansions of the frons, a Western Australia distribution, and its genitalic characters.

Description: Length 6.1–9.9 mm. Width 1.9–3.1 mm. Body elongate, parallel, light to dark red; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.173): Head distinctly narrower than pronotum; slightly narrowed apically, subtriangular in shape; frons with broadly rounded, transverse angular expansions; eyes almost entirely concealed from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, dense. Frontoclypeal suture distinct, slightly arcuate, nearly straight. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum fused to subgenal braces; anterior margin arcuate. Submentum without paired setose pits. Antennal groove well developed, impunctate internally. Antenna sparsely setose, appearing glabrous except under high magnification; segments 3-8 with a single row of minute setae. Antennal club segments with minute setae. Antennal club slightly asymmetrical. Dorsal surface (external face) of mandible with median setose groove.

Thorax (Fig. 4.42): Pronotum elongate, tapering towards base. Pronotum widest near anterior margin, distinctly wider than head. Dorsal surface convex, depressed along midline, more strongly deflexed near anterior angles. Anterior margin arcuate; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with large, circular to oval punctures. Median longitudinal pronotal depression present, shallow, wide; punctures larger and denser in median depression, at times confluent.

Hypomeron sparsely punctate, punctures large and shallow, each bearing a seta; lateral walls greatly deflexed. Prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture more or less straight.

Elytra (Figs. 4.216-4.217): Elytron evenly convex. Interstitial intervals 5, 6, 7, and 9 raised for entire length; interval 9 feebly raised; interval 3 raised towards apex; interval 4 raised for apical half. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; callosity on elytral shoulder thick and projecting dorsolaterally.

Abdomen: Ventrite V comes to a slight point.

Legs: Femur and tibia with short, sparse setae. Inner face of tibia with two setal fringes with long setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of long, dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.241): Phallobase simple. Phallobase with short lateral hook-like projections, projections weakly curved. Parameres very short, broadly rounded, distinctly separated and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with large hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly, apex of projections out turned 90 degrees; projections distinctly separated, parallel medially, very large, nearing the length of the parameres. Median lobe short, moderately thick, more or less straight, posterior tip narrowed and pointed, anterior tip slightly expanded, bearing paired anterior struts. Median lobe bicolored, lighter for apical 1/3.

Variation: Size and color are variable within the species. The punctation along the midline of the pronotal disc is somewhat variable, ranging from sparsely (in most) to moderately punctate, the punctures often confluent.

Type Material (Figs. 4.108-4.115): HOLOTYPE (here designated) label data: Label 1: "Southern Cross / (31˚13'S 119˚20'E) / W. Australia / 21.X.80 PTO / R.P. McMillan / (underside): Emerged from / tunnel of / Penthea sp. / 14.iii.80 / remains of / Penthea larva in tunnel" Label 2: "Western Australian / Museum Entomology / Reg. no. 65199" Label 3: "Deretaphrus / xanthorrhoeae Lea / ? / Det. / J.F. Lawrence" Label 4: "HOLOTYPE / *Deretaphrus rodmani* / Lord and McHugh" Underside: "WAMP 18NL" [WAMP 18NL, examined]. Sex not determined. The holotype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

PARATYPE (here designated) label data: Label 1: "Miling / Western Australia / 20 Nov. 1974 / A. Page" Label 2: "in bored / section / of branch" Label 3: "Western Australian / Museum Entomology / Reg. no. 65263" Label 4: "PARATYPE / *Deretaphrus rodmani* / Lord and McHugh" Underside: "WAMP 61NL" [WAMP 61NL, examined]. Sex not determined. The paratype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

PARATYPE (here designated) label data as above, except: Label 3: "Western Australian / Museum Entomology / Reg. no. 65264" Label 4: "PARATYPE / *Deretaphrus rodmani* / Lord and McHugh" Underside: "WAMP 62NL" [WAMP 62NL, examined]. Sex not determined. The paratype is deposited in the Western Australian Museum, Perth, Western Australia (WAMP).

PARATYPE (here designated) label data: Label 1: “Mullewa W.A. / Miss F. May” Label 2: “Deretaphrus / ignarus / Pasc. / HJC” Label 3: “S. Aust. Museum / specimen” Label 4: “PARATYPE / *Deretaphrus rodmani* / Lord and McHugh” Underside: “SAMA 91NL” [SAMA 91NL, examined]. Sex not determined. The paratype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA).

PARATYPE (here designated) label data: Label 1: “Emerged from / tunnel of Penthea / sp. 19.iii.81 / Southern Cross / (31˚13’S 119˚20’E) / W. Australia / 21.x.80 Larva? / R.P. McMillan” Label 2: “PARATYPE / *Deretaphrus rodmani* / Lord and McHugh” Underside: “ANIC 62NL” [ANIC 62NL, examined]. Sex not determined. The paratype is deposited in the Australian National Insect Collection, Canberra, Australian Capital Territory (ANIC).

PARATYPE (here designated) label data as above, except: Label 2: “PARATYPE / *Deretaphrus rodmani* / Lord and McHugh” Underside: “ANIC 63NL” [ANIC 63NL, examined]. Sex not determined. The paratype is deposited in the Australian National Insect Collection, Canberra, Australian Capital Territory (ANIC).

The paratypes ANIC 62NL and ANIC 63NL are each point-mounted. The points are attached to the same pin, along with two cocoons, presumably the cocoons from which they eclosed. Label 2 for paratype ANIC 63NL is located beneath Label 2 for paratype ANIC 62, in case the specimens are ever separated.

PARATYPE (here designated) label data: Label 1: “Mt. Magnet, W.A. / Aug 1981 / 2 x Casuarina sp. / G.A. Holloway” Label 2: “Australian Museum / K 231649” Label 3: “PARATYPE / *Deretaphrus rodmani* / Lord and McHugh” Underside:

"AMSA 67NL" [AMSA 67NL, examined]. Sex not determined. The paratype is deposited in the Australian Museum, Sydney, Australia (AMSA).

PARATYPE (here designated) label data as above, except: Label 2: "Australian Museum / K 231650" Label 3: "PARATYPE / *Deretaphrus rodmani* / Lord and McHugh" Underside: "AMSA 68NL" [AMSA 68NL, examined]. Sex not determined. The paratype is deposited in the Australian Museum, Sydney, Australia (AMSA).

PARATYPE (here designated) label data as above, except: Label 2: "Australian Museum / K 231651" Label 3: "PARATYPE / *Deretaphrus rodmani* / Lord and McHugh" Underside: "AMSA 69NL" [AMSA 69NL, examined]. Sex not determined. The paratype is deposited in the Australian Museum, Sydney, Australia (AMSA).

Specimens examined: The holotype, 8 paratypes, and 33 specimens were examined.

Distribution (Fig. 4.145): Known only from Western Australia.

Biology: Several specimens emerged from the tunnels of *Penthea saundersii* (Coleoptera: Cerambycidae) in *Acacia* sp. The remains of dead *Penthea* larvae were found in the tunnels, strongly suggesting the possibility of *P. saundersii* as a host of *D. rodmani*. Four specimens were also taken from *Casuarina* sp. (Casuarinaceae) [AMSA 65NL, AMSA 67-69NL].

Etymology: This species is named in honor of James E. (Jim) Rodman, founder of the National Science Foundation Partnerships for Enhancing Expertise in Taxonomy (PEET) program.

Remarks: This species can readily be distinguished from all other *Deretaphrus* by the broadly rounded lateral expansions of the frons and the larger, sparser punctures of the pronotal disc at the midline.

Deretaphrus viduatus Pascoe

(Figs. 4.10, 4.43, 4.218-4.219, 4.242, 4.251)

Deretaphrus viduatus Pascoe 1862: 463.

Deretaphrus colydioides Pascoe 1862: 463. Synonymized by Carter 1937: 200-201.

Deretaphrus colydoides Pascoe, *in* Masters 1871: 79 [misspelling].

Deretaphrus sparsiceps Blackburn 1903: 127. Synonymized by Carter 1937: 200.

Deretaphrus cribriceps Blackburn 1903: 128; **new synonymy.**

Deretaphrus popularis Blackburn 1903: 126; **new synonymy.**

Diagnosis: characterized by the black color, sculpture of the pronotal disc, anterior portion of the head with a median longitudinal impression, elytral interstitial interval 3 only raised near apex, intervals 5 and 7 not carinate, shape of the submentum, and its genitalic characters.

Description: Length 4.9–10.3 mm. Width 1.4–2.7 mm. Body elongate, parallel, black; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.251): Head slightly narrower than pronotum; slightly narrowed apically; frons with slight transverse expansions, lateral margin sinuate; eyes visible from above. Punctures on bulbous posterior portion small, sparse, punctures on anterior portion small, moderately dense. Frontoclypeal suture distinct, arcuate medially, with median depression. Anterior margin of clypeus slightly arcuate. Submentum greatly expanded anteroventrally, mentum completely concealed. Submentum distinctly separated from subgenal braces, anterior margin truncate. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose, setae

shorter than half the length of the segment from which they arise; segments 2-8 with single row of short setae; antennal club segments with two rows of setae; one row located medially and with short setae, second row with medium length setae found at the apex of club segments. Antennal club asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.43): Pronotum elongate. Pronotum widest near anterior ¼. Dorsal surface flattened down the longitudinal midline, convex laterally. Anterior margin slightly arcuate, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles pronounced, with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Pronotal disc with medium sized, dense oval punctures. Median longitudinal pronotal canal well developed, interrupted to form a small, impressed, apical fovea and a basal canal. Raised interruption of the canal impunctate. Apical fovea a small slit, narrowing to a point anteriorly (arrowhead shaped). Basal canal narrow, parallel-sided; deeply impressed; internal lateral margins of canal grooved; slightly expanded and open at the base. Hypomeron minutely punctate; strongly deflexed medially (towards midline). prosternum flat medially, greatly deflexed at lateral margin. Tergosternal suture slightly sinuate.

Elytra (Figs. 4.218-4.219): Elytron flattened dorsally, convex laterally. Interstitial intervals 5 and 7 weakly raised for entire length, more pronounced near apex. Interval 3 raised near apex. Intervals 3, 5, and 7 with micropunctures at crest. Basal

elytral margin with interstitial intervals 3 and 5 ending in a knob-like protuberance; finger-like callosity on the elytral shoulder weakly developed.

Abdomen: Ventrite V more densely punctured than preceding segments.

Legs: Setation sparse. Inner face of tibia with fringe of short setae. Inner face of tibia with small fringe of setae. Tarsus sparsely setose, tarsomeres 1-3 each bearing two pockets of dense setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.242): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, broadly rounded, distinctly separated and individually articulated to phallobase, internal lateral margins slightly arcuate; parameres sparsely setose with short setae at apical margins; dorsal surface with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections narrowly separated, parallel medially, slightly shorter than half the length of the parameres, tips of projections slightly swollen. Median lobe short, moderately thick, more or less straight, posterior tip narrowed and pointed, anterior tip slightly expanded, bearing paired anterior struts. Median lobe slightly lighter in color near anterior end.

Variation (Fig. 4.10): *D. viduatus* is the most intraspecifically variable species of *Deretaphrus*. This species varies greatly in size and color, and the sculpture of the pronotal disc is highly variable. The lateral margins of the pronotal disc range from slightly to greatly curved, the punctation from small and sparse to larger and dense. The median longitudinal canal is also quite variable. The anterior portion ranges from a mere slit (most) to small and slightly elongate, to slightly narrowed apically. In general, the basal portion of the pronotal canal is narrow and parallel sided with the internal lateral

margins grooved, but this is not definite. The basal canal is sometimes slightly expanded at the base, and the internal lateral grooves may be lacking. The raised elytral interstitial intervals are also variously pronounced, ranging from slightly raised (in most) to carinate. There are several species of *Deretaphrus* that are morphologically similar to *D. viduatus*. *D. colydioides* Pascoe, *D. cribriceps* Blackburn, *D. popularis* Blackburn, and *D. sparsiceps* Blackburn all closely resemble *D. viduatus*. The descriptions for these species are poor and the diagnostic characters used to distinguish them are suspect at best. Of *D. popularis*, Blackburn states "I do not find any very salient single character in this species to separate it from its congeners. It is nearest, I think, to the Adelaide insect which I have no doubt is *viduatus,* Pascoe…" After studying the types and collection holdings, I cannot find any characters that satisfactorily distinguish these species. The sculpturing of smaller specimens is much more indistinct than in larger specimens. Due to the extreme size variation and lack of concrete distinguishing characters, for the purposes of stability and practicality, we feel it necessary to synonymize several species with *D. viduatus*. It may be later found that the synonymized species are valid, but at this point, we believe the synonymization of these species will provide much-needed clarity within this group.

Type Material (Figs. 4.68-4.69, 4.116-4.118, 4.120): HOLOTYPE (original designation) label data: Label 1: "Type" Label 2: "Adelaide" Label 3: "Deretaphrus / viduatus / Pasc" Label 4: "Pascoe / Coll. / 93-60" Label 5: "HOLOTYPE? / *Deretaphrus viduatus* Pascoe / det. N.P. Lord 2008" Underside: "BMNH 105NL" (BMNH 105NL, examined). Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

The holotype (♂, original designation) of *Deretaphrus colydioides* Pascoe has the following label data: Label 1: "Type" Label 2: "Sydney" Label 3: Colydioides / typ Pasc" Label 4: "Pascoe / Coll. / 93-60" Label 5: "HOLOTYPE? / *Deretaphrus colydioides* Pasc. / det. N.P. Lord 2008" Underside: "BMNH 96NL" (BMNH 96NL, examined, dissected). The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH). The type specimen of *Deretaphrus colydioides* Pascoe was found to be a unique type (by monotypy). Although the specimen does not bear a holotype label, Pascoe's collection was deposited in the British Museum of Natural History (BMNH), and after a thorough search, no other collections were found to hold any of Pascoe's types. Therefore, the type specimen of *Deretaphrus colydioides* will be considered the holotype.

The holotype (♂, original designation) of *Deretaphrus cribriceps* Blackburn has the following label data: Label 1: "Type / H.T." Label 2: "5666 / T. Vict." Label 3: "Australia. / Blackburn Coll. / B.M.1910-236." Label 4: "Deretaphrus / cribriceps, Blackb." (BMNH 98NL, examined, dissected). The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

The holotype (original designation) of *Deretaphrus popularis* Blackburn has the following label data: Label 1: "Type / H.T." Label 2: "7203 / T." Label 3: "Australia. / Blackburn Coll. / B.M.1910-236." Label 4: "Deretaphrus / popularis, Blackb." (BMNH 106NL, examined). Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

The holotype (original designation) of *Deretaphrus sparsiceps* Blackburn has the following label data: Label 1: "Type / H.T." Label 2: "Australia. / Blackburn Coll. /

B.M.1910-236." Label 3: Deretaphrus / sparsiceps, Blackb." (BMNH 107NL, examined). Sex not determined. The holotype is deposited in the British Museum of Natural History, London, United Kingdom (BMNH).

The cotype (original designation) of *Deretaphrus sparsiceps* Blackburn has the following label data: Label 1: "Port Lincoln / Blackburn" Label 2: "Deretaphrus / sparsiceps / cotype" Label 3: "Deretaphrus / sparsiceps" Label 4: "D. / viduatus / Pasc. / Det. H.J. Carter." Label 5: "S. Aust. Museum / specimen" Label 6: "COTYPE? / *Deretaphrus sparsiceps* / Blackburn 1903" Underside: "SAMA 156NL" (SAMA 156NL, examined). Sex undetermined. The cotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA). The identification and cotype label (label 2) are in Blackburn's handwriting.

The cotype (original designation) of *Deretaphrus sparsiceps* Blackburn has the following label data: Label 1: "Adelaide / Blackburn" Label 2: "sparsiceps, Blackb." Label 3: "I.8723 / Deretaphrus / sparsiceps Bl / S. Australia / Cotype" Label 4: "COTYPE? / *Deretaphrus sparsiceps* / Blackburn 1903" Underside: "SAMA 274NL" (SAMA 274NL). Sex undetermined. The cotype is deposited in the South Australian Museum, Adelaide, South Australia (SAMA). The third label denotes this specimen as a cotype. The identification label (label 2) is in Blackburn's handwriting, but the cotype label (label 3) is not. It is unknown whether or not this specimen is an actual type, but is here included for completeness.

Specimens examined: The holotypes of *D. viduatus, D. cribriceps, D. popularis*, and *D. sparsiceps*, 2 cotypes of *D. sparsiceps*, and 129 specimens were examined.

Distribution (Fig. 4.146): Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania, Victoria, and Western Australia.

Biology: One specimen was taken from under the bark of *Eucalyptus viminalis* [ANIC 67NL], one specimen was taken from under the bark of *Eucalyptus* sp. [ANIC 200NL], two specimens were taken from the stems of Salt Brush [SAMA 67-68NL], three specimens were taken by fogging hoop pine scrub with pyrethrum [QMBA 14-16NL], one specimen was taken by fogging Python vine scrub with pyrethrum [QMBA 7NL], one specimen was taken night collecting in an open forest [QMBA 6NL], one specimen was taken at a light trap [ANIC 292NL], one specimen was taken from within rotten branches [QDPI 17NL], and one specimen was reared from Bipinnatte wattle [ANIC 27NL].

Etymology: Not known.

Taxonomic notes: *Deretaphrus viduatus* Pascoe: The type specimen of *Deretaphrus viduatus* Pascoe was found to be a unique type (by monotypy). Although the specimen does not bear a holotype label, Pascoe's collection was deposited in the British Museum of Natural History (BMNH), and after a thorough search, no other collections were found to hold any of Pascoe's types. Therefore, the type specimen of *Deretaphrus viduatus* will be considered the holotype.

A cotype of *Deretaphrus sparsiceps* Blackburn [SAMA 274] is clearly *D. viduatus* Pascoe. Another specimen [SAMA 156NL] is labeled as a cotype of *D. sparsiceps* in Blackburn's distinctive handwriting, however, the specimen is too damaged to provide a definitive identification.

Remarks: As mentioned in the "Variation" section, this species is highly variable. It is possible that some of the junior synonyms may one day be found to be valid species, but at the present time, too few concrete morphological characters are present to adequately and satisfactorily diagnose multiple species within this group. *D. viduatus* most closely resembles *D. aequaliceps* Blackburn and *D. ignarus* Pascoe. *D. viduatus* may be distinguished from *D. aequaliceps* by the anterior angles of the pronotum rounded and not pronounced, the basal portion of the median longitudinal pronotal canal narrow and parallel-sided, and the generally larger size. *D. viduatus* can be distinguished from *D. ignarus* by the median longitudinal pronotal canal more distinctly impressed, raised elytral interstitial intervals not distinctly carinate at apex, and the generally darker color.

References: *Deretaphrus viduatus* Pascoe: Blackburn 1903: 126-130; Carter 1937: 200-201; Grouvelle 1903: 184; Masters 1871: 79.

Deretaphrus colydioides Pascoe: Carter 1937: 200-201; Lea 1898: 550.

Deretaphrus colydoides Pascoe: Blackburn 1903: 121, 127-128; Masters 1871: 79.

Deretaphrus cribriceps Blackburn: Carter 1937: 200-201; Heinze 1943: 119.

Deretaphrus popularis Blackburn: Carter 1937: 200-201.

Deretaphrus sparsiceps Blackburn: Carter 1937: 200-201.

***Deretaphrus wollastoni* Newman**

(Figs. 4.44, 4.220-4.221, 4.243)

Deretaphrus wollastoni Wollastoni and Newman 1855: 210.

Diagnosis: characterized by it elytral interstitial intervals carinate numerously interrupted, antenna almost pubescent, and its genitalic characters.

Description: Length 6.7–10.6 mm. Width 2.1–2.9 mm. Body elongate, parallel, dark red; dorsal surface glabrous, slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head: Head slightly narrower than pronotum; slightly narrowed apically; frons with sinuate transverse expansions; eyes partially concealed from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, very dense. Frontoclypeal suture not distinct, slightly arcuate medially. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally; mentum not visible. Submentum narrowly separated from subgenal braces; submentum slightly inflexed, truncate; with large punctures, smooth at anterior margin. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose, appearing glabrous except under high magnifications, setae on antennal club segments sparse. Antennal club distinctly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.44): Pronotum elongate, tapering towards base. Pronotum widest near anterior ¼. Dorsal surface convex, depressed along midline. Anterior margin straight, wider than head; anterior angles obtuse. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles posterior angles depressed basally, with small denticle. Lateral margin with incomplete carinae, forming a raised margin for basal half in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum. Pronotal disc with large, closely set, shallow punctures, nearly reticulate; puncture size decrease towards anterior margin. Median longitudinal pronotal depression well developed. Median depression shallows anteriorly, narrows

slightly basally, posterior portion of depression less punctate, closed at the base by posterior margin of pronotum, bordered on either side by a raised portion (“rib”) of the pronotal disc. Pronotal disc with paired, short ridges that originate from the posterior corners of the pronotum, extend longitudinally (not following curvature of the lateral margins) and end before the midline. Hypomeron punctate; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Prosternum depressed immediately anteriad of procoxae. Tergosternal suture more or less straight. Anterior procoxal groove raised, sinuate with a sharply incised medially just anteriad of the procoxae.

Elytra (Figs. 4.220-4.221): Elytron evenly convex. Interstitial intervals 3, 5-9 raised and shiny for entire length; more strongly raised (nearly carinate) towards apex; interval 4 raised, ending slightly before basal elytral margin. All raised intervals frequently interrupted, forming numerous tubercles. Crest of raised intervals with punctures bearing minute setae. Basal elytral margin with intervals 3 and 5 ending in a knob-like protuberance; finger-like callosity on the elytral shoulder short but pronounced.

Abdomen: Ventrite V slightly swollen in middle of segment, depressed at apex.

Legs: Setation sparse. Inner face of tibia with one prominent setal fringe with relatively short setae. Tarsus sparsely setose, tarsomeres 1-3 with two pockets of setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose.

Aedeagus (Fig. 4.243): Phallobase simple. Phallobase with lateral hook-like projections, projections curved about 90 degrees. Parameres moderately short, broadly rounded apically, narrowed basally, distinctly separated and individually articulated to phallobase; parameres sparsely setose with short setae at apical margins; dorsal surface

with short hook-like projections; projections subtriangular, thickest at base, narrowing anteriorly; projections narrowly separated, parallel medially, slightly shorter than half the length of the parameres, tips of projections slightly swollen, outturned. Median lobe short, moderately thick, slightly sinuate, posterior tip narrowed and pointed, anterior tip slightly expanded, bearing paired anterior struts. Median lobe bicolored, lighter for anterior 1/3.

Variation: The size and color is variable within the species. In some, the median longitudinal pronotal depression is slightly more impressed.

Type Material (Fig. 4.121): No specimen could be identified as a type of *Deretaphrus wollastoni*. Newman gave no indication where the type specimens were deposited, and their current location is unknown. The type does not reside in Newman's material at the British Natural History Museum (pers. comm. Max Barclay). Therefore, a neotype is here designated for *Deretaphrus wollastoni* Newman.

NEOTYPE (♂, here designated) label data: Label 1: "Brisbane" Label 2: "Coll. Hacker" Label 3: "♂" Label 4: "(folded): Deretaphrus / erichsoni / Newm. / Det. H.J. Carter" Label 5: "wollastoni / Newm. / det. Dr. E. Heinze 19_" Label 6: "NEOTYPE / *Deretaphrus wollastoni* / Newman 1855" Underside: "MNHUB 44NL" [MNHUB 44NL, examined]. The neotype is deposited in the Museum fur Naturkunde, Humboldt-Universitat zu Berlin, Berlin, Germany (MNHUB).

Specimens examined: The neotype and 45 specimens were examined.

Distribution (Fig. 4.147): New South Wales, Northern Territory, Queensland, South Australia, and Western Australia.

Biology: Two specimens were taken at a light [ANIC 167NL, SAMA 252NL], three specimens were taken at a mercury vapor light [ANIC 19NL, ANIC 20NL, ANIC 26NL], one specimen was take under bark [ANIC 310NL], one specimen was reared from *Jacksonia scoparia* (Fabaceae), and one specimen was taken by fogging trees with pyrethrum [QMBA 11NL].

Etymology: This species was named in honor of the late Dr. T. V. Wollaston, a prominent coleopterist of the 19th century.

Taxonomic notes: In 1855, T.V. Wollaston and E. Newman co-authored a paper on *Deretaphrus*. In that paper, Newman described two new species (*D. erichsoni* and *D. wollastoni*), thus Newman is credited as the author of the species, but the citation for the paper is "Wollaston and Newman, 1855." Newman's description of *D. wollastoni* is poor and cannot be used to satisfactorily identify any specimen as such. In the description, Newman states that there is "on each margin, is a ridge or keel of corresponding length, which does not follow the curved margin of the prothorax where it widens, but is continued in a direct line towards the anterior margin, ceasing, like the median depression, about half-way between the anterior and posterior margins of the prothorax." When interpreted strictly, this character is not present in any *Deretaphrus*. It was apparent that Pascoe (1862) had not seen a specimen of *D. wollastoni*. Blackburn (1903) wrote: "*D. Wollastoni*, Newm., is probably not a *Deretaphrus;* at any rate it is very different from any species before me…" There is no mention of *D. wollastoni* in Carter's (1937) revision of the Australian Colydiidae.

There is a single specimen identified as *Deretaphrus wollastoni* in E. Heinze's material at the Berlin Museum [MNHUB]. The specimen does have two small ridges

that extend more or less anteriorly in a direct line. Although the majority of Newman's description is vague, the specimen identified as *D. wollastoni* by E. Heinze is the closest fit. Rather than list *D. wollastoni* as a *nomen dubium*, the name will be conserved and a neotype for the species is here designated. The specimen identified as *D. wollastoni* by E. Heinze is the best and only reasonable candidate to serve as a neotype (here designated). All subsequent identifications were base off of the neotype.

Remarks: This specimen most closely resembles *Deretaphrus erichsoni* Newman. The raised interstitial intervals of both species are numerously interrupted. In *D. wollastoni*, the interrupted portions of the elytral interstitial intervals do not form distinct denticles near apex, instead, interruptions form raised or elevated patches throughout the entire length of the elytra. In *D. erichsoni*, the raised intervals are interrupted to form distinct denticles near the apex of the elytra, the median longitudinal depression of the pronotal disc is only distinctly apparent at the base, and the pronotal width nearly equals the pronotal length.

References: Blackburn 1903: 120; Masters 1871: 79; Pascoe 1862: 461-462.

***Deretaphrus xanthorrhoeae* Lea**

(Figs. 4.11-4.13, 4.45, 4.222-4.223, 4.244, 4.252)

Deretaphrus xanthorrhoeae Lea 1898: 548.

Diagnosis: characterized by its almost glabrous antenna, shape of the submentum, no lateral expansion of the head abdominal ventrite V with a notched posterior face in females, Western Australian distribution, and its genitalic characters.

Description: Length 6.6–9.5 mm. Width 2–2.6 mm. Body elongate, parallel, dark red to black; dorsal surface glabrous, matte to slightly shiny; ventral surface moderately shiny, glabrous except for minute setae that arise from punctures.

Head (Fig. 4.252): Head slightly narrower than pronotum; slightly narrowed apically; frons without transverse expansions; eyes visible from above. Punctures on bulbous posterior portion small, sparse; punctures on anterior portion small, denser. Frontoclypeal suture not distinct, slightly arcuate medially. Anterior margin of clypeus arcuate. Submentum greatly expanded anteroventrally; mentum not visible. Submentum narrowly separated from subgenal braces; anterior margin of submentum sinuate. Submentum without paired setose pits. Antennal groove well developed, impunctate. Antenna sparsely setose, setae small, but distinctly visible, setae less than ¼ of the length of the segment from which they arise, segments 3-8 with a single row of short setae; setae on antennal club segments sparse, arising near the apex. Antennal club slightly asymmetrical. Dorsal surface (external face) of mandible without median setose groove.

Thorax (Fig. 4.45): Pronotum elongate, tapering towards base. Pronotum widest near anterior ¼. Dorsal surface greatly convex, flattened medially. Anterior margin straight, slightly wider than head; anterior angles rounded. Base of pronotum distinctly narrower than elytral bases; posterior margin weakly sinuate, posterior angles with small denticle. Lateral margin with incomplete carinae, forming a distinct raised margin in dorsal view. Carinae end anteriorly before the true anterior margin of the pronotum. Pronotal disc with small, dense, ovoid punctures. Median longitudinal pronotal depression moderately well developed, surface of pronotal disc depressed along midline. Depression widens at base, forming two raised portions on either side of midline.

Anteriorly, depression slightly interrupted, strongly punctate anteriad of interruption, with a small line or slit. Posterior portion of interruption with an apical groove that abruptly widens (into an isosceles triangle); internally, groove punctate. Hypomeron densely punctate except for laterad of coxae and at dorsal margin, punctures larger than found on pronotal disc; lateral walls subparallel. Prosternum flat medially, greatly deflexed at lateral margin. Prosternum depressed immediately anteriad of procoxae. Tergosternal suture more or less straight.

Elytra (Figs. 4.222-4.223): Elytron convex, slightly flattened dorsally. Elytral punctures small and evenly spaced. Interstitial intervals 3, 5, 7 and 9 weakly raised and shiny for entire length; intervals 4 and 6 slightly raised medially (not as strong as 3, 5, 7, 9). Basal margin with intervals 3 and 5 ending in a small knob-like protuberance; finger-like callosity on the elytral shoulder small.

Abdomen: Punctures on ventrite V smaller and denser than on ventrites I-IV. In females, the posterior face of ventrite V with a semicircular excised notch, the dorsal margin of which bears a small point (Figs. 4.54-4.55). In males, tip of ventrite V simple (Fig. 4.53).

Legs: Setation sparse. Inner face of tibia with two prominent setal fringes with relatively long setae. Ventral apex of tibia with two pockets of dense setae that arise on either side of the large, curved tibial spur. Tarsus moderately setose, tarsomeres 1-3 with two pockets of long setae on ventral surface at the apex, remainder of tarsomere surface sparsely setose with short setae.

Aedeagus (4.244): Phallobase simple. Phallobase without lateral hook-like projections. Parameres moderately short, narrowed apically, subtriangular, distinctly

separated (nearest to one another at apex) and individually articulated to phallobase, sparsely setose with short setae at apical margins; dorsal surface with long hook-like projections; projections subtriangular, thickest at base, projections narrowly separated, parallel medially, extending past middle of parameres, tips of projections slightly swollen. Median lobe short, more or less straight, moderately thick, posterior tip narrowed, pointed at apex; anterior tip slightly expanded, bearing short, paired anterior struts. Median lobe bicolored, lighter for small portion only near anterior tip.

Variation: The size and color vary within the species. In some, the anterior portion of the median longitudinal canal is short and very narrow, in others, the anterior portion is not distinctly visible, but the surrounding area is impressed. The degree of carination of the elytral interstitial intervals is also somewhat variable, ranging from slightly raised to distinctly raised and shiny.

Type Material (Figs. 4.122-4.123): LECTOTYPE (here designated) label data: On card: "TY" Label 1: "xanthorrheae / Lea TYPE / Swan R" Label 2: "9572 / Deretaphrus / xanthorrheae Lea / W. Australia / TYPE" Label 3: "LECTOTYPE / *Deretaphrus* / *xanthorrhoeae* Lea 1898" Underside: "SAMA 275NL" [SAMA 275, examined]. Sex not determined.

PARALECTOTYPE (here designated) label data: Same as above, except label 3 reads: "LECTOTYPE / *Deretaphrus* / *xanthorrhoeae* Lea 1898" Underside: "SAMA 276NL" [SAMA 276NL, examined]. Sex not determined.

Both the lectotype and paralectotype are mounted on the same card mount. The specimen on the left is the lectotype [SAMA 275NL], the specimen on the right is the

paralectotype [SAMA 276NL]. The lectotype and paralectotype are deposited in the South Australian Museum, Adelaide, South Australia.

Specimens examined: The lectotype, paralectotype, and 53 specimens were examined.

Distribution (Fig. 4.148): Queensland and Western Australia.

Biology (Figs. 4.11-4.13): In the description, Lea (1898) states that *D. xanthorrhoeae* "… may frequently be obtained from the dead crowns of various species of' *Xanthorrhoea* and occasionally from similar situations in *Kingia australis."* One specimen was take in Xanthorrhoeae [WAMP 12NL], one specimen was taken in log heartwood [ANIC 299NL], two specimens were from Black boy [WAMP 9-10NL, WAMP 50NL, WAMP 57-58NL, WAMP 64-65NL], and one specimen was in an inquilines collection, card-mounted with an ant [WAMP 25NL].

Etymology: This species was named after the genus of plants (*Xanthorrhoea*) native to Australia on which the species was originally found.

Remarks: This species most closely resembles *D. ocularis* **n. sp.** and *D. ignarus* Pascoe. *D. xanthorrhoeae* can be distinguished from *D. ocularis* by the non-reniform shape of the eye, and from *D. ignarus* by the sinuate anterior of the submentum and elytral interstitial intervals 3, 5, and 7 less strongly raised.

References: Blackburn 1903: 120; Carter 1937: 200.

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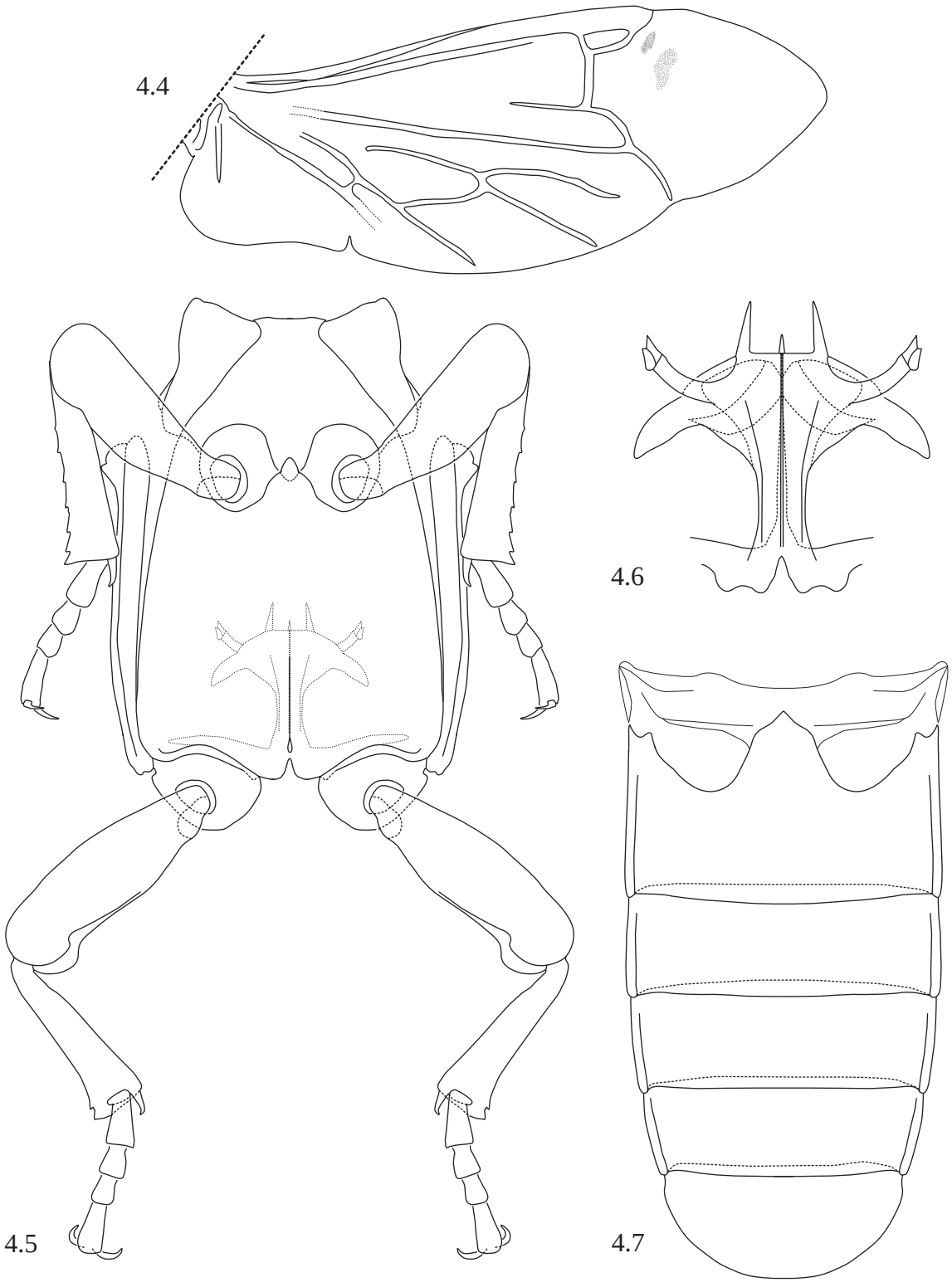
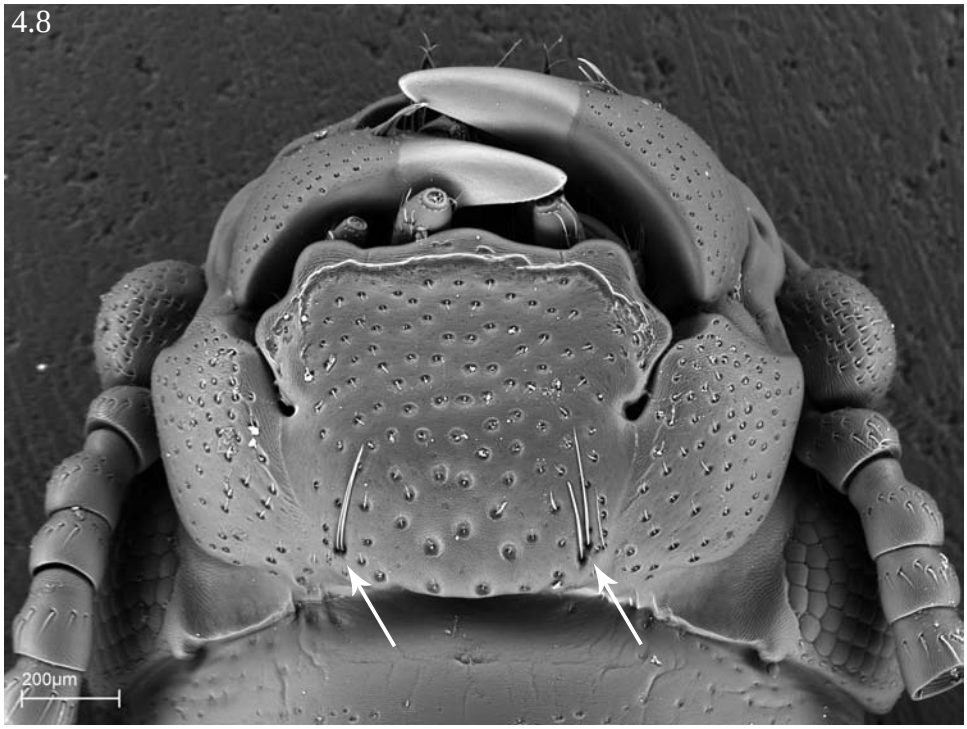
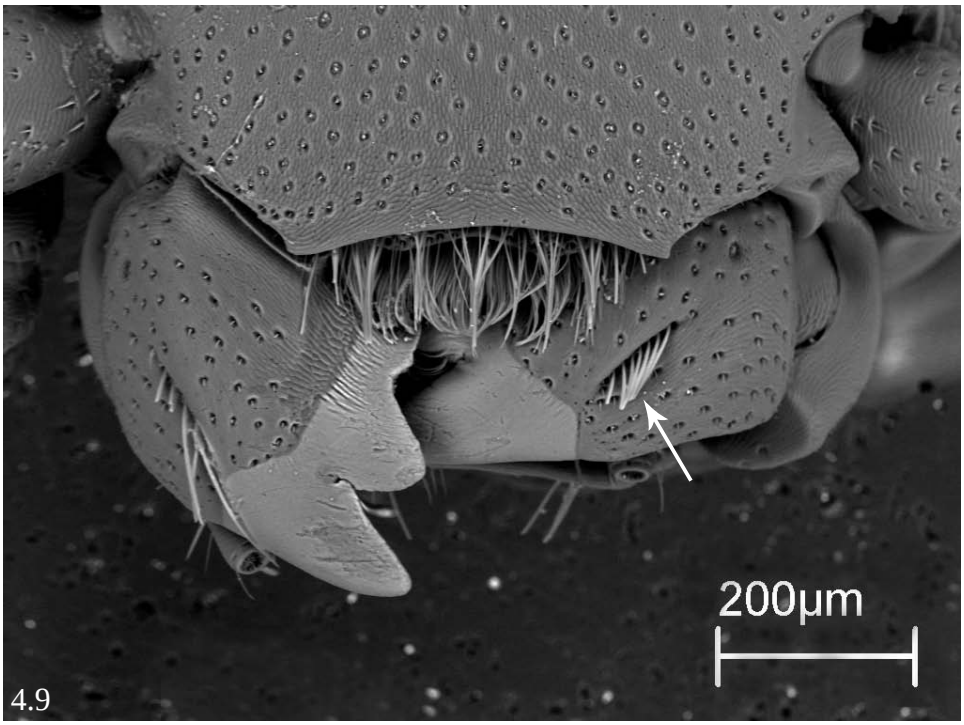
Figures 4.1-4.3. *Deretaphrus fossus* habitus images. 4.1) *D. fossus* dorsal habitus; 4.2) *D. fossus* ventral habitus; 4.3) *D. fossus* lateral habitus



Figures 4.4-4.7. *Deretaphrus fossus* Newman. 4.4) wing, right, dorsal view; 4.5) mesothorax and metathorax, ventral view; 4.6) metentosternite, dorsal view; 4.7) abdomen, ventral view.





Figures 4.8-4.9. *Deretaphrus* morphology. 4.8) *Deretaphrus interruptus* head, ventral view, showing paired, setose pits at base of submentum;
4.9) *Deretaphrus piceus* mandibles, anterior view, showing setose groove on external mandibular face.

Figures 4.4-4.8. *Deretaphrus* biology. 4.4) Series of *D. viduatus*, exhibiting size and color variation among siblings; 4.5) *D. xanthorrhoeae* cocoons, dorsal; 4.6) *D. xanthorrhoeae* cocoons, ventral; 4.7) Waxy, independent cocoon of *D. xanthorrhoeae*; 4.8) Silken cocoon mass of *D. bucculentus*.

Figures 4.15-4.20. *Deretaphrus puncticollis* biology. 4.15) *Trichaulax philipsii* adult; 4.16) *Deretaphrus puncticollis* siblings with cocoon; 4.17) *T. philipsii* pupal case; 4.18-4.20) Parasitized *T. philipsii* larva. Note: *D. puncticollis* cocoons attached to host, adult *D. puncticollis* emerging from larva.

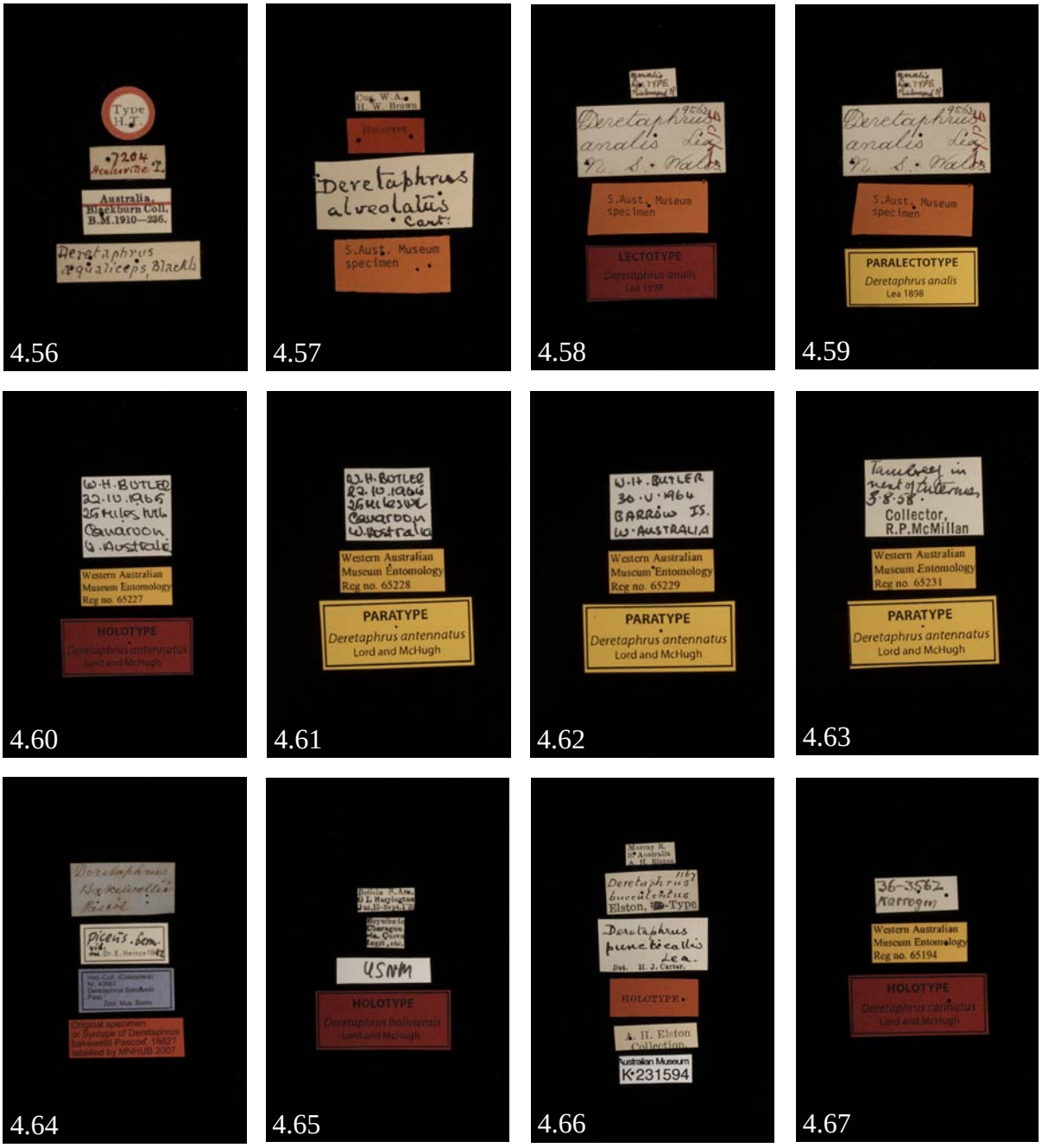
Figures 4.21-4.29. *Deretaphrus* pronota. 4.21) *D. aequaliceps* Blackburn; 4.22) *D. alveolatus* Carter; 4.23) *D. analis* Lea; 4.24) *D. antennatus* **n. sp.**; 4.25) *D. boliviensis* **n. sp.**; 4.26) *D. bucculentus* Elston; 4.27) *D. carinatus* **n. sp.**; 4.28) *D. erichsoni* Newman; 4.29) *D. fossus* Newman.

Figures 4.30-4.38. *Deretaphrus* pronota. 4.30) *D. gracilis* Blackburn; 4.31) *D. hoplites* **n. sp.**; 4.32) *D. ignarus* Pascoe; 4.33) *D. incultus* Carter; 4.34) *D. interruptus* Grouvelle; 4.35) *D. iridescens* Blackburn; 4.36) *D. lateropunctis* **n. sp.**; 4.37) *D. ocularis* **n. sp.**; 4.38) *D. oregonensis* Horn.

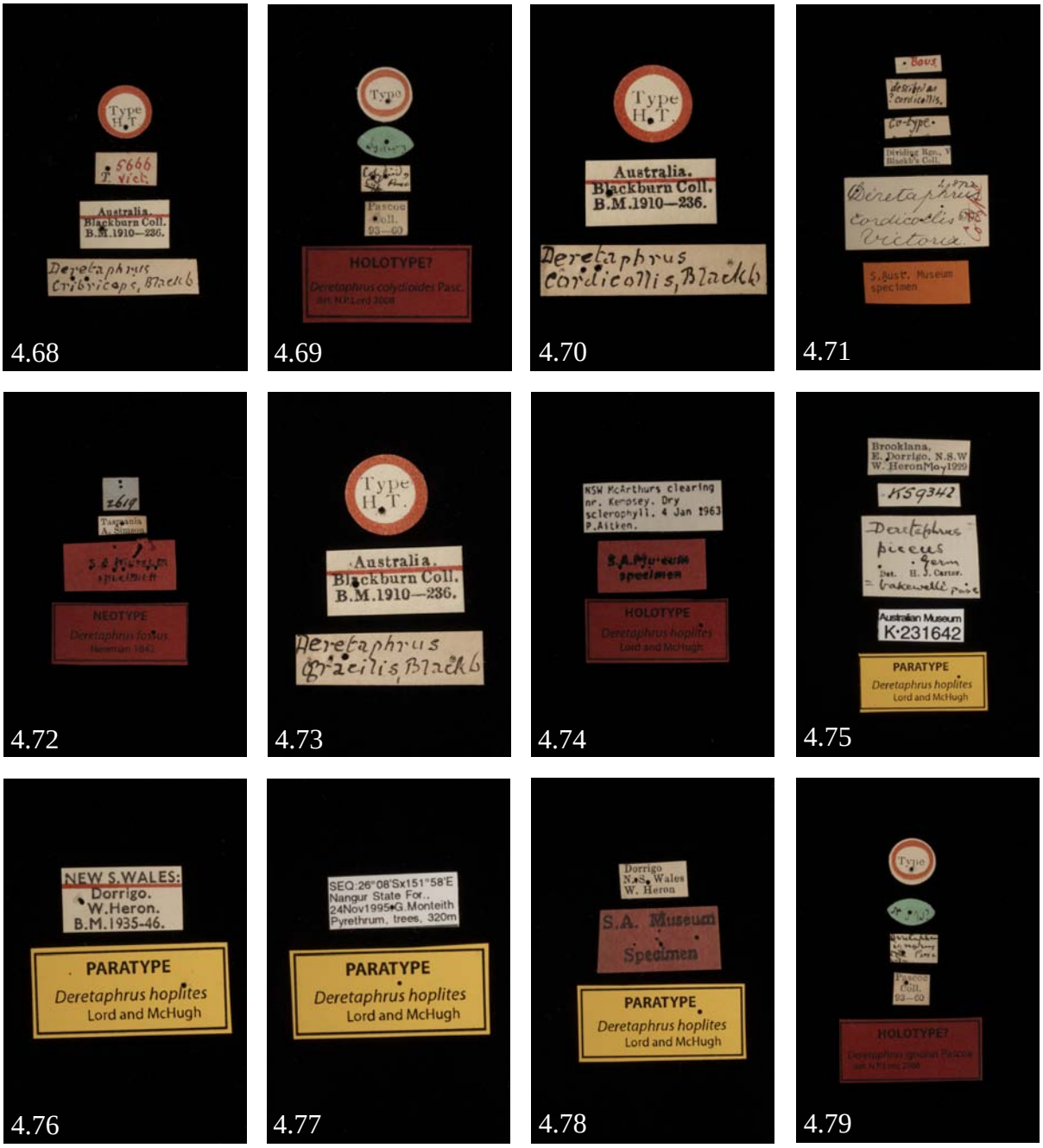
Figures 4.39-4.45. *Deretaphrus* pronota. 4.39) *D. parviceps* Lea; 4.40) *D. piceus* (Germar); 4.41) *D. puncticollis* Lea; 4.42) *D. rodmani* **n. sp.**; 4.43) *D. viduatus* Pascoe; 4.44) *D. wollastoni* Newman; 4.45) *D. xanthorrhoeae* Lea.

Figures 4.46-4.49. *Deretaphrus* abdominal apex, ventral. 4.46) *D. analis*; 4.47) *D. piceus*; 4.48) *D. hoplites*, male; 4.49) *D. hoplites*, female.

Figures 4.50-4.55. *Deretaphrus* abdominal apex, ventral. 4.50) *D. erichsoni*, male; 4.51-4.52) *D. erichsoni*, female; 4.53) *D. xanthorrhoeae*, female; 4.54-4.55) *D. xanthorrhoeae*, male.

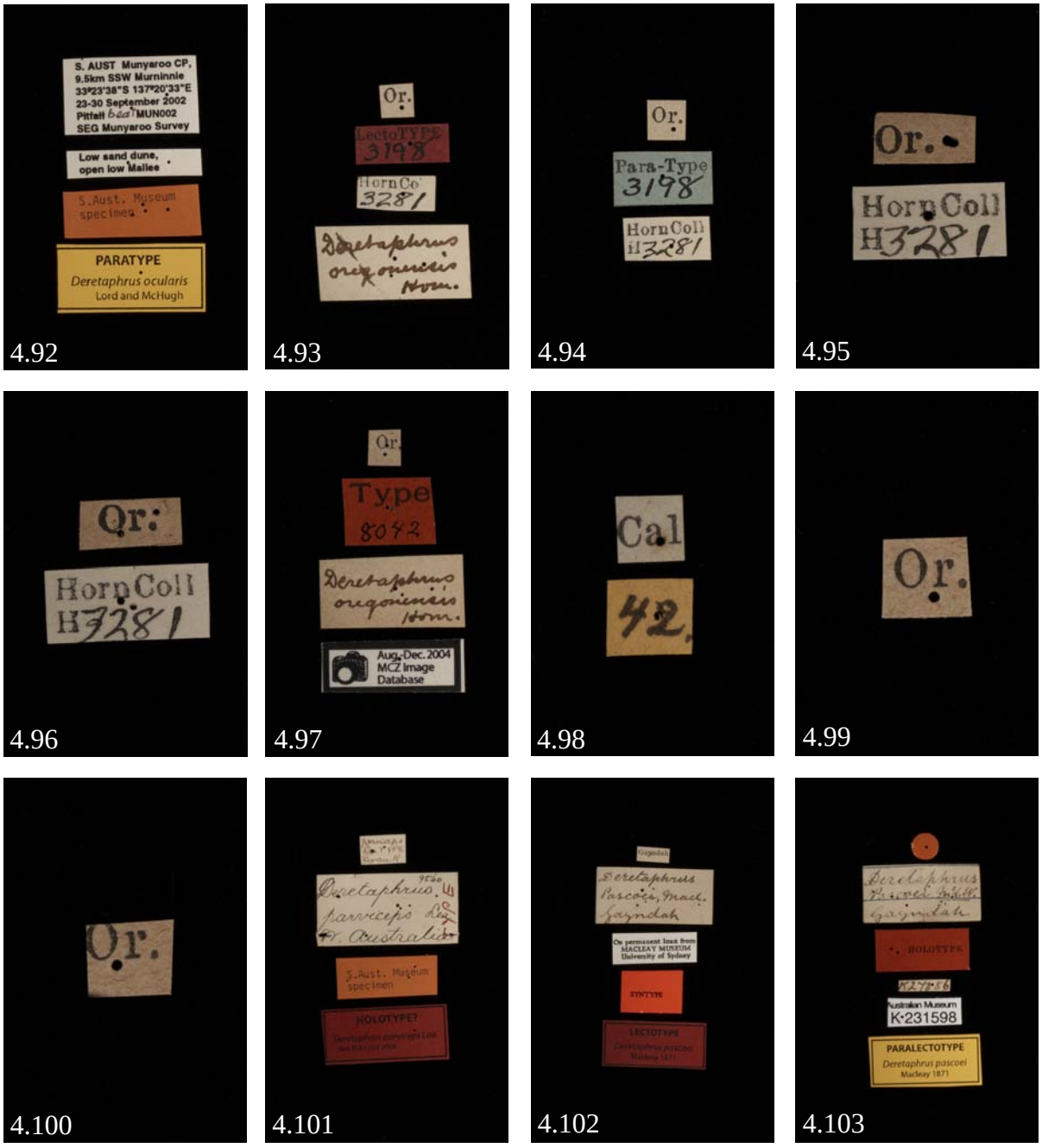


Figures 4.56-4.67. *Deretaphrus* type specimen labels.
4.56) *D. aequaliceps* Blackburn holotype; 4.57) *D. alveolatus* Carter holotype;
4.58) *D. analis* Lea lectotype; 4.59) *D. analis* Lea paralectotypes;
4.60) *D. antennatus* **n. sp.** holotype; 4.61-4.63) *D. antennatus* **n. sp.** paratypes;
4.64) *D. bakewellii* Pascoe syntype; 4.65) *D. boliviensis* **n. sp.** holotype;
4.66) *D. bucculentus* Elston holotype; 4.67) *D. carinatus* **n. sp.** holotype.

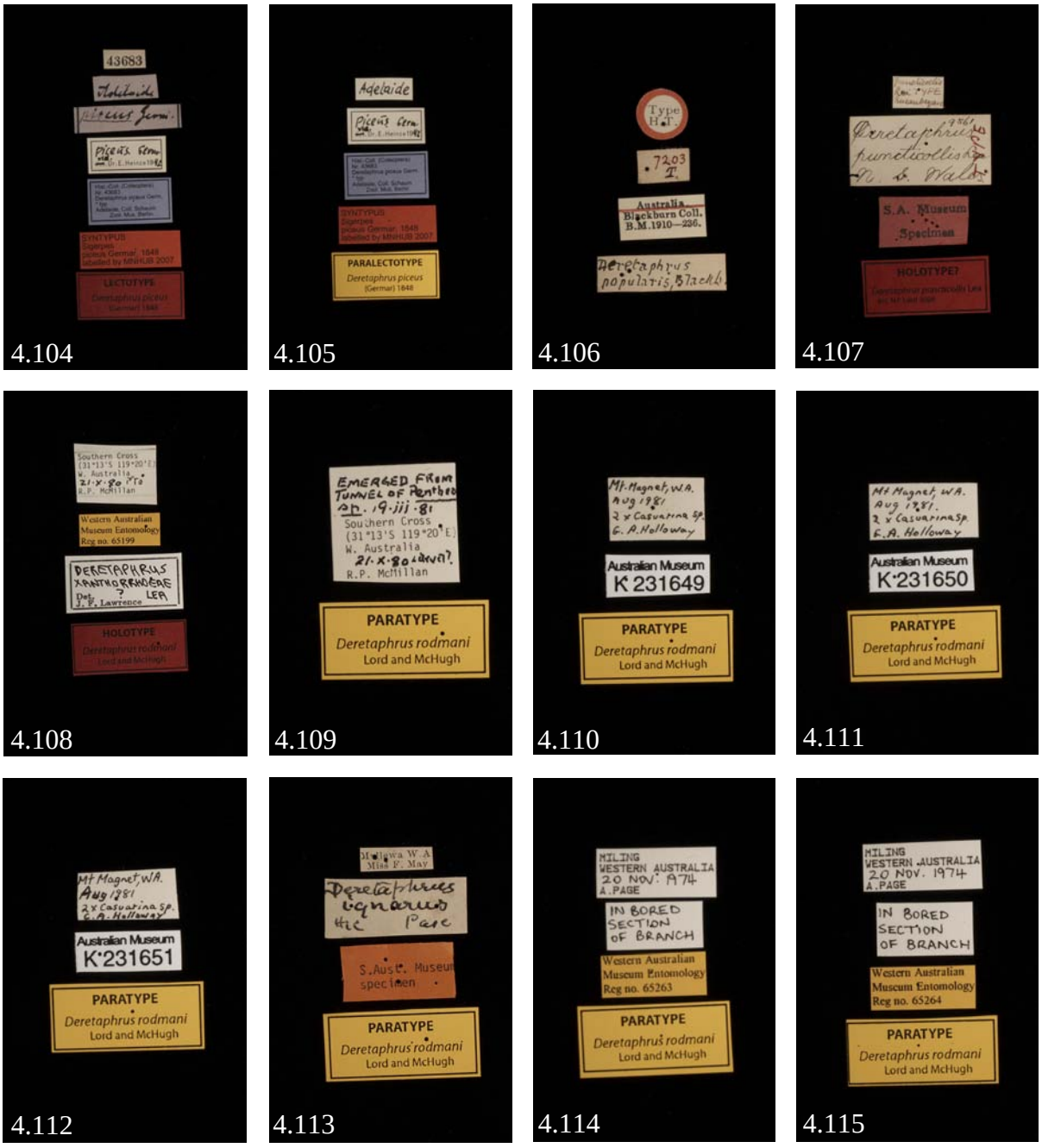


Figures 4.68-4.79. *Deretaphrus* type specimen labels.
4.68) *D. cribriceps* Blackburn holotype; 4.69) *D. colydioides* Pascoe holotype;
4.70) *D. cordicollis* Blackburn holotype; 4.71) *D. cordicollis* Blackburn cotype;
4.72) *D. fossus* Newman neotype; 4.73) *D. gracilis* Blackburn holotype;
4.74) *D. hoplites* **n. sp.** holotype; 4.75-4.78) *D. hoplites* **n. sp.** paratypes;
4.79) *D. ignarus* Pascoe holotype.

Figures 4.80-4.91. *Deretaphrus* type specimen labels.
4.80) *D. incultus* Carter holotype; 4.81) *D. incultus* Carter paratype;
4.82) *D. incultus* Carter paratype; 4.83) *D. interruptus* Grouvelle lectotype;
4.84) *D. interruptus* Grouvelle paralectotype; 4.85) *D. iridescens* Blackburn holotype;
4.86) *D. lateropunctis* **n. sp.** holotype; 4.87-4.88) *D. lateropunctis* **n. sp.** paratypes;
4.89) *D. ocularis* **n. sp.** holotype; 4.90-4.91) *D. ocularis* **n. sp.** paratypes.



Figures 4.92-4.103. *Deretaphrus* type specimen labels.
4.92) *D. ocularis* **n. sp.** paratype; 4.93) *D. oregonensis* Horn lectotype;
4.94) *D. oregonensis* Horn paratype; 4.95-4.100) *D. oregonensis* Horn types;
4.101) *D. parviceps* Lea holotype; 4.102) *D. pascoei* Macleay lectotype;
4.103) *D. pascoei* Macleay paralectotypes.



Figures 4.104-4.115. *Deretaphrus* type specimen labels.
4.104) *D. piceus* (Germar) lectotype; 4.105) *D. piceus* (Germar) paralectotype;
4.106) *D. popularis* Blackburn holotype; 4.107) *D. puncticollis* Lea holotype;
4.108) *D. rodmani* **n. sp.** holotype; 4.109-4.115) *D. rodmani* **n. sp.** paratypes.

Figures 4.116-4.123. *Deretaphrus* type specimen labels.
4.116) *D. sparsiceps* Blackburn holotype; 4.117-4.118) *D. sparsiceps* Blackburn cotype;
4.119) *D. thoracicus* Blackburn holotype; 4.120) *D. viduatus* Pascoe holotype;
4.121) *D. wollastoni* Newman neotype; 4.122) *D. xanthorrhoeae* Lea lectotype;
4.123) *D. xanthorrhoeae* Lea paralectotype.

Figure 4.124. *Deretaphrus aequaliceps* Blackburn distribution map.

Figure 4.125. *Deretaphrus alveolatus* Carter distribution map.

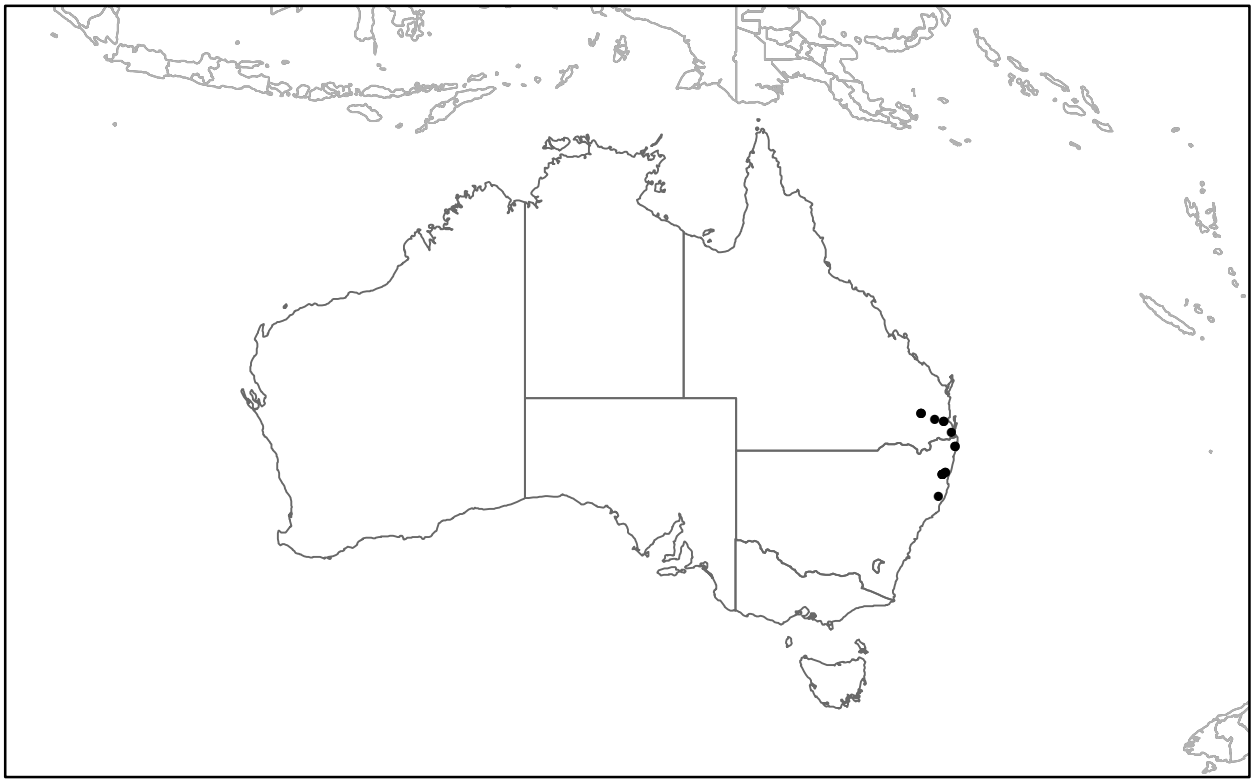


Figure 4.126. *Deretaphrus analis* Lea distribution map.

Figure 4.127. *Deretaphrus antennatus* **n. sp.** distribution map.

Figure 4.128. *Deretaphrus boliviensis* **n. sp.** distribution map.

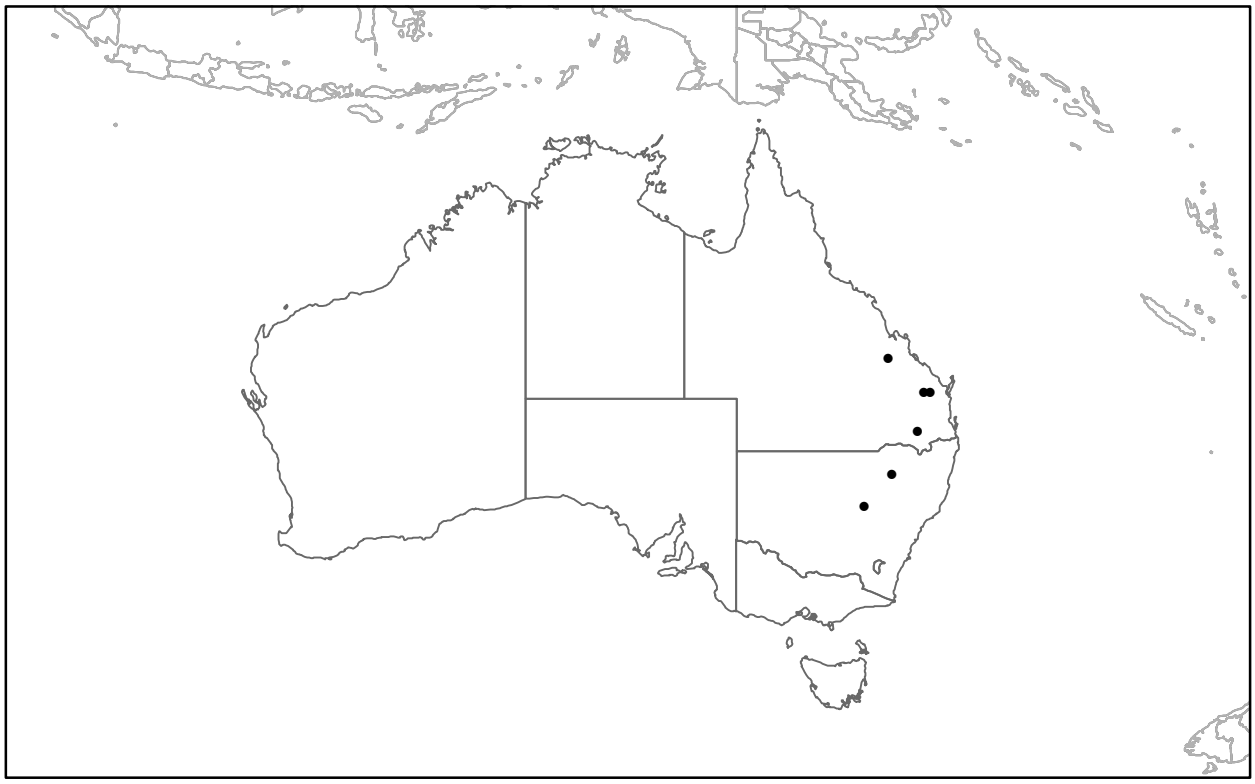


Figure 4.129. *Deretaphrus bucculentus* Elston distribution map.

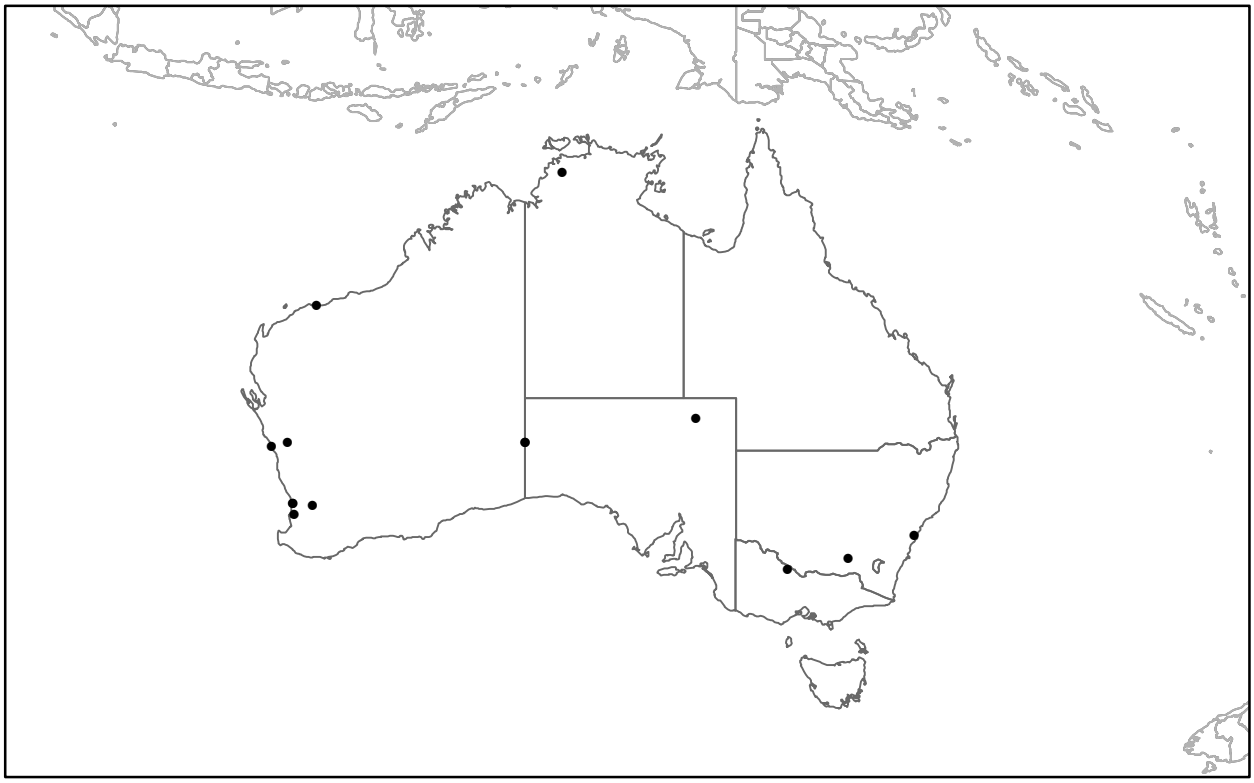


Figure 4.130. *Deretaphrus carinatus* **n. sp.** distribution map.

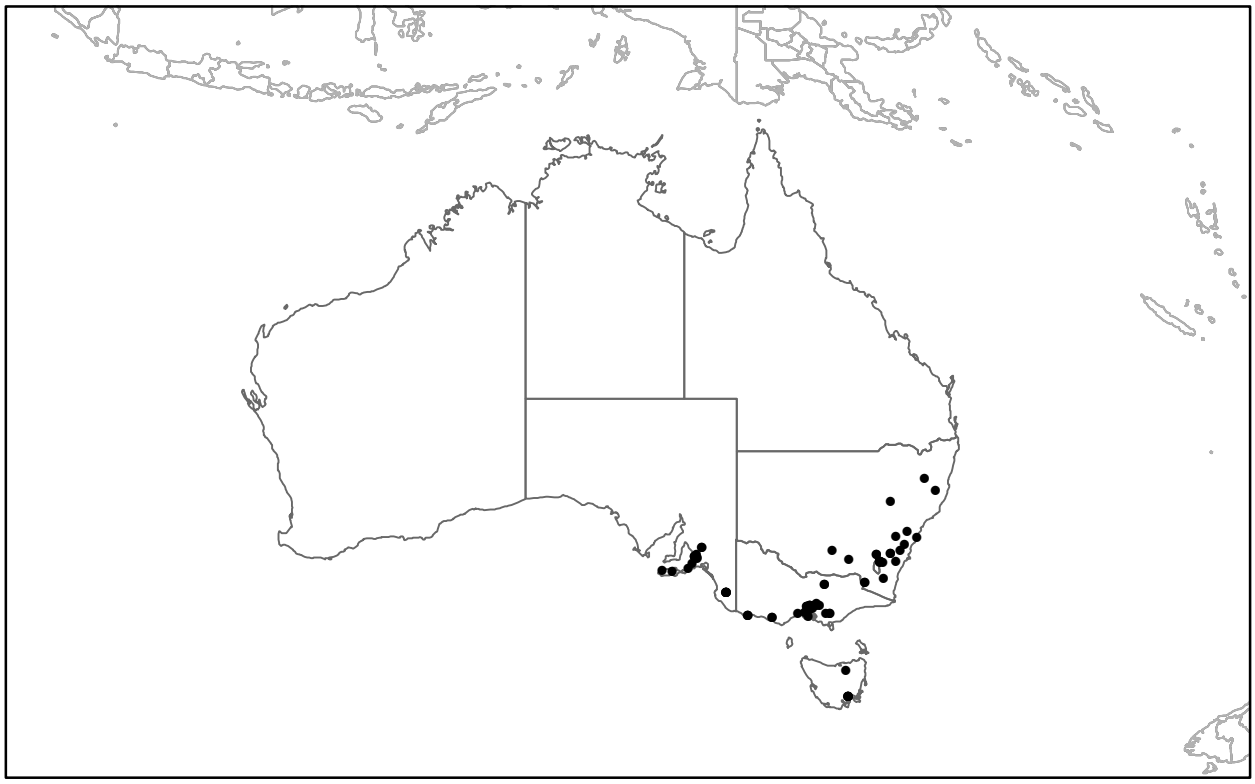


Figure 4.131. *Deretaphrus erichsoni* Newman distribution map.

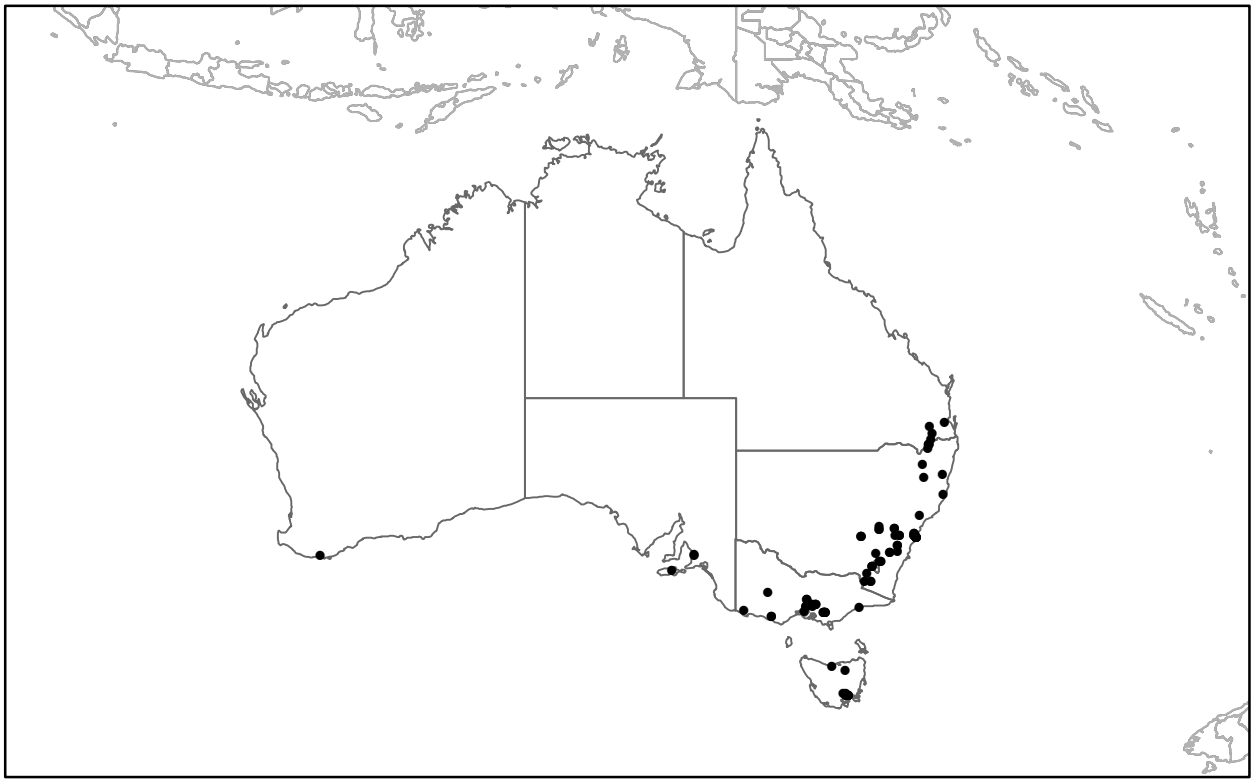


Figure 4.132. *Deretaphrus fossus* Newman distribution map.

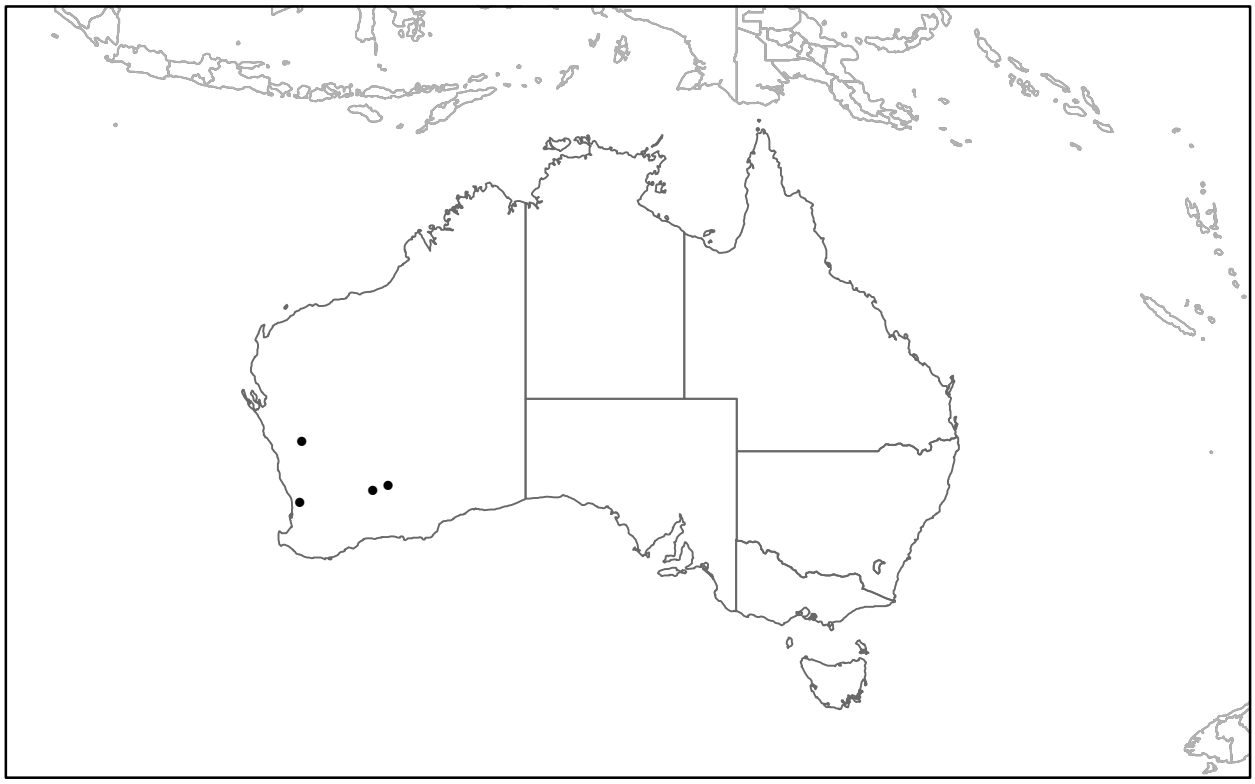


Figure 4.133. *Deretaphrus gracilis* Blackburn distribution map.

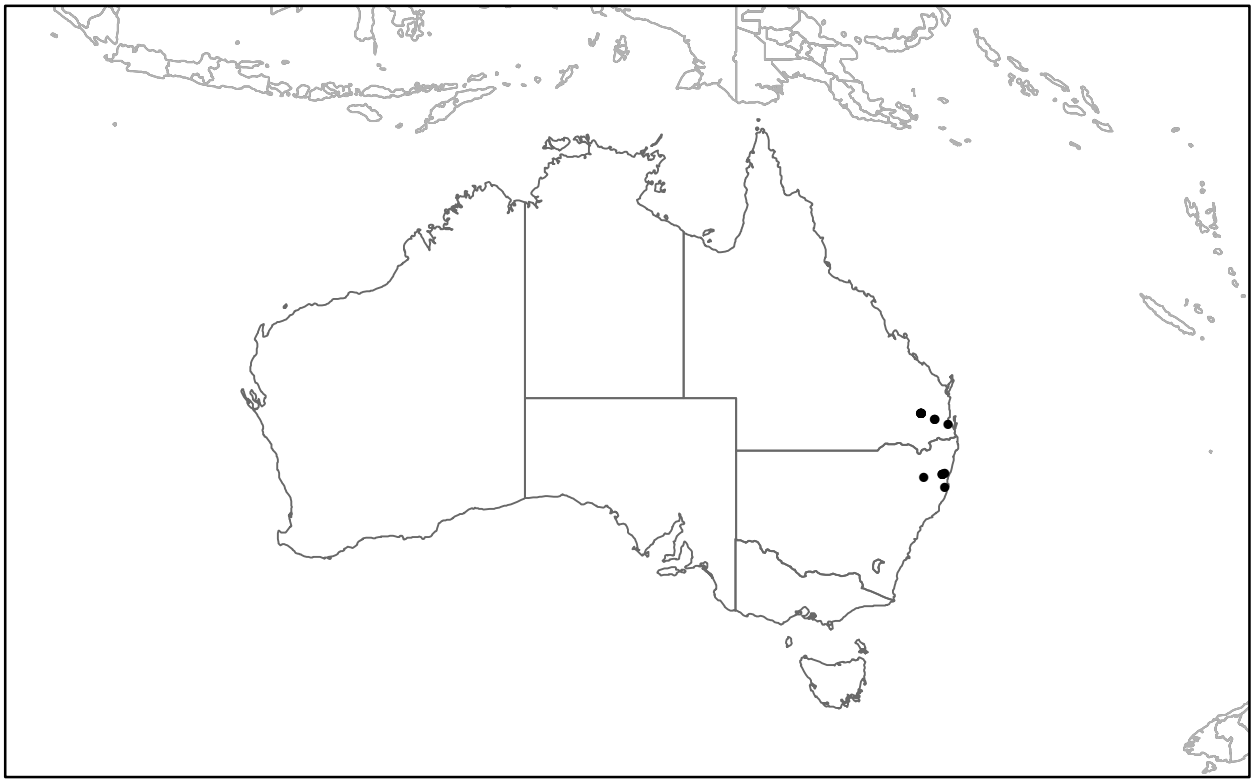


Figure 4.134. *Deretaphrus hoplites* **n. sp.** distribution map.

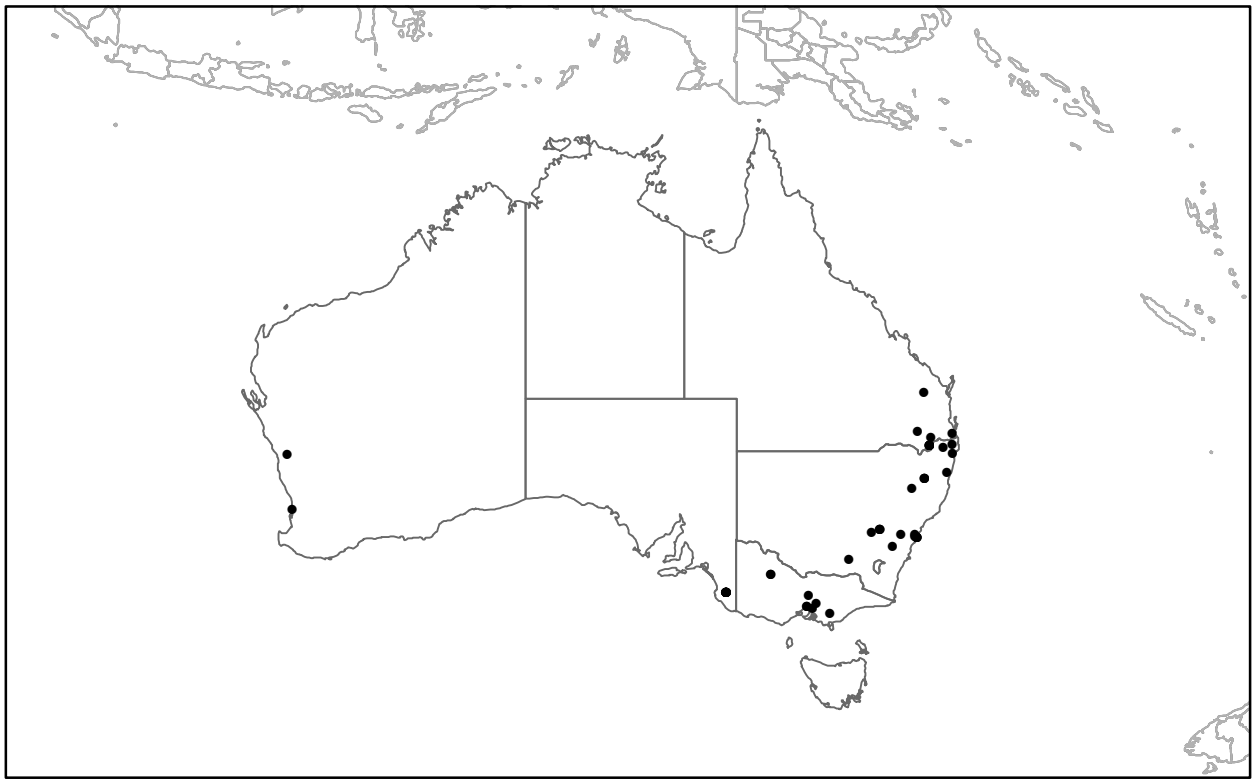


Figure 4.135. *Deretaphrus ignarus* Pascoe distribution map.

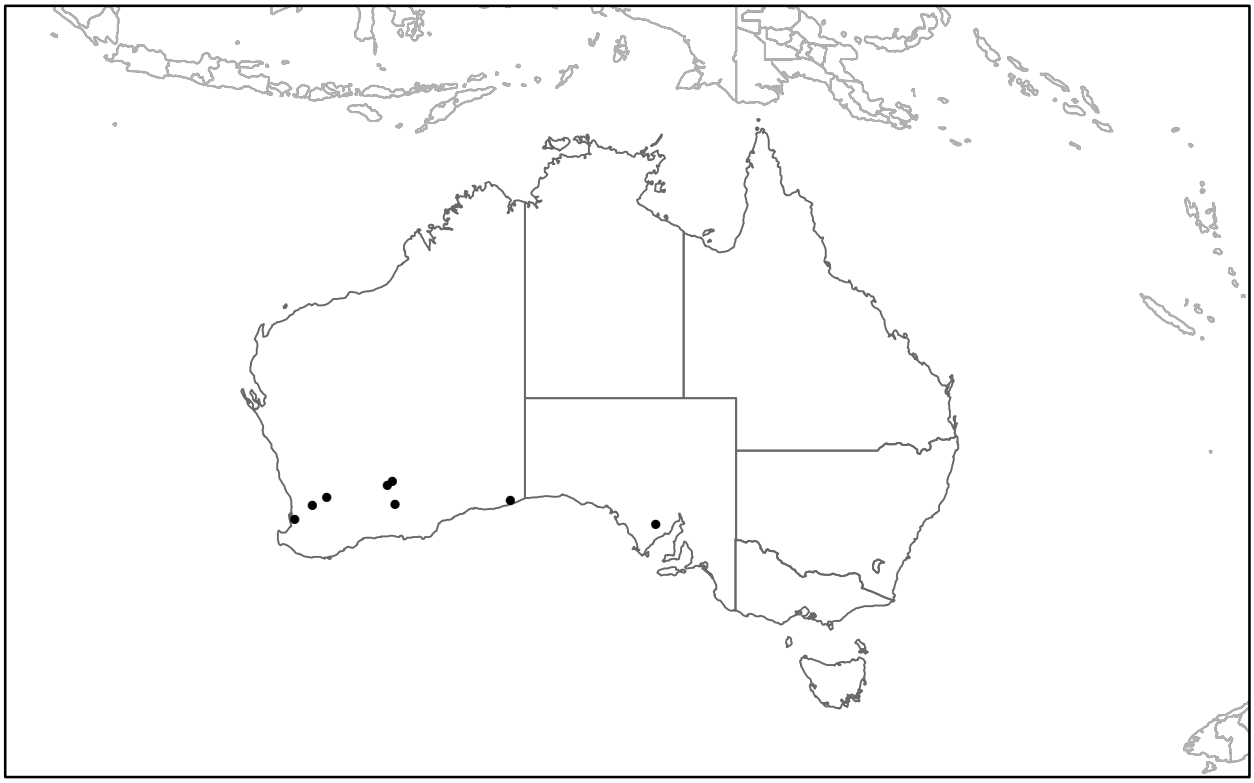


Figure 4.136. *Deretaphrus incultus* Carter distribution map.

Figure 4.137. *Deretaphrus interruptus* Grouvelle distribution map.

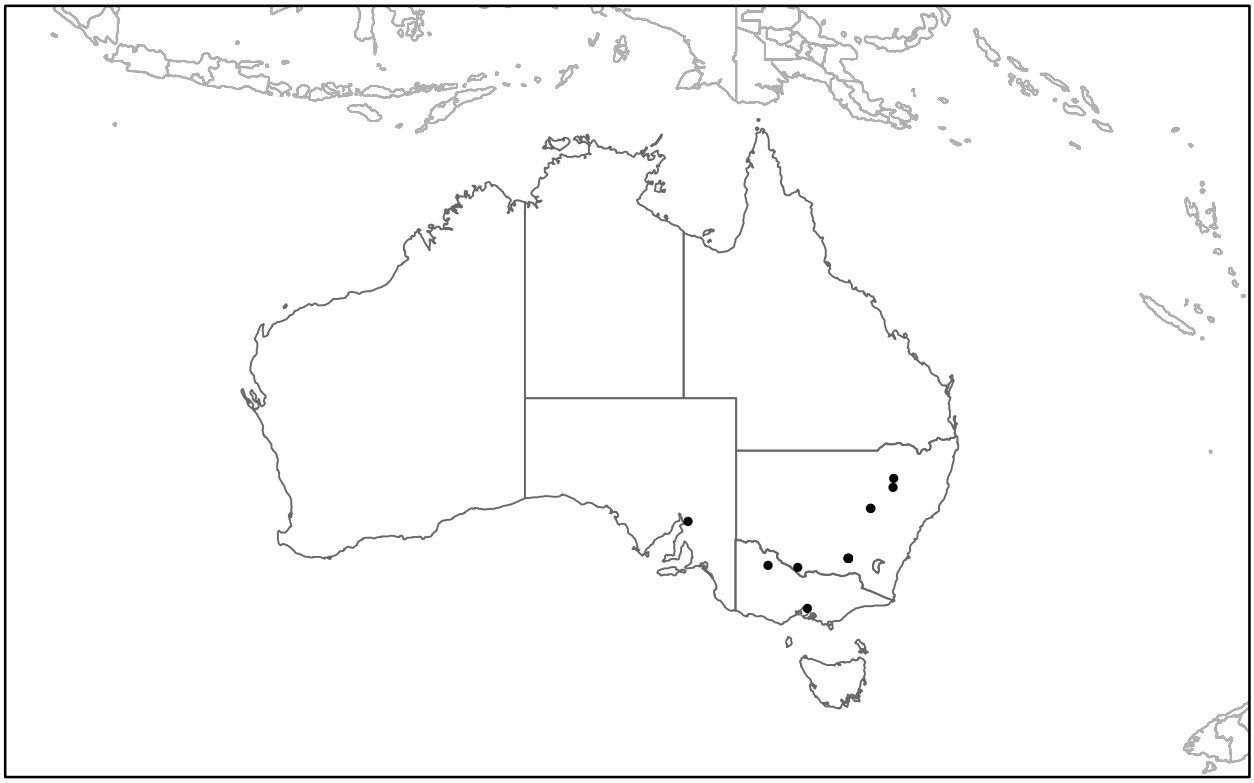


Figure 4.138. *Deretaphrus iridescens* Blackburn distribution map.

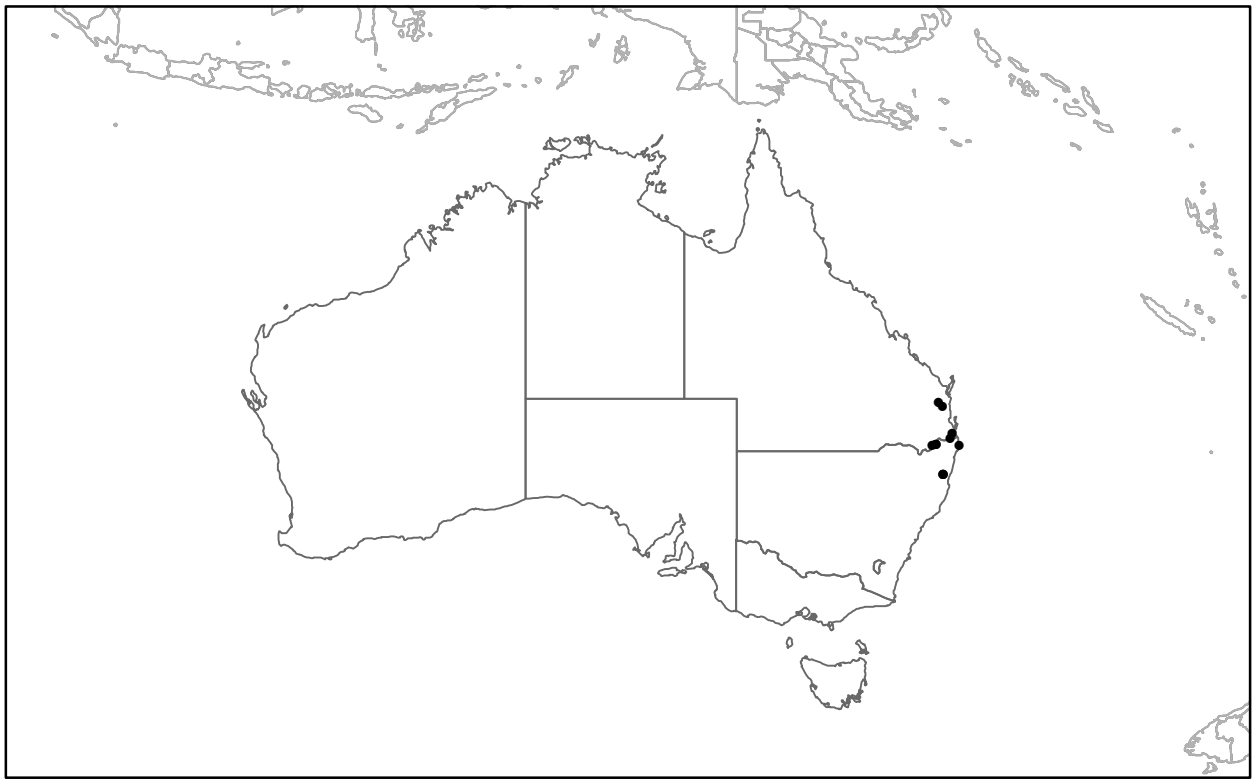


Figure 4.139. *Deretaphrus lateropunctis* **n. sp.** distribution map.

Figure 4.140. *Deretaphrus ocularis* **n. sp.** distribution map.

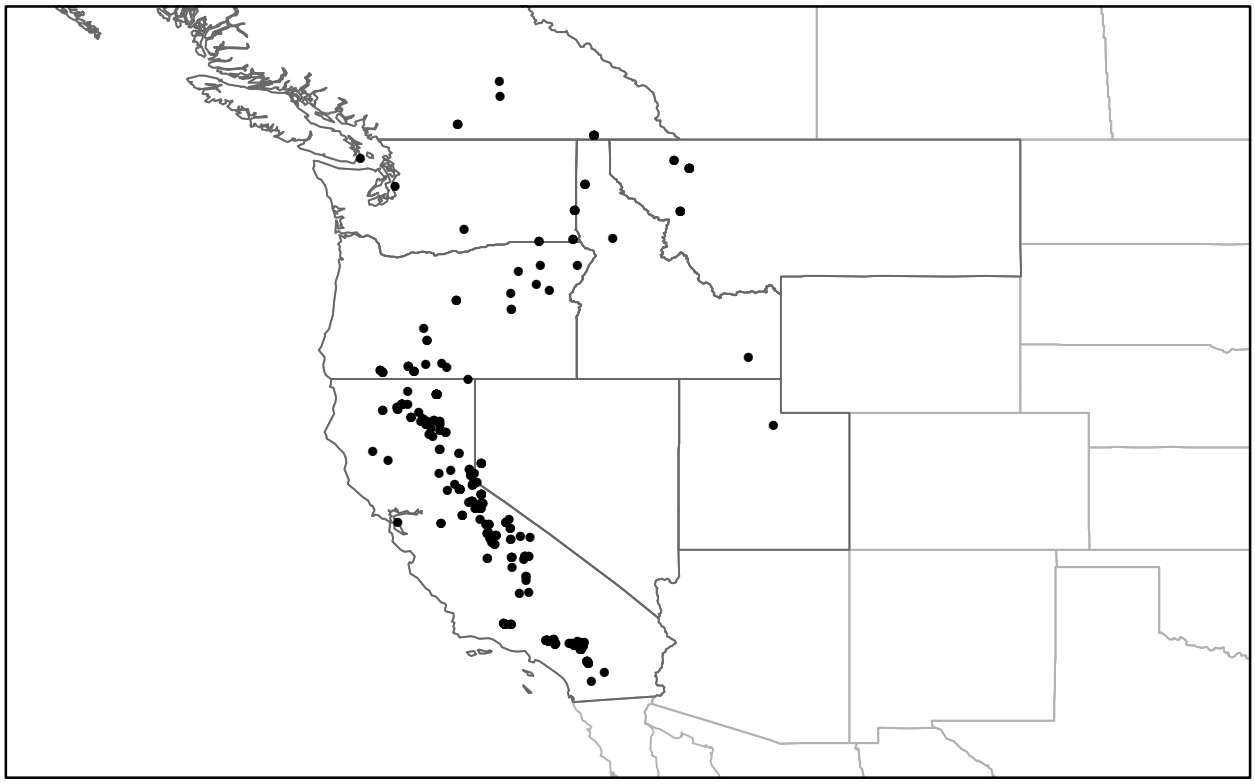


Figure 4.141. *Deretaphrus oregonensis* Horn distribution map.

Figure 4.142. *Deretaphrus parviceps* Lea distribution map.

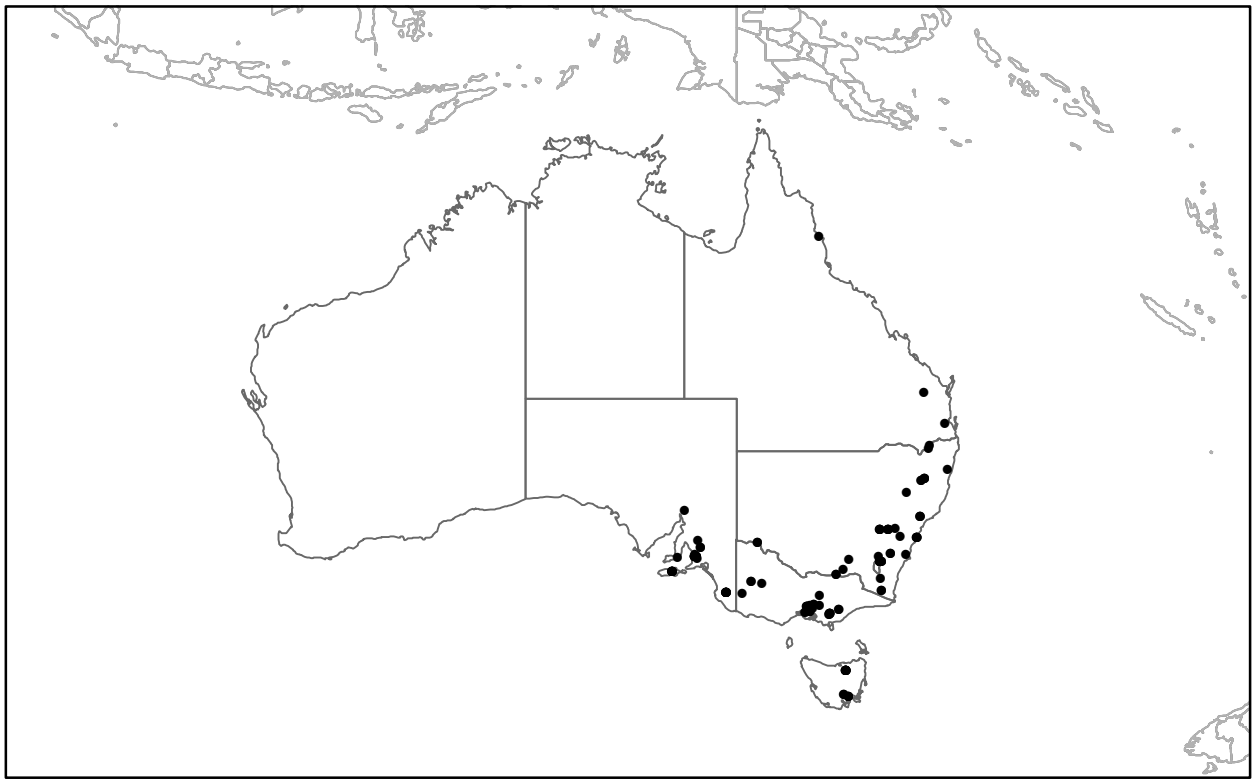


Figure 4.143. *Deretaphrus piceus* (Germar) distribution map.

Figure 4.144. *Deretaphrus puncticollis* Lea distribution map.

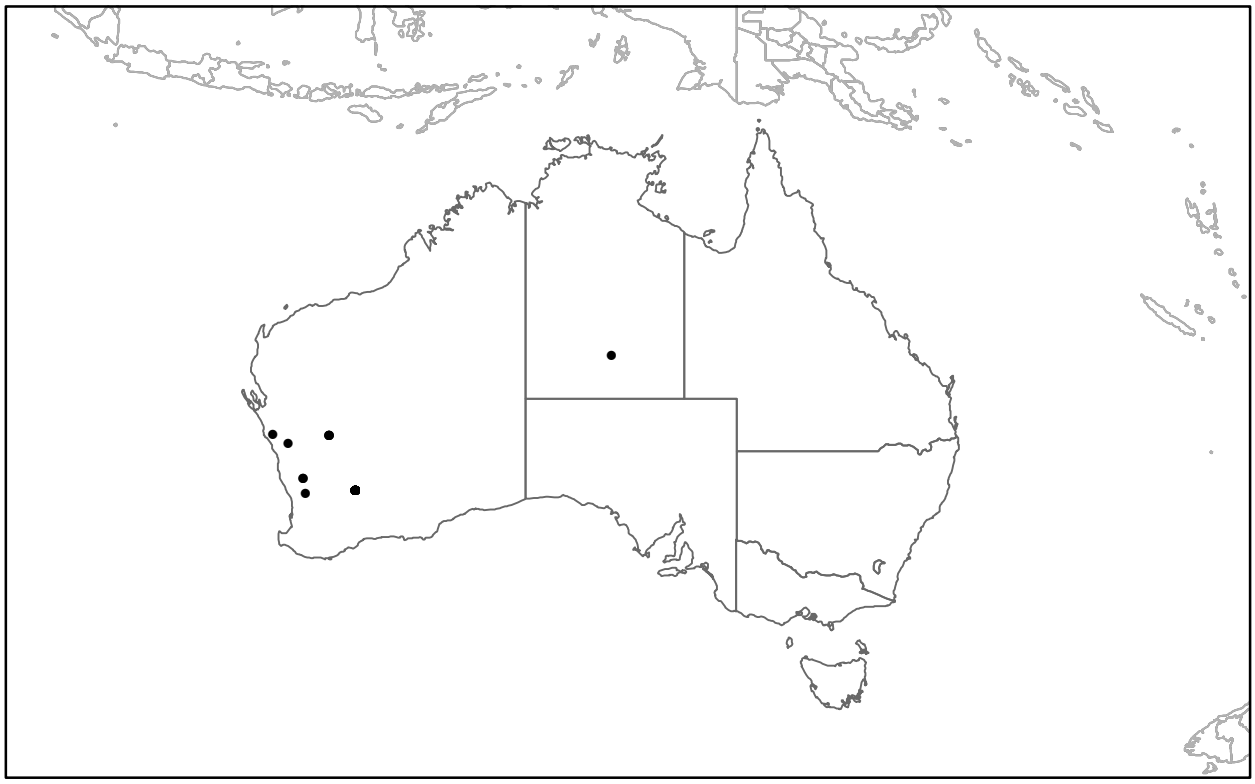


Figure 4.145. *Deretaphrus rodmani* **n. sp.** distribution map.

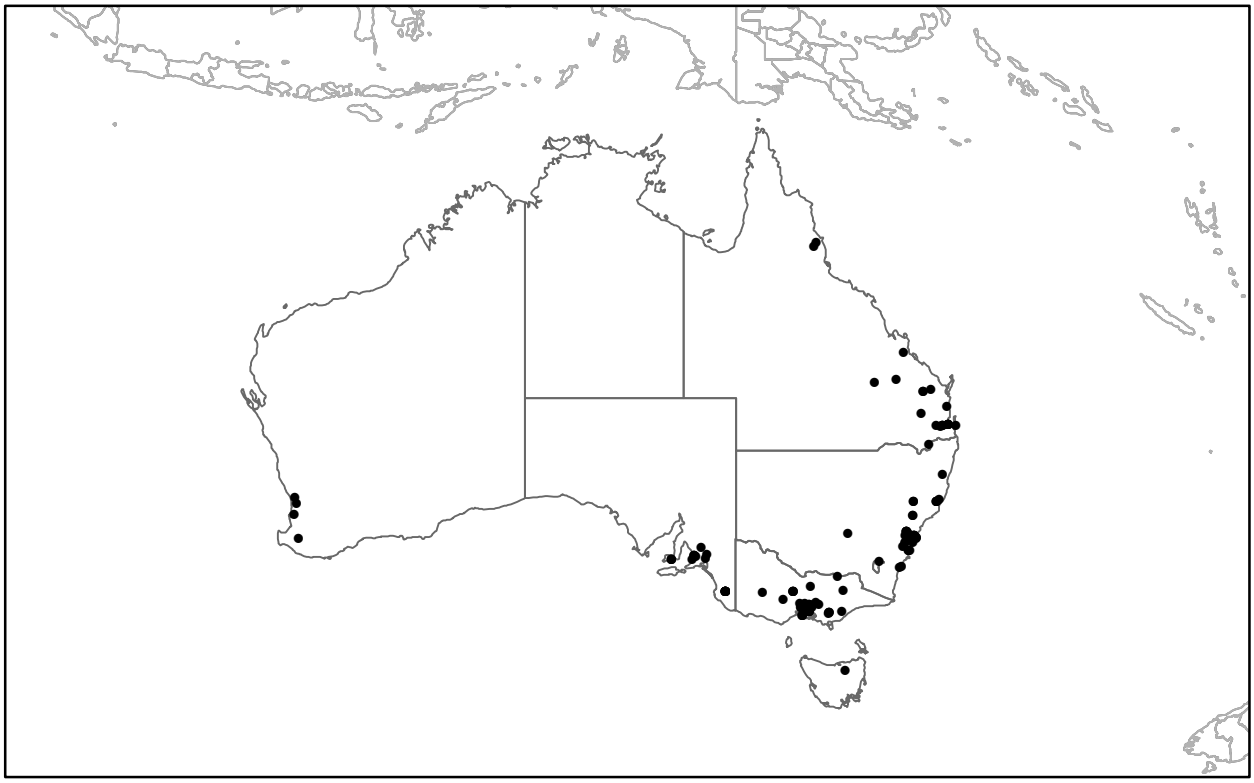


Figure 4.146. *Deretaphrus viduatus* Pascoe distribution map.

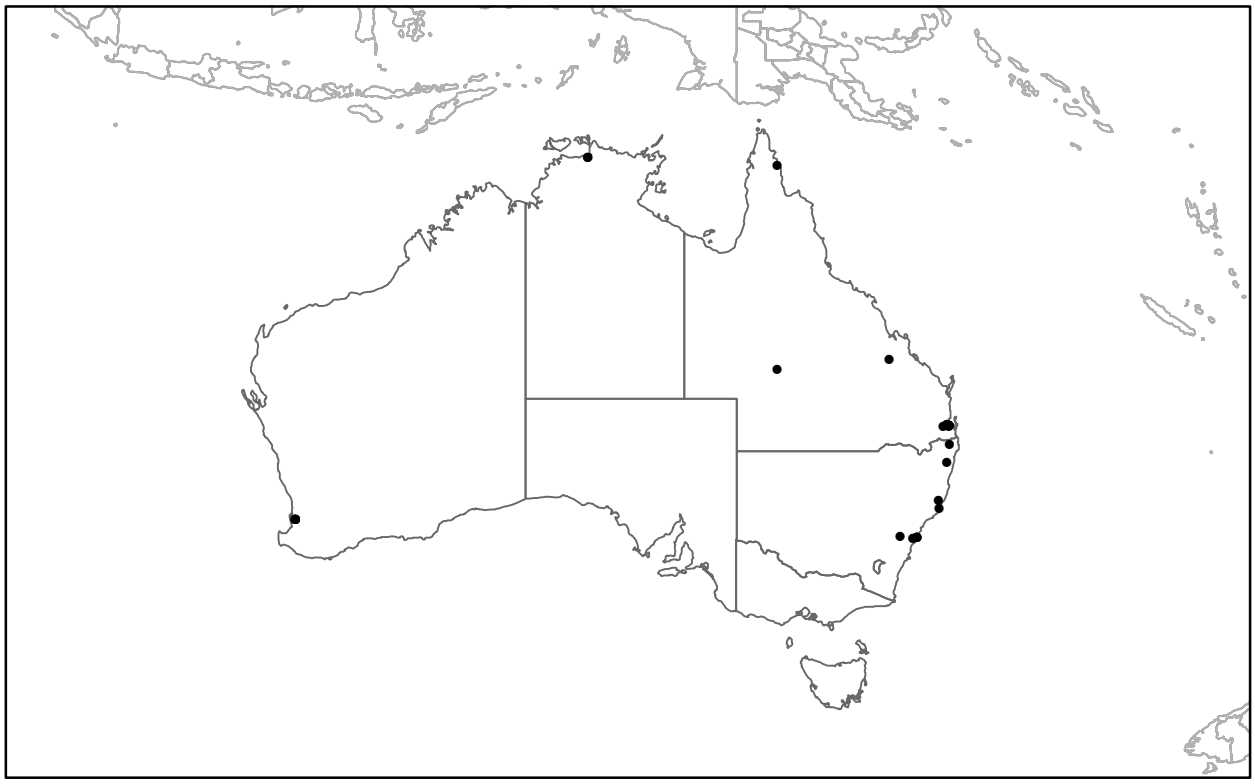


Figure 4.147. *Deretaphrus wollastoni* Newman distribution map.

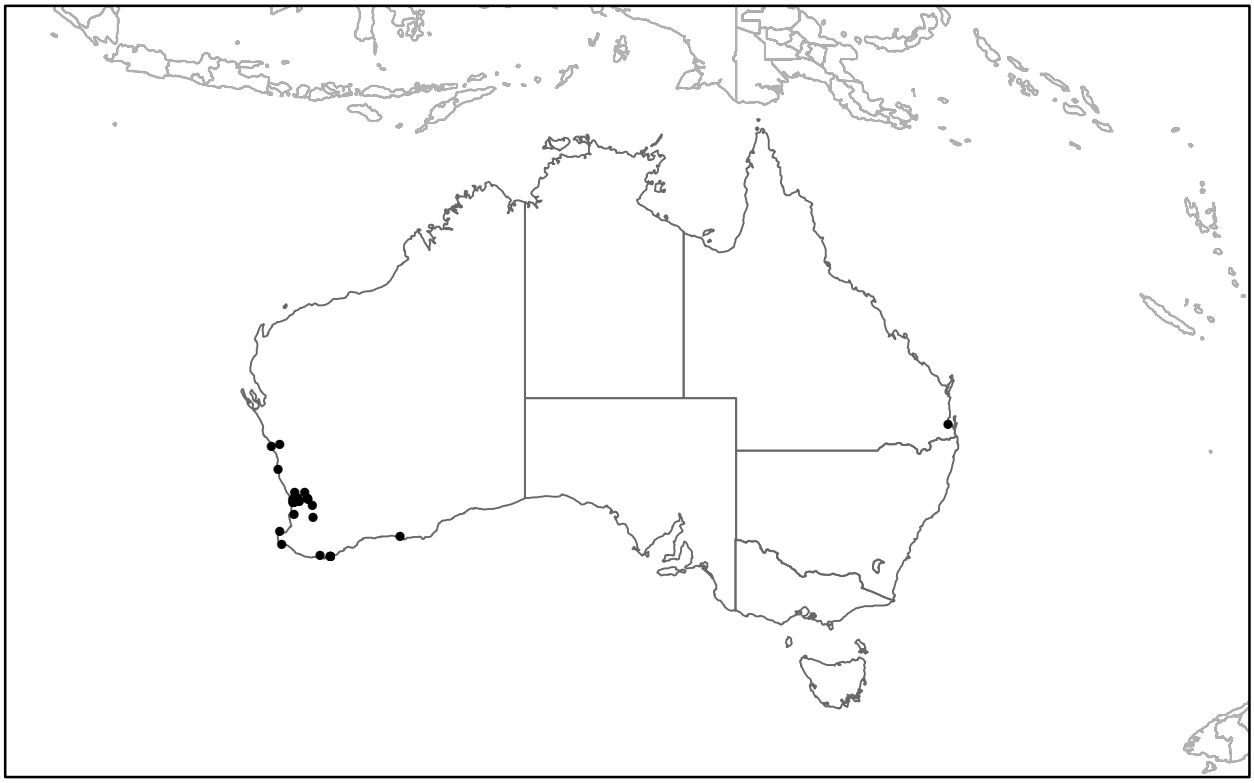
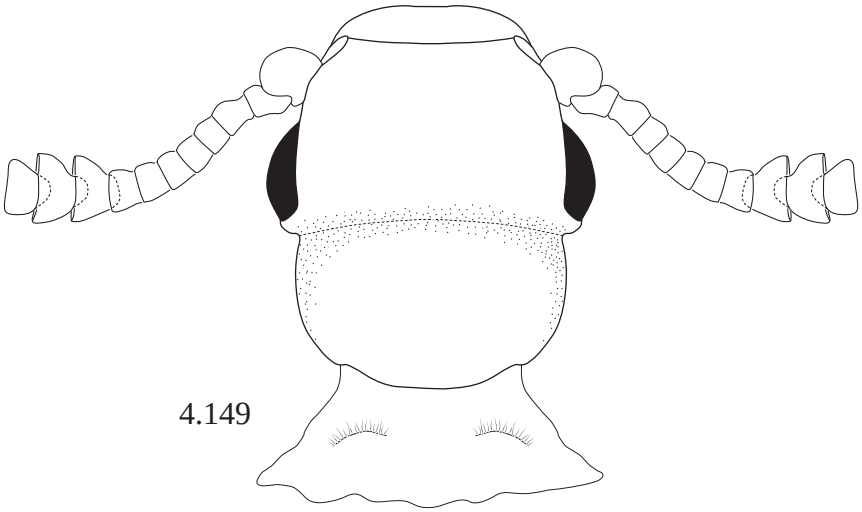


Figure 4.148. *Deretaphrus xanthorrhoeae* Lea distribution map.



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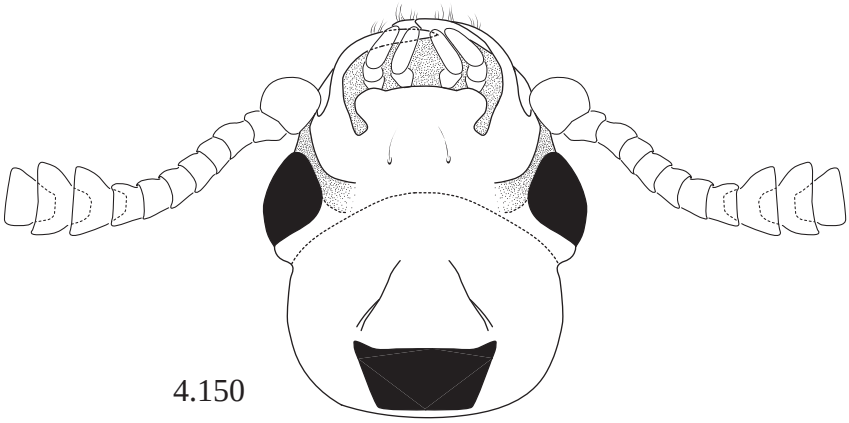

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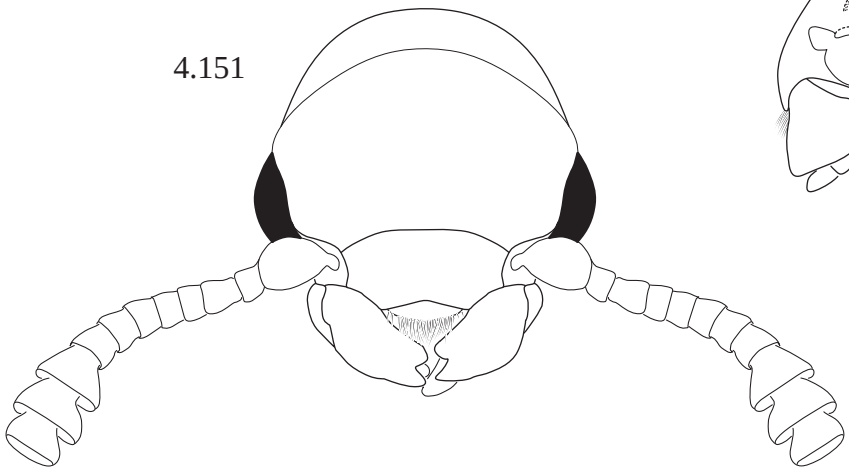

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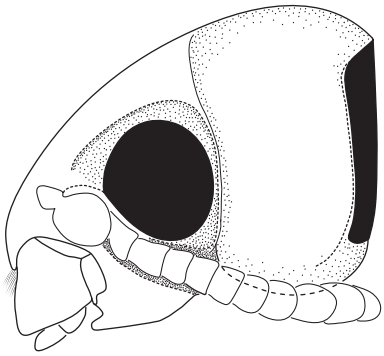
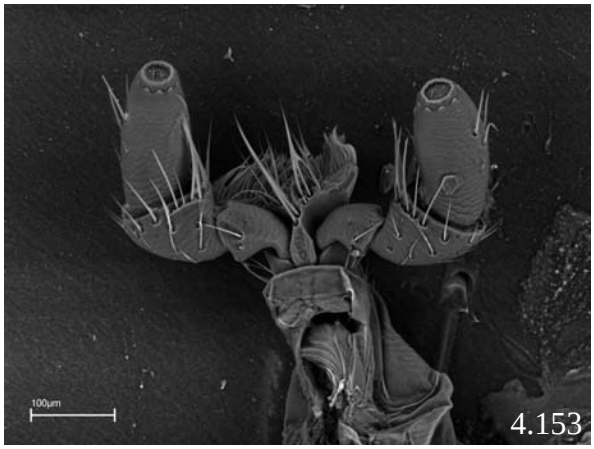
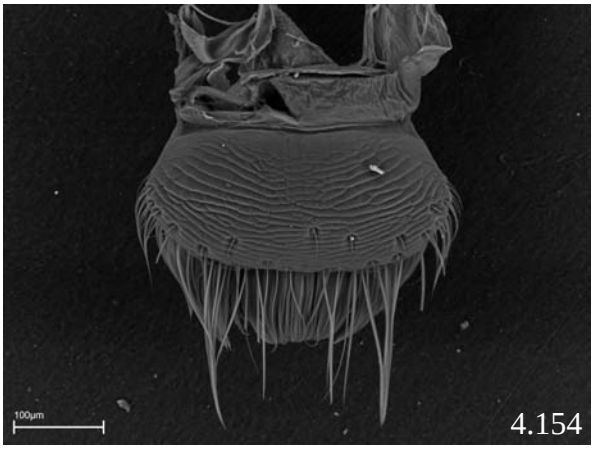
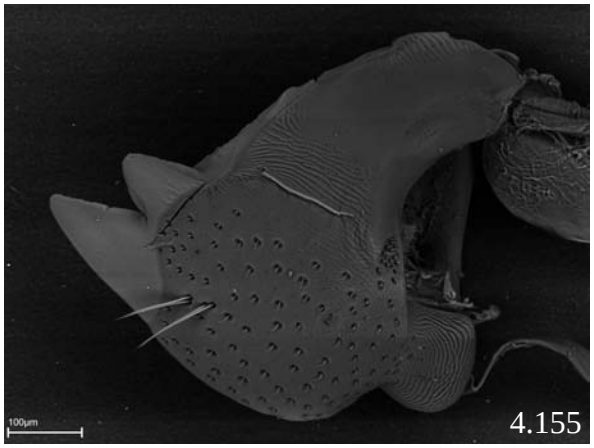


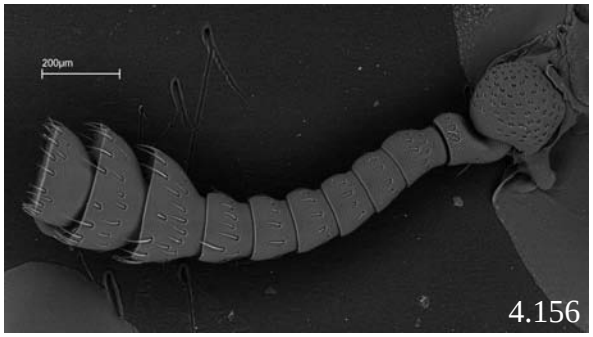
4.152

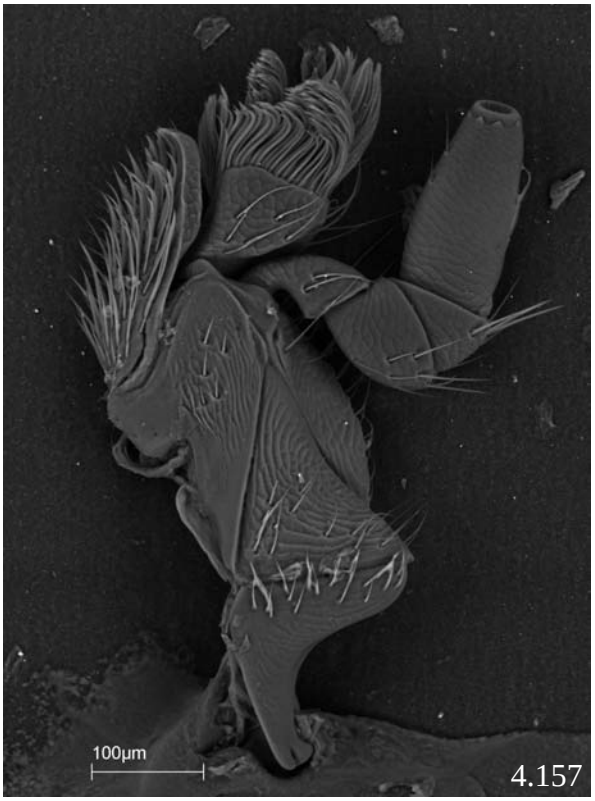
Figures 4.149-4.152. *Deretaphrus fossus* head. 4.149) dorsal; 4.150) ventral; 4.151) anterior; 4.152) lateral.





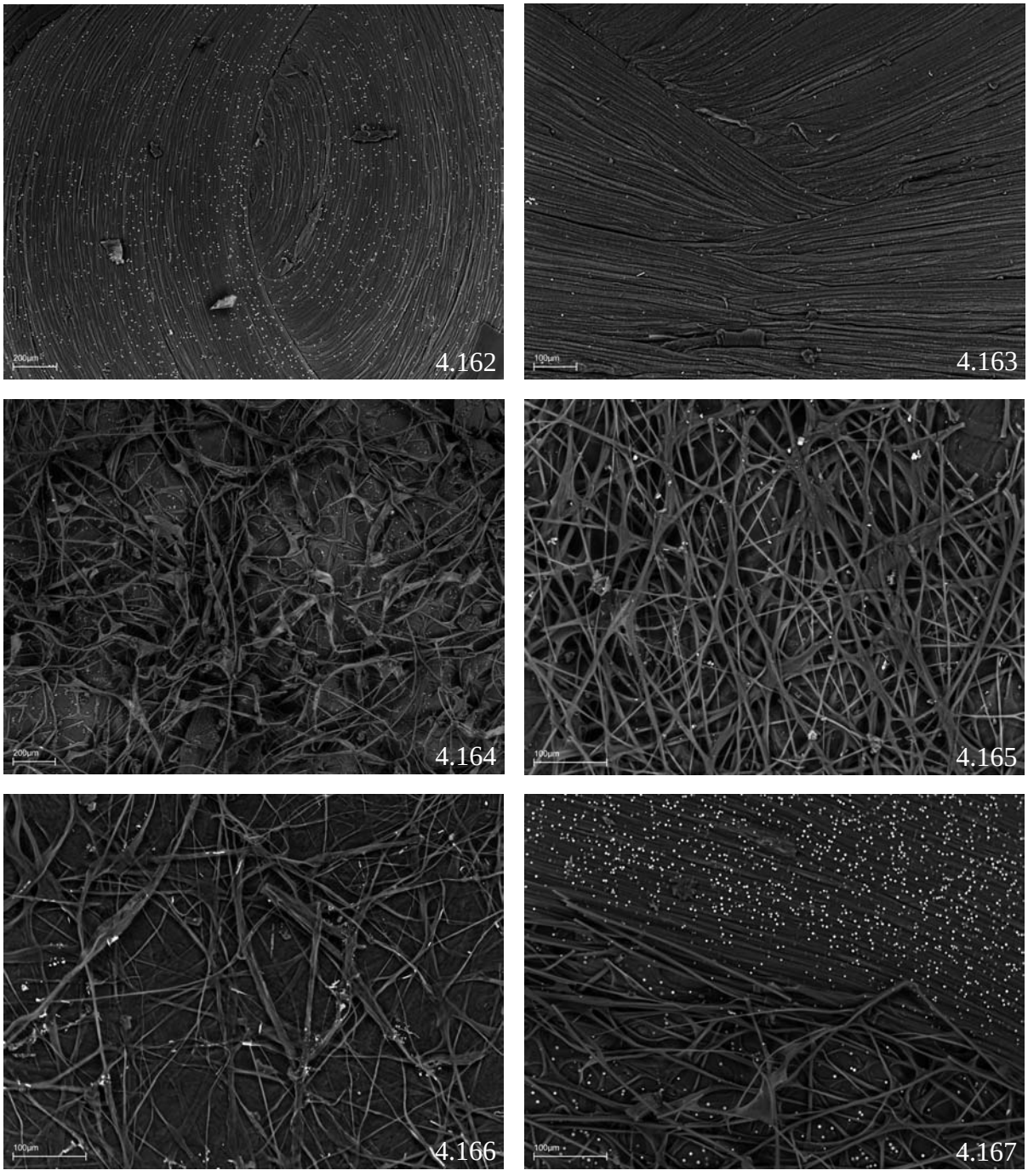






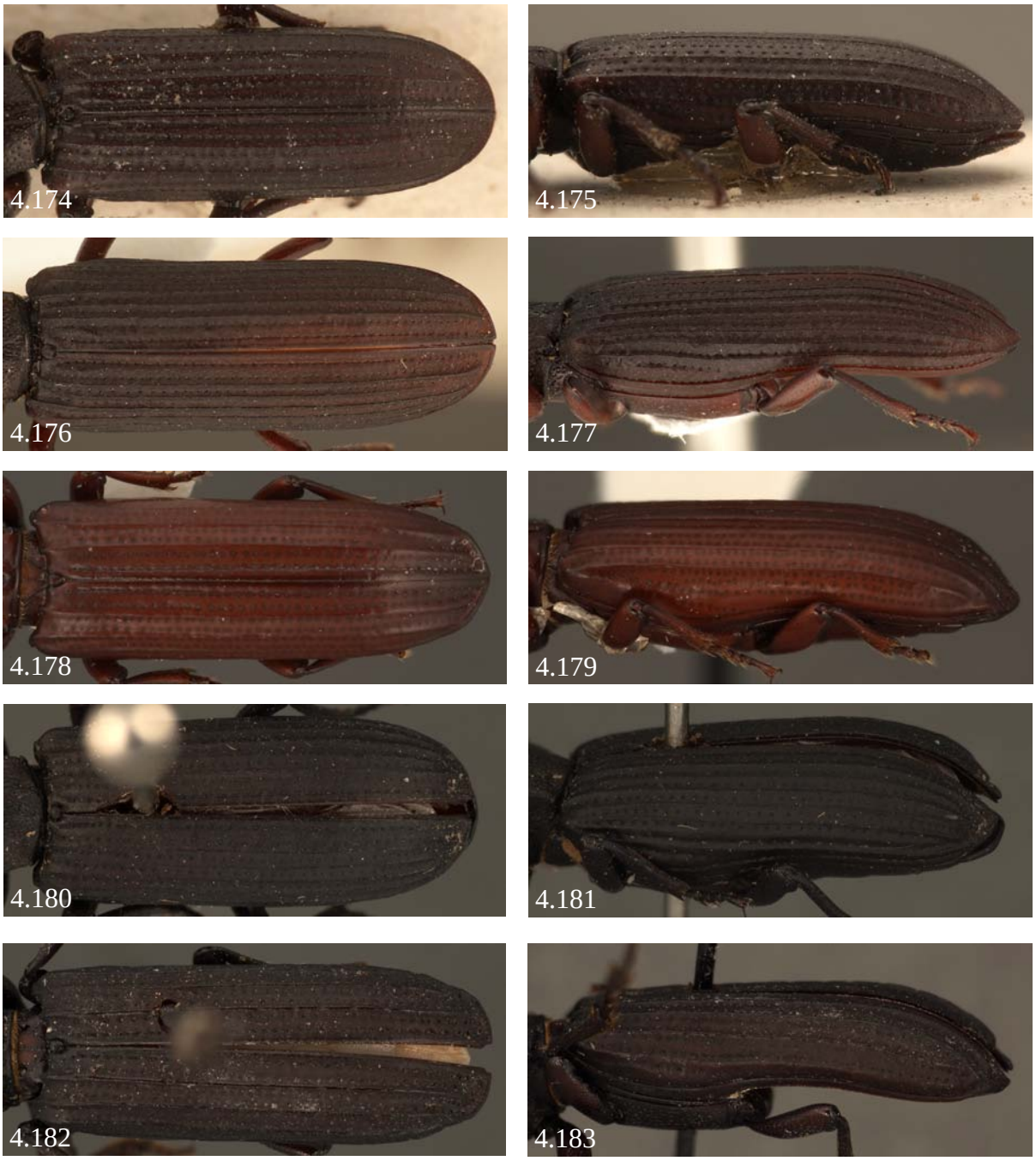
Figures 4.153-4.157. *Deretaphrus fossus* Newman head appendages. 4.153) labium, ventral; 4.154) labrum, dorsal; 4.155) left mandible, dorsal; 4.156) antenna; 4.157) left maxilla, ventral.

Figures 4.158-4.161. *Deretaphrus fossus* genitalia.
4.158) phallobase, dorsal; 4.159) male genitalia, partially extruded, dorsal; 4.160) male genitalia, partially extruded, ventral; 4.161) ovipositor, dorsal.

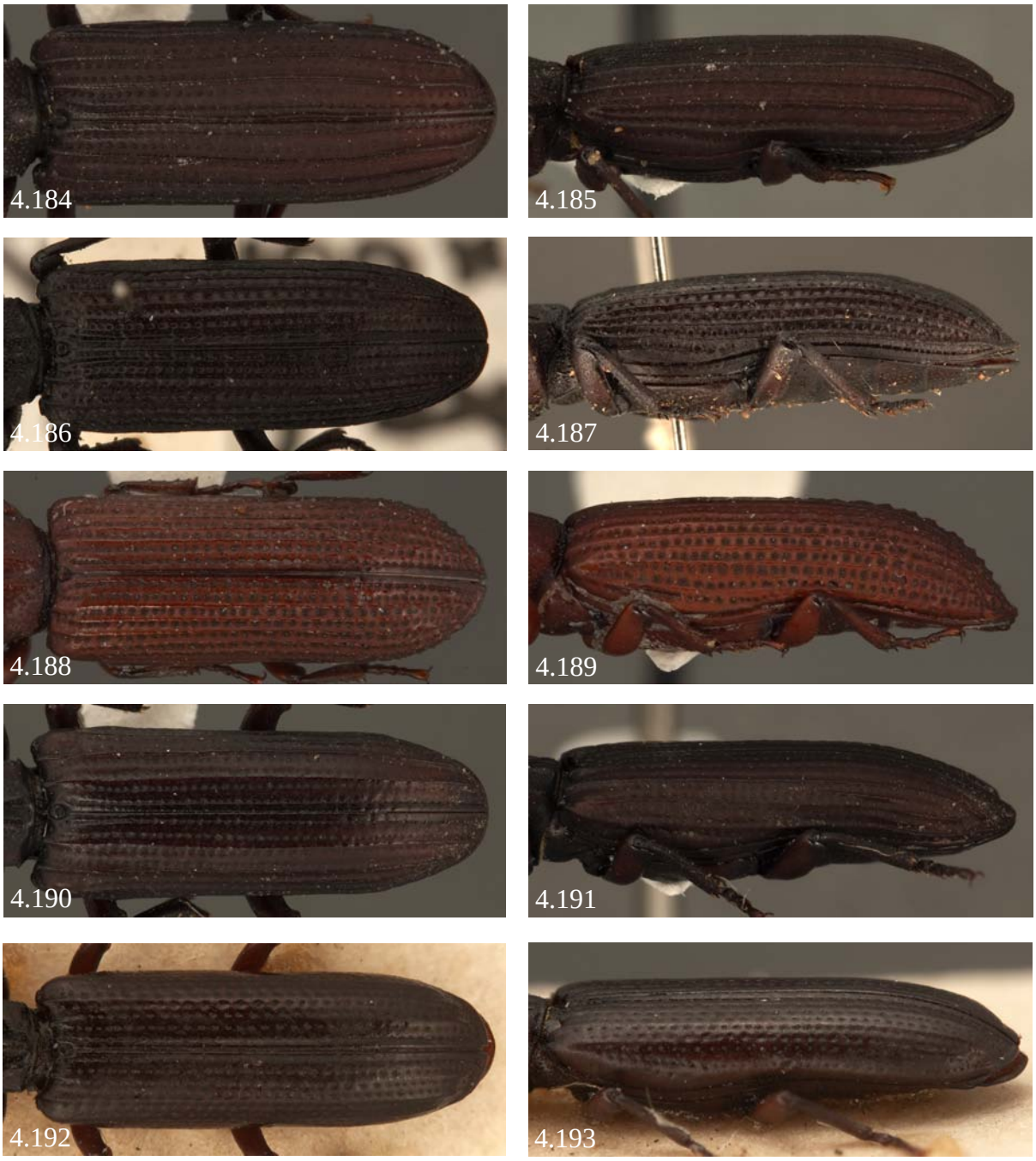


Figures 4.162-4.167. SEMs of *Deretaphrus* spp. cocoons.
4.162) *D. xanthorrhoeae*, 50x; 4.163) *D. xanthorrhoeae*, 100x; 4.164) *D. puncticollis*, 50x; 4.165) *D.* sp., 170x; 4.166) *D. viduatus*, 170x; 4.167) *D. viduatus*, 170x.

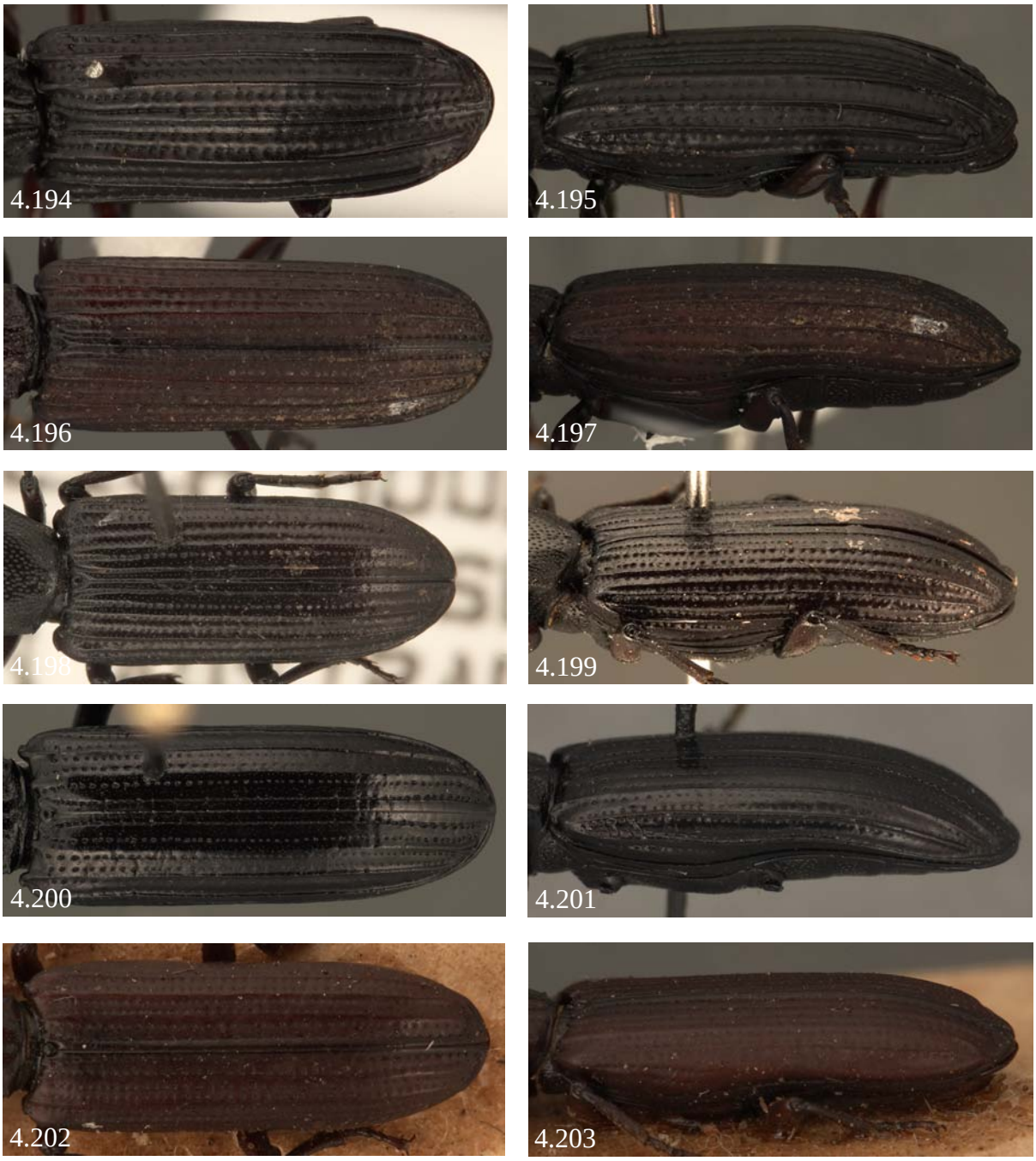
Figures 4.168-4.173. *Deretaphrus* spp. head, dorsal. 4.168) *D. bucculentus* Elston; 4.169) *D. carinatus* **n. sp.**; 4.170) *D. incultus* Carter; 4.171) *D. ocularis* **n. sp.**; 4.172) *D. parviceps* Lea; 4.173) *D. rodmani* **n. sp.**



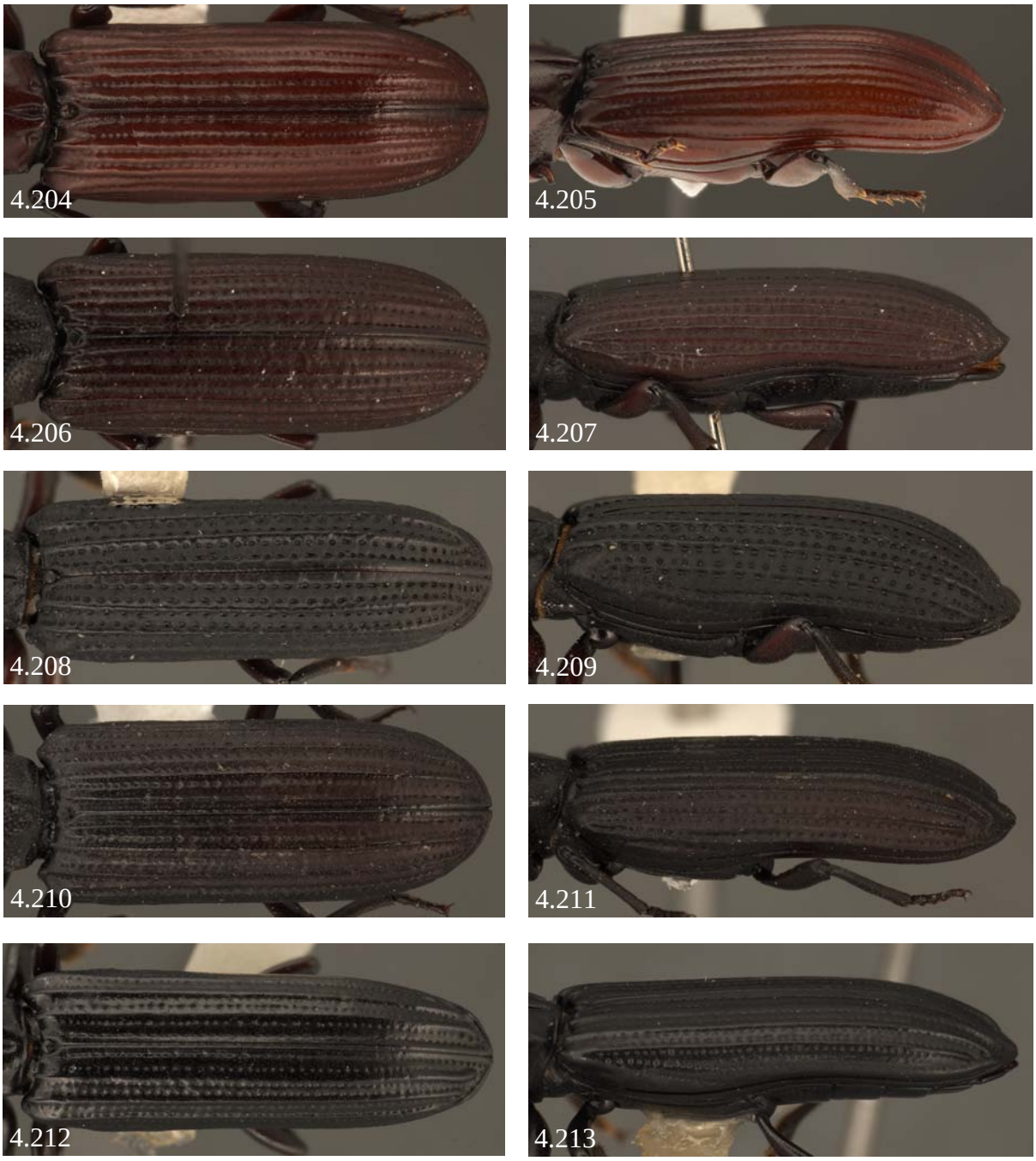
Figures 4.174-4.183. Elytra (dorsal, lateral) of *Deretaphrus* spp.
4.174-4.175) *D. aequaliceps* Blackburn; 4.176-4.177) *D. alveolatus* Carter;
4.178-4.179) *D. analis* Lea; 4.180-4.181) *D. antennatus* **n. sp.**;
4.182-4.183) *D. boliviensis* **n. sp.**



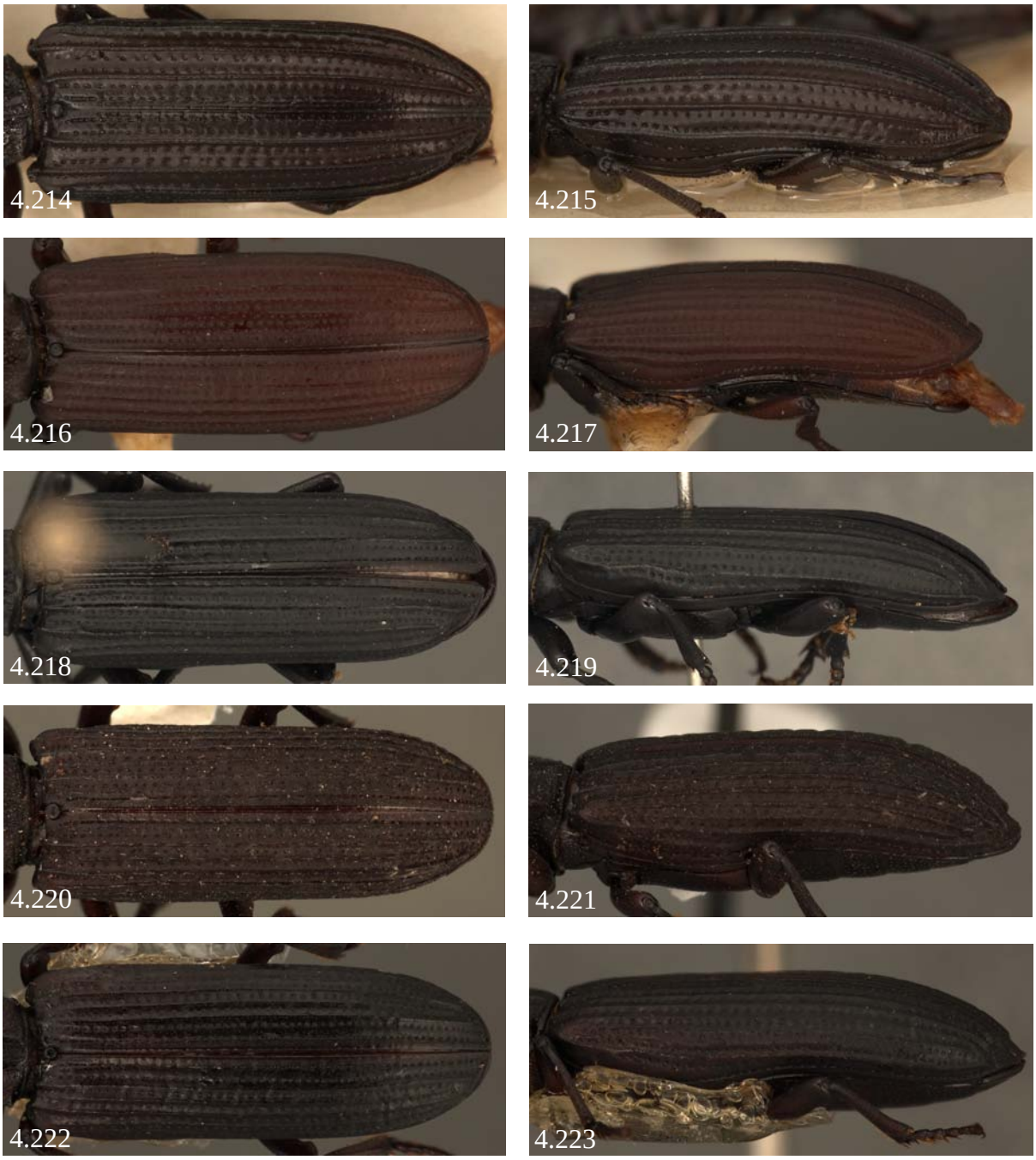
Figures 4.184-4.193. Elytra (dorsal, lateral) of *Deretaphrus* spp. 4.184-4.185) *D. bucculentus* Elston; 4.186-4.187) *D. carinatus* **n.sp.**; 4.188-4.189) *D. erichsoni* Newman; 4.190-4.191) *D. fossus* Newman; 4.192-4.193) *D. gracilis* Blackburn.



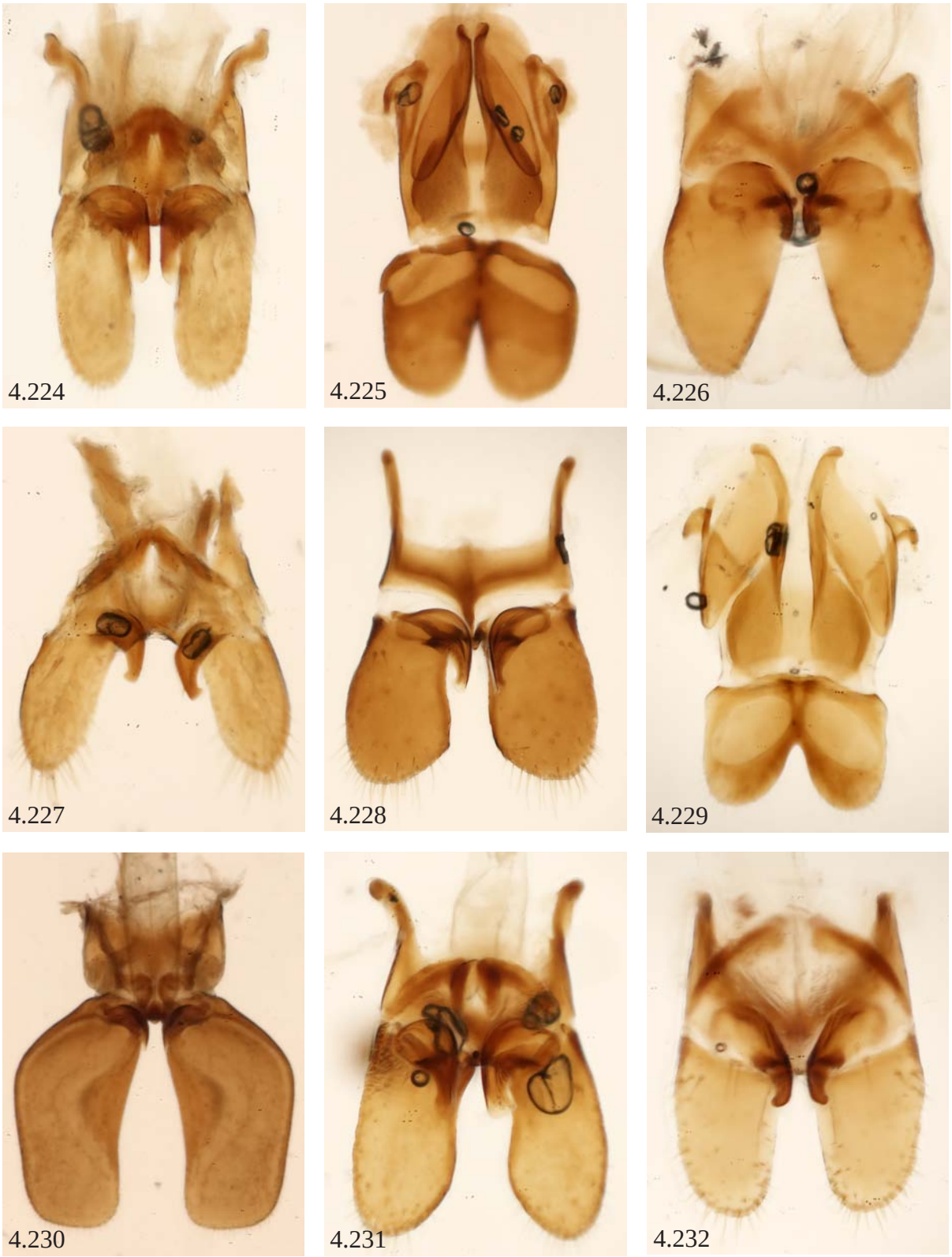
Figures 4.194-4.203. Elytra (dorsal, lateral) of *Deretaphrus* spp. 4.194-4.195) *D. hoplites* **n. sp.**; 4.196-4.197) *D. ignarus* Pascoe; 4.198-4.199) *D. incultus* Carter; 4.200-4.201) *D. interruptus* Grouvelle; 4.202-4.203) *D. iridescens* Blackburn.



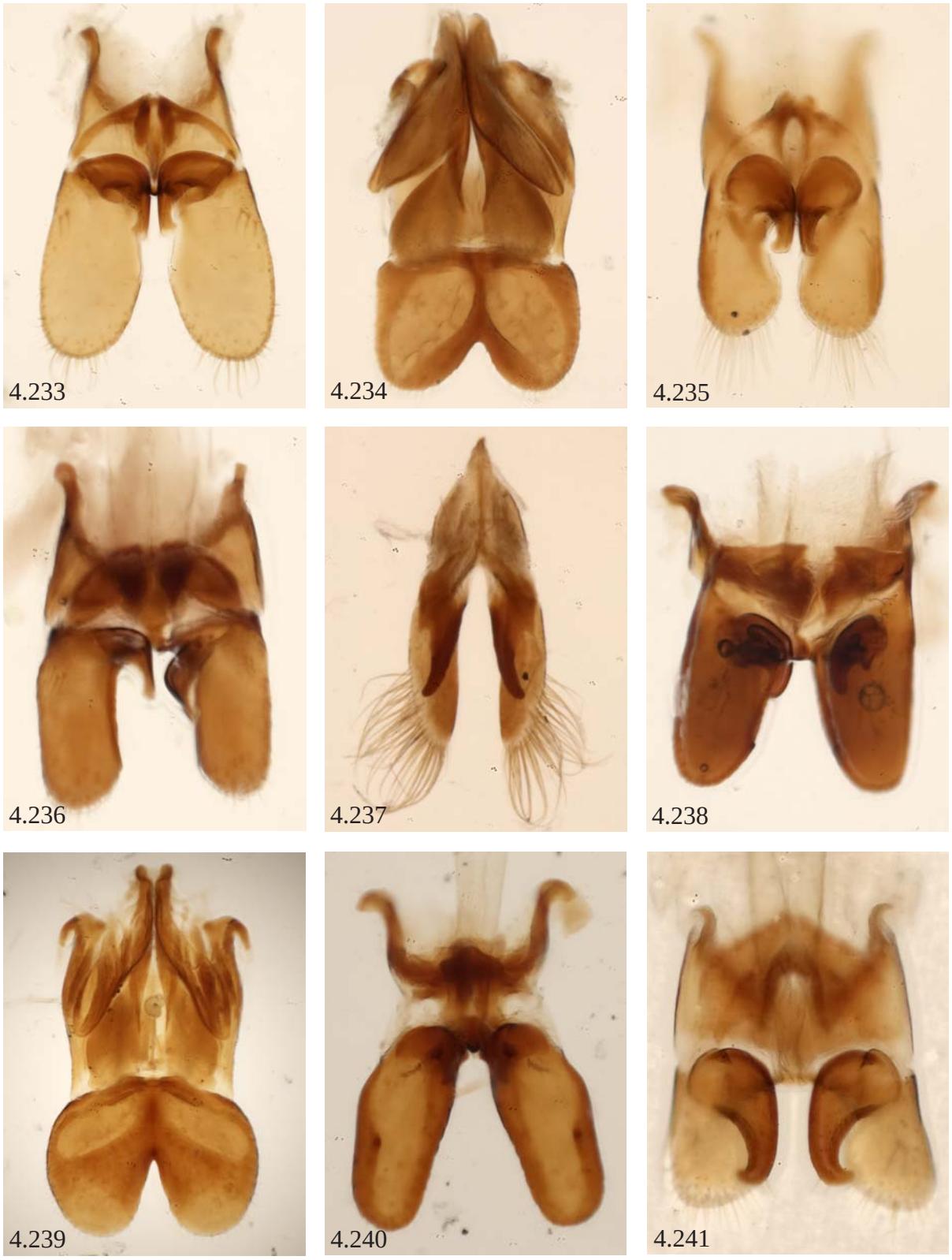
Figures 4.204-4.213. Elytra (dorsal, lateral) of *Deretaphrus* spp. 4.204-4.205) *D. lateropunctis* **n. sp.**; 4.206-4.207) *D. ocularis* **n. sp.**; 4.208-4.209) *D. oregonensis* Horn; 4.210-4.211) *D. parviceps* Lea; 4.212-4.213) *D. piceus* (Germar).



Figures 4.214-4.223. Elytra (dorsal, lateral) of *Deretaphrus* spp. 4.214-4.215) *D. puncticollis* Lea; 4.216-4.217) *D. rodmani* **n. sp.**; 4.218-4.219) *D. viduatus* Pascoe; 4.220-4.221) *D. wollastoni* Newman; 4.222-4.223) *D. xanthorrhoeae* Lea.

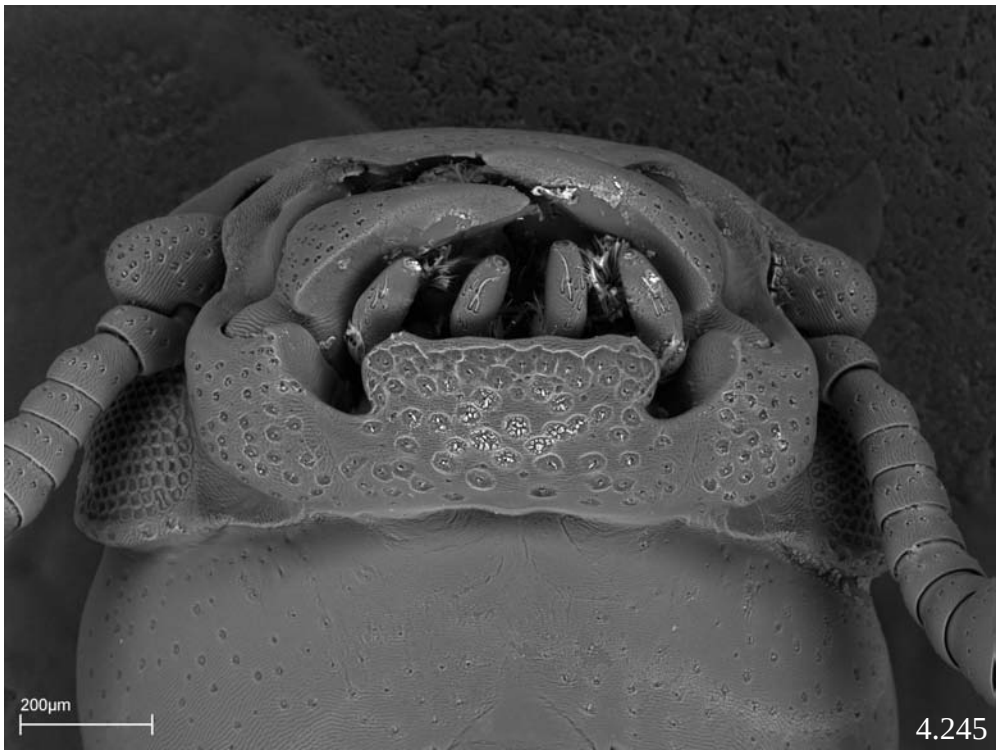


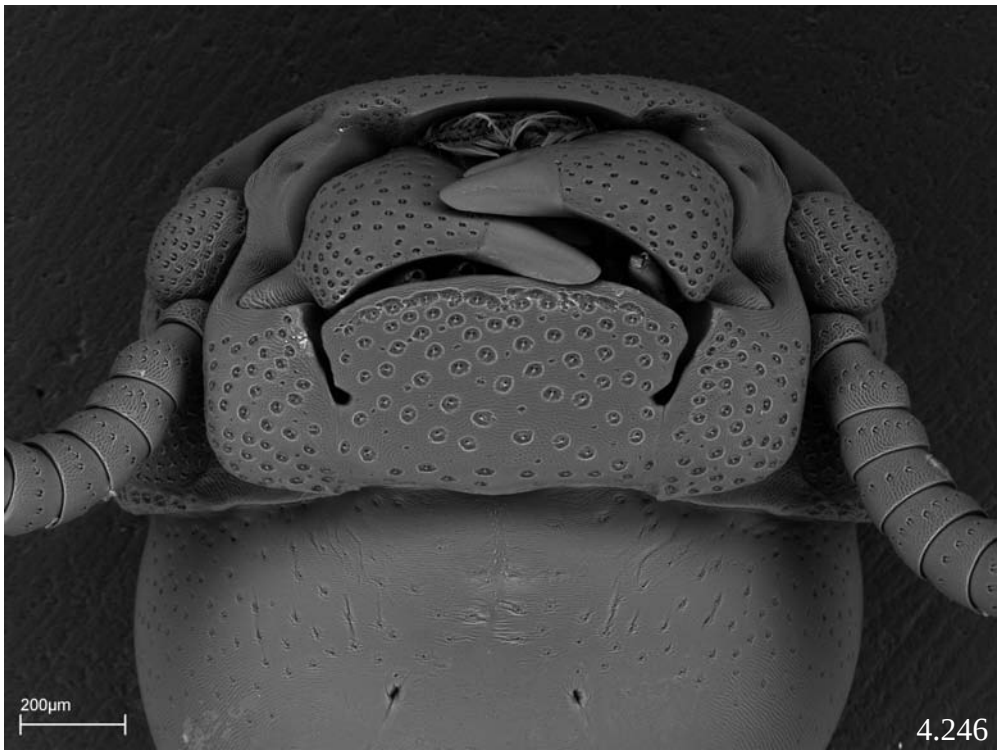
Figures 4.224-4.232. *Deretaphrus* spp. phallobase, dorsal. 4.224) *D. alveolatus*; 4.225) *D. analis*; 4.226) *D. bucculentus*; 4.227) *D. erichsoni*; 4.228) *D. fossus*; 4.229) *D. gracilis*; 4.230) *D. hoplites*; 4.231) *D. ignarus*; 4.232) *D. incultus*.



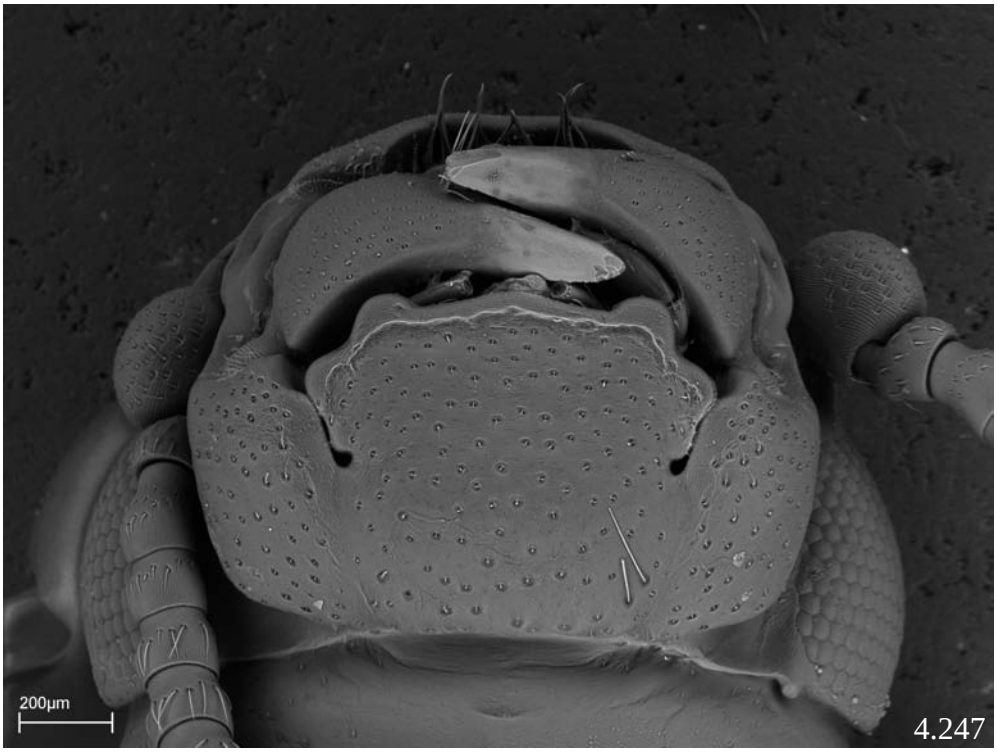
Figures 4.233-4.241. *Deretaphrus* spp. phallobase, dorsal. 4.233) *D. interruptus*; 4.234) *D. iridescens*; 4.235) *D. lateropunctis*; 4.236) *D. ocularis*; 4.237) *D. oregonensis*; 4.238) *D. parviceps*; 4.239) *D. piceus*; 4.240) *D. puncticollis*; 4.241) *D. rodmani*.

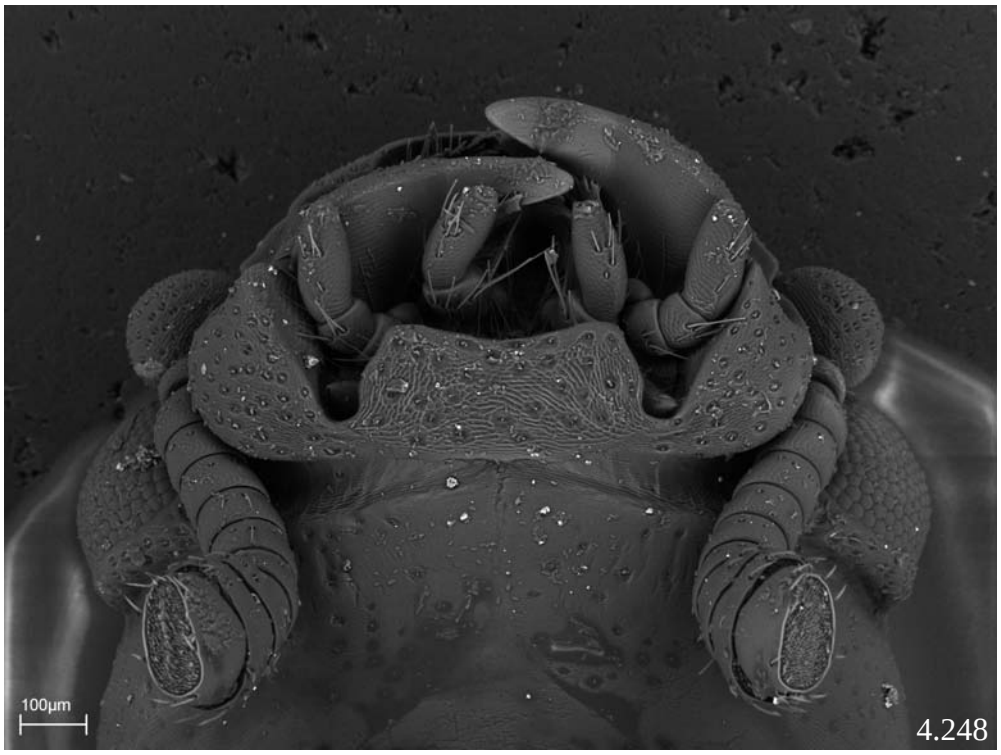
Figures 4.242-4.244. *Deretaphrus* spp. phallobase, dorsal. 4.242) *D. viduatus*; 4.243) *D. wollastoni*; 4.244) *D. xanthorrhoeae.*



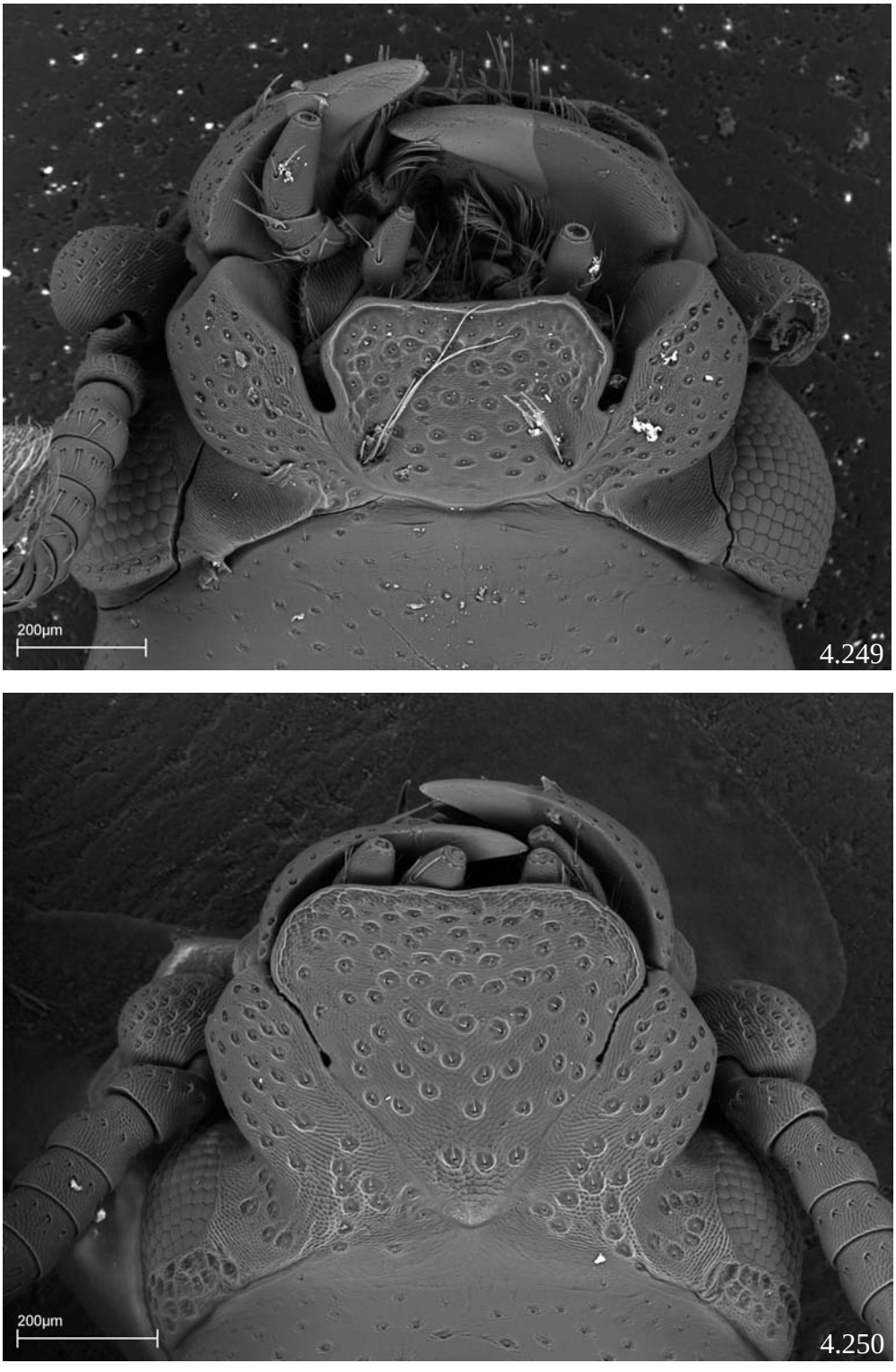


Figures 4.245-4.246. Head of *Deretaphrus* spp., ventral, illustrating shape of submentum. 4.245) *D. erichsoni* Newman; 4.246) *D. ignarus* Pascoe.

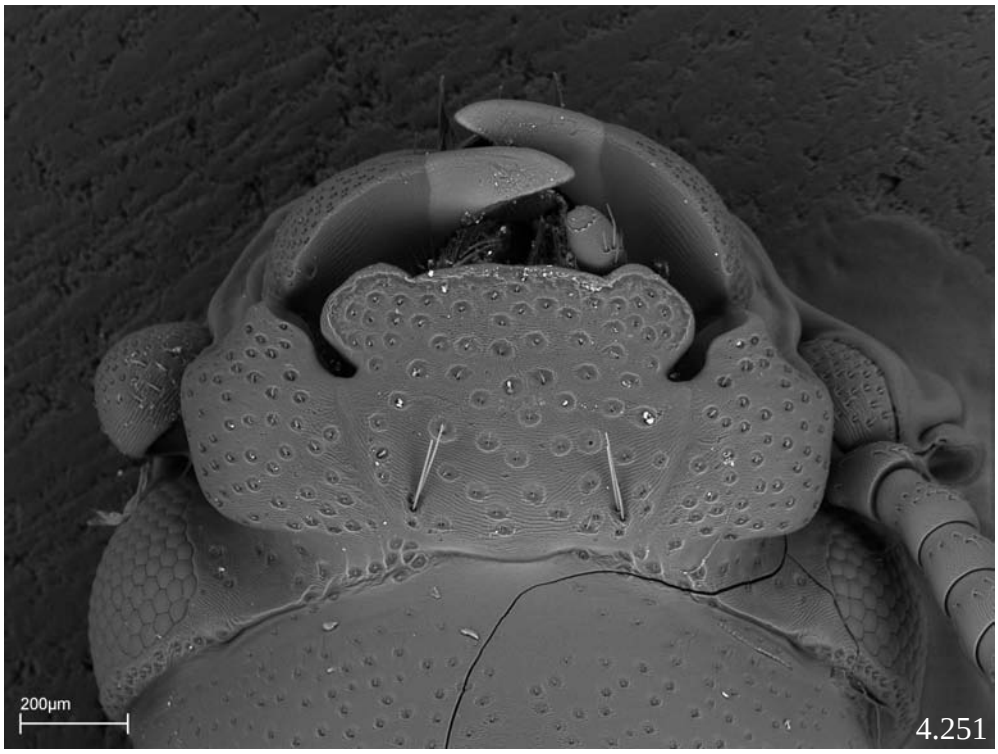


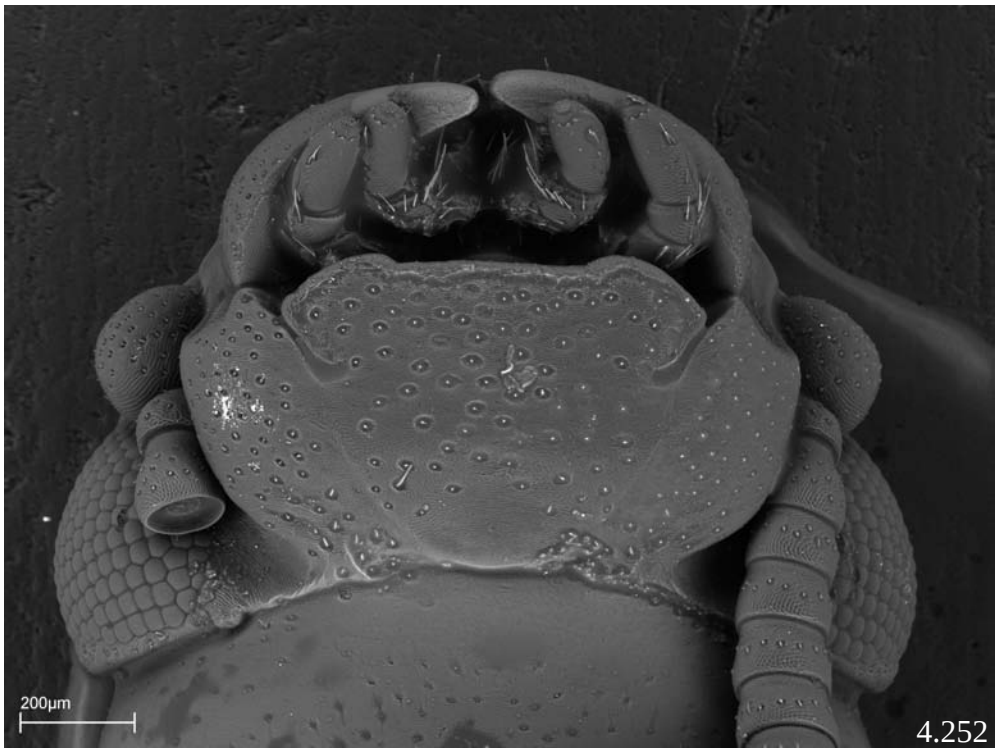


Figures 4.247-4.248. Head of *Deretaphrus* spp., ventral, illustrating shape of submentum. 4.247) *D. interruptus* Grouvelle; 4.248) *D. oregonensis* Horn.



Figures 4.249-4.250. Head of *Deretaphrus* spp., ventral, illustrating shape of submentum. 4.249) *D. piceus* (Germar); 4.250) *D. puncticollis* Lea.





Figures 4.251-4.252. Head of *Deretaphrus* spp., ventral, illustrating shape of submentum. 4.251) *D. viduatus* Pascoe; 4.252) *D. xanthorrhoeae* Lea.

CHAPTER 5

CONCLUSION

The Cerylonid Series of Cucujoidea is in serious need of taxonomic work at both higher and lower levels. Within the group, there are numerous nomenclatural errors, problems in the classification, and an abundance of undescribed diversity. For this thesis, two independent projects were conducted in an attempt to improve the taxonomic condition of two families of the Cerylonid Series. A molecular phylogenetic analysis of the family Latridiidae was performed, as well a taxonomic revision of the genus *Deretaphrus* Newman (Coleoptera: Bothrideridae).

The molecular phylogenetic analysis did not recover a monophyletic Latridiidae. Instead, one of the enigmatic genera (*Akalyptoischion* Andrews) was found to reside outside Latridiidae, but still nested within the Cerylonid Series. This result, combined with supporting morphological data, led to the erection of a new family, Akalyptoischionidae, Lord *et al.* Excluding *Akalyptoischion*, the monophyly of Latridiidae and its two subfamilies (Latridiinae, Corticariinae) was supported. There was little support for other internal groups within the family. This was in part due to a relatively small taxon sampling, but it likely reflects some of the taxonomic problems that plague the family.

The taxonomic revision of the genus *Deretaphrus* Newman treated 34 nominal species: 27 previously described species plus seven new species: *Deretaphrus antennatus* **sp. nov.,** *D. boliviensis* **sp. nov.,** *D. carinatus* **sp. nov.,** *D. hoplites* **sp. nov.,** *D. lateropunctis* **sp. nov.,** *D. ocularis* **sp. nov.,** and *D. rodmani* **sp. nov.** All previously named, valid species were redescribed. Two new junior synonyms were reported. Two former junior synonyms were

returned to valid status, neotypes were designated for two species, lectotypes were designated for three species, and paralectotypes were designated for three species. A key to the adults of all known valid species, detailed species descriptions, distribution maps, label data, biological information, and figures were generated.

These two research projects were some of the first of several that aim to revise and restructure the problematic Cucujoidea, emphasizing the groups within the Cerylonid Series. The molecular analysis of the family resulted in erection of a new family, and the revision of *Deretaphrus* uncovered a large percentage of species new to science. If this trend continues throughout the rest of the Cerylonid Series, and for Cucujoidea as a whole, we will undoubtedly see large increases in known beetle diversity as well as dramatic changes in both lower and higher-level classifications.

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APPENDIX A

Revised classification of the genus *Deretaphrus* Newman, 1842

Deretaphrus Newman, 1842

aequaliceps Blackburn 1903

alveolatus Carter 1937

analis Lea 1898

antennatus Lord and McHugh 2008, **NEW SPECIES**

boliviensis Lord and McHugh 2008, **NEW SPECIES**

bucculentus Elston 1923, **RETURNED TO VALID STATUS**

carinatus Lord and McHugh 2008, **NEW SPECIES**

erichsoni Newman 1855

granulipennis Reitter 1877

fossus Newman 1842

cordicollis Blackburn 1903

gracilis Blackburn 1903

hoplites Lord and McHugh, 2008, **NEW SPECIES**

ignarus Pascoe 1862

pascoei Macleay 1871

incultus Carter 1937

interruptus Grouvelle 1903

iridescens Blackburn 1903, **RETURNED TO VALID STATUS**

lateropunctis Lord and McHugh 2008, **NEW SPECIES**

ocularis Lord and McHugh 2008, **NEW SPECIES**

oregonensis Horn 1873

parviceps Lea 1898

piceus (Germar) 1848

bakewellii Pascoe 1862

thoracicus Blackburn 1903

puncticollis Lea 1898

rodmani Lord and McHugh 2008, **NEW SPECIES**

viduatus Pascoe 1862

colydioides Pascoe 1862

cribriceps Blackburn 1903, **NEW SYNONYMY**

popularis Blackburn 1903, **NEW SYNONYMY**

sparsiceps Blackburn 1903

wollastoni Newman 1855

xanthorrhoeae Lea 1898

APPENDIX B

Collections Studied and Acronyms

Material examined:

AAIC -Albert Allen Personal Insect Collection, Boise, ID, USA

AMNH -American Museum of Natural History, New York, NY, USA

AMSA -Australian Museum, Sydney, Australia

ANIC -Australian National Insect Collection, CSIRO, Canberra, Australia

BMNH -British Museum of Natural History, London, United Kingdom

BPBM -Bishop Museum, Honolulu, HI, USA

BYUC -Brigham Young University Insect Collection, Provo, UT, USA

CASC -California Academy of Sciences, San Francisco, CA, USA

CDFA -California Department of Food and Agriculture, Plant Pests Diagnostic Center, Sacramento, CA, USA

CUIC -Cornell University Insect Collection, Ithaca, NY, USA

EMEC -Essig Museum, University of California, Berkeley, CA, USA

FMNH -Field Museum of Natural History, Chicago, IL, USA

FSCA -Florida State Collection of Arthropods, Gainesville, FL, USA

HNHM -Természettudományi Múzeum, Allatár, Budapest, Hungary

ISNB -Institut royal des Sciences naturelles de Belgique, Brussels, Belgium

LACM -Natural History Museum of Los Angeles County, Los Angeles, CA, USA

MAIC -Michael A. Ivie Insect Collection, Bozeman, MT, USA

MAMU -Macleay Museum, University of Sydney, New South Wales, Australia

MCZ -Museum of Comparative Zoology, Cambridge, MA, USA

MNHUB -Museum fur Naturkunde, Humboldt-Universitat zu Berlin, Berlin, Germany

MTEC -Montana State University Entomology Collection, Bozeman, MT, USA

MVMA -Museum Victoria, Melbourne, Australia

NZAC -New Zealand Arthropod Collection, Auckland, New Zealand

OUMNH -Oxford University Museum of Natural History, Oxford, United Kingdom

QDPI -Queensland Department of Primary Industries, Brisbane, Australia

QMBA -Queensland Museum, Brisbane, Australia

QPIM -Queendland Department of Primary Industries, Mareeba, Australia

SAMA -South Australian Museum, Adelaide, Australia

SRFP -Station de Recherches Fruitières de Pocquereux, Institut Agronomique néo-Calédonien (IAC), La Foa, New Caledonia

TAMU -Texas A&M University Insect Collection, College Station, TX, USA

UCDC -Bohart Museum, University of California, Davis, CA, USA

UQIC - University of Queensland Insect Collection, Brisbane, Australia

USNM -Smithsonian Institution, National Museum of Natural History, Washington D.C., USA

WAMP -Western Australian Museum, Perth, Australia

ZMPA -Polish Academy of Sciences, Museum of the Institute of Zoology, Warszawa, Poland

Collection/Specimen Data:

INHS -Illinois Natural History Survey, Champaigne, IL, USA

KSUC -Kansas State University Insect Collection, Manhattan, KS, USA

SBMNH -Santa Barbara Museum of Natural History, Santa Barbara, CA, USA

SDMC -San Diego Natural History Museum, San Diego, CA, USA

UCRC -University of California, Riverside Insect Collection, Riverside, CA, USA

WSUC -Washington State University Insect Collection, Pullman, WA, USA