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Larvae of
Curculionoidea
(Insecta: Coleoptera):
a systematic overview

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DEDICATION

This work is respectfully dedicated to the late

Dr J.C.M. Gardner

1894–1970

*formerly of the Forest Research Institute, Dehra Dun, India
whose meticulous studies and perceptive comments first
led me to consider the potential of larval systematics*



"It is perhaps not yet unanimously agreed by students of the Coleoptera that a description of a species, however detailed, based entirely on the adult can only be a partial one. A natural classification should take all stages into consideration, the structure of early stages being regarded as complementary to conclusions based on the adults and probably of special value where strong but opposed opinions occur, as in Scolytidae, as to the grouping of certain genera" (Gardner 1934).

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Front cover The larva depicted is *Mandalotus miricollis*, feeding on a root of white clover. Artist: Brenda May.

Uhinga mua Ko *Mandalotus miricollis*, e kai ana i te pakiaka o te tarataru e kiia ana ko 'white clover'.

Kai-whakaahua: Brenda May.

Class / Karaaihe **Insecta**
Order / Oota **Coleoptera**

Superfamily / Whaamere-nui
Curculionoidea

Weevil larvae

Illustration: Larva of the vegetable weevil, *Listroderes difficilis*, eating cabbage leaf. Artist: B.M. May. **Whakaahuatanga:** Ko te iroiro o te wiiwara kai hua-raakau e huaina ana ko *Listroderes difficilis* e kai ana i te rau kaapeti. Kai-whakaahua: B.M. May.

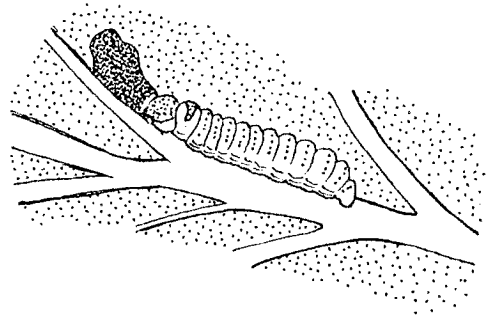
The weevils are one of the largest groups of Coleoptera, and in New Zealand about 1500 species are endemic.

All weevils, or snout-beetles, feed on plant material, and are thus found in a wide range of habitats. Some live in the soil, feeding on roots; others live at soil level and feed on leaves or crowns. A group of mainly small species feed internally, boring into stems and mining between the upper and lower surfaces of leaves. Living trees may be attacked by bark beetles, and once a tree is dead many kinds of weevil enter to feed on the wood.

A very small proportion of species world-wide are pests of agriculture, forestry, commercial crops, and home gardens. Those that have been accidentally introduced into New Zealand have multiplied rapidly in the absence of population pressure and of their natural enemies.

Adult weevils, perhaps because of the relative ease with which many can be found, have always attracted the attention of collectors and are fairly well documented. Larvae, on the other hand, with their cryptic feeding habits and 'look-alike white grub' image, have largely been neglected. It is now realised that the character states in each larva are diagnostic, and can be used to determine its identity and relationships. For this purpose it is essential to have correctly identified specimens, and a reference collection of over 300 species has been amassed through an on-going programme of rearing.

The search for larvae in their natural habitats, and subsequently their rearing through to the pupal and adult



He roopuu tino nui nga wiiwara (*weevils*) i roto i nga Coleoptera. I Niu Tiireni nei, e tata ki te kotahi mano erima rau nga tuumomo, kaaore e kitea ana i eetahi atu whenua.

Ekai-raakau katoa ana nga wiiwara, ara, nga piitara-ihu. No reira, he nui oo raatou kaainga. Kei roto i te oneone eetahi, e kai pakiaka ana; kei runga i a Papa eetahi, e kai rau-raakau ana. Ko teetahi roopu, he mea iti, ka uru ki roto ki nga rau me nga too, ka kai. Ka kookiritia nga raakau e ora ana e nga piitara-kiri-raakau, aa, kia mate kee te raakau, e hia kee nga tuumomo wiiwara ka uru ki roto ki te kai.

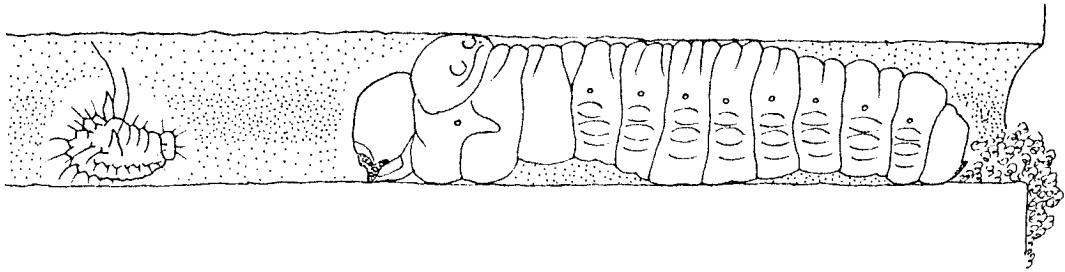
Kaaore e nui nga wiiwara nanakia o te ao, araa, nga mea e kai ana i nga taonga o Rongo-ma-taane. Engara kua piki haere te tupu o nga mea i uru poka noa mai, na te mea kaaore oo raatou hoariri i konei, aa, kaaore hoki e nohoia nuitia ana teenei whenua.

Na te mea e kitea waingohia ana nga wiiwara pakeke, ka kohikohia e nga kai-kohi, aa, kua aata tuhia nga aahuatanga. Ko nga kuuao kaaore iaata maatakina i mua, i te mea he iroiro noa te aahua, he hunahuna hoki te kai. Inaiaanei kua kitea he aahua anoo too teenei, too tenei, aa ka taaea te whiriwhiri i nga huaanga o ia iroiro, o ia iroiro. Kua aata kohikohia e toru rau tuumomo iroiro hei maatakitaki ma te tangata.

Na te kimikimi i nga iroiro i roto i oo raatou kaainga, na te whaangai i nga ngaarara, i nga pakeke hoki, kaatahi anoo ka whakaaturia eetahi aahuatanga. Ko nga wiiwara-putiputi, kotahi rau nga tuumomo maaori, he raakau pai too teenei tuumomo, he raakau pai too teenei tuumomo. Ka kainga nga putiputi me nga hua. Ka tatari a *Aneuma compta* kia tuwhera ai nga pana, aa, kaatahi anoo ka panga i tana hua kotahi.

(continued overleaf)

(ara haere tonu)



stages, have revealed details of their life history that were previously unknown. For instance, in the flower weevil group of about 100 very small native weevils each species was found to belong to its own particular host plant, where many larvae feed on the flowers and developing ovaries. *Aneuma compta* on lacebark waits until the seed capsules are fully expanded before inserting its single egg.

Some species are miners in green leaves. Most of them make individual burrows, but at least two species live communally, with up to 20 larvae in a single leaf. The minute adult of *Geochus*, with no wings and no claws on its feet, spends its whole life on the forest floor, where its larvae are miners in fallen leaves, feeding on the dead tissue.

Rhinorhynchus species are of particular interest in that they are the only representatives in New Zealand of the ancient family Nemonychidae. They develop on the male flowers of cone-bearing trees, where they feed on pollen; their mouthparts are modified for grinding pollen grains. About 3 weeks for larval growth is followed by a lengthy prepupal resting period in the soil, sometimes extending into a second season. This may be regarded as a strategy for survival, since at least some of the population will still be alive if the host tree fails to flower.

Wood-boring weevils of the genus *Platypus* are known as ambrosia beetles. They are gardeners, cultivating their food supply of fungus on the walls of their tunnels. The adult pair which start the colony bring in the first spores. Later, the garden is maintained and spread by the older progeny, which have mouthparts adapted for the purpose.

Contributor Brenda M. May was born and educated in England. She emigrated to New Zealand in 1952, and in 1956 joined the entomology section of the Plant Diseases Division of DSIR as a technical assistant. As a result of numerous enquiries for identification from growers and gardeners, Brenda became interested in rearing the immature stages of weevils. She has continued this work as a Research Associate since her retirement in 1980. Brenda sees her Fauna of New Zealand contribution on weevil larvae as the culmination of her efforts, and she now intends to relax into other pursuits.

Illustration: Larvae of the wood-boring weevil *Platypus apicalis*: first stage, and mature larva at tunnel entrance. Artist: B.M. May.

Whakaahuatanga: Ko te iro o te wiiwara wiri-raakau *Platypus apicalis*: iro kuuao, iro pakeke i te puuaha o tana rua. Kai-whakaahua: B.M. May.

He kai-keri rua i nga rau raakau e tahi tuumomo. E noho takitahi ana e tahi; e rua nga tuumomo e noho huihui ana, ka tae ki te rua tekau e noho ana i te rua kotahi. Ko te pakeke o *Geochus* he mea iti rawa, ka ahore kau ana parirau, ka ahore kau nga matikuku o ana waewae; ka noho i te oneone o te ngahere mai i te whaanautanga tae noa ki te matenga; he kai-keri rua i roto i nga rau raakau kua makere iho, aa, ka kai.

Nga tuumomo e huaina ana ko *Rhinorhynchus* he mea miiharo. Ko raatou anakete uri o Nemonychidae i Niu Tiireni nei, he iwi no nehe noa atu nga tuupuna. Ka tupu raatou i runga i nga puawai taane o nga paaina, e kai punga-punga ana. Kua hangaia kee te waha hei orooro i te punga-punga. E toru wiki i noho-a-iroiro; i muri mai ka roa te noho hei ngaarara i roto i te oneone, tae noa pea ki te rua tau. Na reira, mehemea ka ahore nga putiputi o te raakau e hiakaitia ana i te teenei tau, ka ora teetahi moorehu mo te tau e haere mai ana.

Ko nga wiiwara wiri-raakau, ko *Platypus*, e huaina ko nga piitara kai-atua. He ahuhenua te mahi, e whakatupu ana i nga harore i runga i nga tahataha o nga rua. Ka haria mai te kaakano harore e te tokorua naana i tiimata te whaanau. I muri mai ka mahia, ka whakanuia te maara e aa raaua tamariki; kua hanga kee nga waha kia pai ai taua mahi.

Ko Brenda M. May te kai-tuhi; no Ingarangi ia, aa, ka kuraina i reira. I haere mai ki Niu Tiireni i te tau 1952; i te tau 1956 ka uru ia hei kai-aawhina i te waahanga o te Tari Mate Raakau o te DSIR e paa ana ki te Aitanga-a-peepeke. Na te maha o nga uiui nga taangata ahu-whenua ka huri a Brenda ki te whaangai i nga kuuao wiiwara. Kei te haere tonu teenei mahi i muri i tana okiokinga i te tau 1980. E ai ki a ia ko tana taumata okiokinga eenei mahi e pa ana ki nga kuuao wiiwara. Inaaiane i kotana hiahia he whakataa, he huri kee ki e tahi atu mahi.

ABSTRACT

An overview is presented of the larvae of superfamily Curculionoidea. Their systematic arrangement follows a new 'scheme' (G. Kuschel, in press) wherein the number of families worldwide is reduced to 6 and the number of subfamilies to 21. The data matrix underpinning this scheme includes biological and morphological character-states of larvae as well as adult weevils. In the present study an annotated list of larval character-states is given. Representative genera of all families, and of the subfamilies of Curculionidae, the largest group, are diagnosed, keyed, and illustrated. Of the 107 species reviewed, 85 occur in New Zealand (60 endemic, 25 introduced) and 22 are exotic. These latter are included for the sake of continuity or because their position is transitional.

CHECKLIST OF TAXA

<p>Note. This is not a comprehensive list of the Curculionoidea known as larvae from New Zealand. It covers only those species described in this work as representatives of family-group taxa; most of them (listed in bold type) occur in New Zealand.</p> <p>Family NEMONYCHIDAE 24</p> <p>Subfamily NEMONYCHINAE 25</p> <p>Genus <i>Nemonyx</i> Redtenbacher, 1845 25</p> <p style="padding-left: 20px;"><i>lepturoides</i> (Fabricius, 1801) 26</p> <p>Subfamily DOYDIRHYNCHINAE 26</p> <p>Genus <i>Limberis</i> des Gozis, 1881 26</p> <p style="padding-left: 20px;"><i>comptus</i> (LeConte, 1876) 26</p> <p style="padding-left: 20px;"><i>pilosus</i> (LeConte, 1876) 27</p> <p>Subfamily RHINORHYNCHINAE 27</p> <p>Tribe Rhinorhynchini 27</p> <p>Genus <i>Rhinorhynchus</i> Sharp, 1882 27</p> <p style="padding-left: 20px;"><i>rufulus</i> (Broun, 1880) 28</p> <p style="padding-left: 20px;">sp. indet. 28</p> <p>Tribe Rhynchitomacerini 29</p> <p>Genus <i>Rhynchitomacer</i> Voss, 1937 29</p> <p style="padding-left: 20px;"><i>rufus</i> Kuschel, 1954 29</p> <p>Tribe Mecomacerini 29</p> <p>Genus <i>Mecomacer</i> Kuschel, 1954 29</p> <p style="padding-left: 20px;"><i>scambus</i> Kuschel, 1954 30</p> <p>Tribe Rhynchitoplesiini 30</p> <p>Genus <i>Rhynchitomacerinus</i> Voss, 1952 30</p> <p style="padding-left: 20px;"><i>kuscheli</i> (Voss, 1952) 30</p> <p>Family ANTHRIBIDAE 30</p> <p>Subfamily URODONTINAE 31</p> <p>Genus <i>Bruchela</i> Dejean, 1821 31</p> <p style="padding-left: 20px;"><i>lili</i> (Fåhraeus, 1839) 31</p>	<p>Subfamily ANTHRIBINAE 32</p> <p>Genus <i>Arecopais</i> Broun, 1893 32</p> <p style="padding-left: 20px;"><i>spectabilis</i> (Broun, 1880) 32</p> <p>Genus <i>Cacephatus</i> Blackburn, 1900 33</p> <p style="padding-left: 20px;"><i>inornatus</i> (Sharp, 1886) 33</p> <p>Genus <i>Dasyanthribus</i> Holloway, 1982 33</p> <p style="padding-left: 20px;"><i>purpureus</i> (Broun, 1880) 33</p> <p>Genus <i>Garyus</i> Holloway, 1982 33</p> <p style="padding-left: 20px;"><i>altus</i> (Sharp, 1876) 33</p> <p>Genus <i>Helmoreus</i> Holloway, 1982 34</p> <p style="padding-left: 20px;"><i>sharpi</i> (Broun, 1880) 34</p> <p>Genus <i>Hoherius</i> Holloway, 1982 34</p> <p style="padding-left: 20px;"><i>meinertzhageni</i> (Broun, 1880) 34</p> <p>Genus <i>Phymatus</i> Holloway, 1982 34</p> <p style="padding-left: 20px;"><i>hetaera</i> (Sharp, 1876) 35</p> <p>Genus <i>Pleosporius</i> Holloway, 1982 35</p> <p style="padding-left: 20px;"><i>bullatus</i> (Sharp, 1876) 35</p> <p>Genus <i>Sharpius</i> Holloway, 1982 35</p> <p style="padding-left: 20px;"><i>brouni</i> (Sharp, 1876) 35</p> <p>Subfamily CHORAGINAE 36</p> <p>Genus <i>Araecerus</i> Schoenherr, 1823 36</p> <p style="padding-left: 20px;"><i>palmaris</i> (Pascoe, 1882) 36</p> <p>Genus <i>Dysnocryptus</i> Broun, 1893 37</p> <p style="padding-left: 20px;"><i>inflatus</i> (Sharp, 1876) 37</p> <p>Genus <i>Notochoragus</i> Holloway, 1982 37</p> <p style="padding-left: 20px;"><i>crassus</i> (Sharp, 1876) 37</p> <p>Family BELIDAE 37</p> <p>Subfamily BELINAE 38</p> <p>Genus <i>Agathinus</i> Broun, 1880 38</p> <p style="padding-left: 20px;"><i>tridens</i> (Fabricius, 1787) 38</p> <p>Genus <i>Pachyurinus</i> Kuschel, 1959 39</p> <p style="padding-left: 20px;"><i>rubicundus</i> (Broun, 1880) 39</p> <p style="padding-left: 20px;"><i>sticticus</i> (Broun, 1893) 39</p>
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INTRODUCTION

"It is perhaps not yet unanimously agreed by students of the Coleoptera that a description of a species, however detailed, based entirely on the adult can only be a partial one. A natural classification should take all stages into consideration, the structure of early stages being regarded as complementary to conclusions based on the adults and probably of special value where strong but opposed opinions occur, as in Scolytidae, as to the grouping of certain genera" (Gardner 1934b).

The words quoted above, written nearly 60 years ago at Dehra Dun, India, are just as pertinent today. Many larval diagnoses have been published since that time, but there have been few attempts to give larval characters their full

weight in the context of a general classification. The larval form is simpler than that of the adult. There are about one-third the number of character states to be considered and therefore fewer to cause confusion when deciding which of them are diagnostic of primary divisions.

Emden (1938) established the position of the antennae relative to the termination of the frontal sutures as the main factor separating the so-called primitive (orthocerous) larvae from those of the more advanced (gonatocerous) weevils. Gardner (1934a) used antennal shape to delimit the traditional Adelognatha (broad-nosed weevils). Crowson (1955) employed larval characters to a limited extent in support of his classification system, which is widely accepted today. Kuschel (in press) has resorted to cladistic analysis in his attempt to reduce the unwieldy number of curculionid subfamilies. His data matrix includes biological as well as morphological character states of both adults and larvae.

In this study I have followed the lines of Kuschel's new scheme, wherein the number of families is reduced to six and the subfamilies to twenty-one. Many previously designated subfamilies are reduced to tribes. Exotic taxa such as Oxycoryninae and Attelabidae are included because they are important for continuity or, as in the case of *Ithycerus Schoenherr*, hold a spectacularly transitional position.

MORPHOLOGY

Diagnostic features. Curculionoid larvae are cylindrical grubs with the typical abdominal segments (Abd II–VII) unsclerotised and traversed on the dorsum by from two to four plicae or folds. Abd IX lacks urogomphi. A hypopharyngeal bracon is present, except in some leaf-miners. The maxilla has the galea and lacinia united to form a mala. Legs are vestigial or absent, rarely three-segmented with a claw (*Nemonyx*).

Larvae of Lucanidae, Trogidae, and Scarabaeidae are superficially similar to those of Curculionoidea apart from their well developed legs. The head capsule carries a hypopharyngeal bracon, their Abd segments are plicate and unsclerotised, and Abd IX lacks urogomphi. In Ptinidae, Anobiidae, Lyctidae, Bruchidae, and Chrysomeloidea (the closest out-group) the hypopharyngeal bracon is absent, and legs are present except in some Cerambycidae.

The antennae of all Curculionoidea except Belidae and Attelabidae are regarded as being one-segmented. The antennal segment itself is a membranous cushion which may be plane, convex, or cylindrical. It carries a supplementary cone as well as a variety of sensoria in the form of hairs, pores, or papillae, but since the cone is the most diagnostic structure it has become known as the 'antenna'.

Some Belidae have a basal retractile membrane as in Cerambycidae, but this is not regarded as an additional segment.

Despite their uniform appearance curculionoid larvae present sharp character states, as detailed below, with the ancestral (plesiomorphic) state versus the derived (apomorphic) state. The modal numbers of setae for Curculionidae are used for comparison, and are listed in Table 3 (p. 50).

Head

- (1) Free vs. retractile (dorsoepicranial seta 1 level with apex of frons, or forward of it) (Fig. 463).
- (2) Extrusible vs. permanently retracted, held in position by strong musculature (as in Belidae, Fig. 197–199).
- (3) Frontal sutures reaching mandible (Fig. 310, 336) vs. delimited in front by a frontoepicranial bridge (Fig. 387, 398).
- (4) Endocarinal line present (Fig. 2) vs. absent.
- (5) Endocarinal line simple vs. divided (Fig. 209).
- (6) Dorsoepicranial seta 3 on epicranial half vs. in suture or on frontal plate (Fig. 474, 506).
- (7) Frontal setae exceeding 5 pairs vs. 5 pairs or fewer.
- (8) Frontal setae comprising 5 pairs of similar length vs. *fs1,2,3,5* short or absent (*fs4* is the most constant).
- (9) Frontoclypeal suture distinct (Fig. 79) vs. effaced (Fig. 4).
- (10) Clypeal setae comprising 3 or more pairs vs. not more than 2 pairs.
- (11) Clypeolabral suture distinct vs. effaced.
- (12) Antennae concealed from above (Fig. 35) vs. exposed.
- (13) Antennae 2-segmented (Fig. 200) vs. 1-segmented (Fig. 26).
- (14) Antennae circular in cross-section vs. oval.
- (15) Antennae longer than wide vs. wider than long or subequal.
- (16) Ocelli (stemmata) 3 or more (Fig. 23, 387) vs. not more than 2.

Mouthparts

- (17) Mandibles with molar section undeveloped vs. developed (Fig. 29).
- (18) Mandibles with 3 or more teeth on incisor section (Fig. 144) vs. 1 or 2 teeth.
- (19) Labrum with 4 pairs of primary setae (Fig. 4) vs. not more than 3 pairs.
- (20) Labrum transverse or quadrate vs. longitudinal (Fig. 854).
- (21) Epipharyngeal lining with 4 or more pairs of anterolateral setae (Fig. 390, 400) vs. up to 3 pairs.

- (22) Hypopharyngeal bracon clear vs. variously sclerotised (Fig. 443, 852).
- (23) Hypopharyngeal bracon without a sclerome medially vs. with a complex medial sclerome (as in Anthribidae, Fig. 77).
- (24) Maxillary palps 3-segmented (Fig. 204) vs. 2-segmented.
- (25) Maxillary palps 2-segmented vs. 1-segmented (Fig. 351).
- (26) Maxilla with palpiger (Fig. 204) vs. without palpiger.
- (27) Maxillary mala bearing a lacinia (as in Anthribidae, Fig. 82) or an uncus (as in Nemonychidae, Fig. 17) vs. without lacinia or uncus.
- (28) Articulatory lobes distinct (Fig. 7) vs. obsolete.
- (29) Buccal setae simple vs. some setae branched (Fig. 1068b).
- (30) Labial palps 2-segmented vs. 1-segmented (Fig. 360a).
- (31) Labral tormae absent vs. present.
- (32) Tormae represented by lateral scleromes (Fig. 80) vs. paired paramasal rods.
- (33) Tormae free vs. united at base (Fig. 615).

Thorax

- (34) Pronotal shield simple vs. variously modified (Fig. 196).
- (35) Spiracle on mesothorax or intersegmental vs. on prothorax.
- (36) Legs or papillae present vs. absent.

Abdomen

- (37) Spiracles 8 in number vs. fewer than 8.
- (38) Spiracles with 2 airtubes (bicameral) vs. with 1 (unicameral) (Fig. 194).
- (39) Spiracles with 1 airtube vs. none (Fig. 470).
- (40) Spiracles located on pleurum vs. on dorsum (Fig. 788, 797).
- (41) Dorsal transverse plicae (folds) 2 in number (Fig. 1) vs. 3 or 4 (Fig. 830, 949).
- (42) Ventropleural lobes entire vs. subdivided (as in Rhynchophorinae, Fig. 1062).
- (43) Abd VIII/IX simple vs. modified (Fig. 427).
- (44) Abd X (anus) terminal vs. subdorsal (Fig. 611), subterminal (Fig. 558), or ventral (Fig. 548).
- (45) Abd X simple vs. modified (e.g., pygopod, Fig. 23).

Alimentary canal

- (46) Malpighian tubules 6 in number vs. 4.
- (47) Rectal bracon a ligamentous ring vs. a sclerotised loop (Fig. 938).

Divergence between species shows in features such as pigmentation of head and setae and relative lengths of setae, and in the type and relative abundance of cuticular vestiture.

EVOLUTION IN LARVAL MORPHOLOGY

The process of evolution as a result of cybernetics (Gk. *kubernetes*, steersman), or feedback from the environment, can be followed in various groups of organisms through sequences of morphological change when sufficient material is available. In weevils, evolution of the larvae has not necessarily proceeded at the same rate as in the adults. Because they usually live in sheltered situations, larvae are more likely to have remained constant, and can sometimes indicate a phylogenetic direction which has become uncertain in the adult, e.g., in the Australian *Demysus* Pascoe / *Tranes* Schoenherr complex (Molytini) (May, in press), and in the forest litter-inhabiting weevil *Geochus* Broun (see p. 80).

A classification system is a man-made artefact for presenting the multitudinous array of insects in an orderly fashion. The taxa are placed in a series of discrete compartments from where, because evolution is continuous, there is considerable overlap, especially at the family or subfamily level. Such transitional taxa can be recognised in weevil larvae, and will be discussed in the sections where they occur. Before assigning larvae to any particular grouping, however, one must remember that certain biological conditions can initiate synapomorphies in taxa which are not otherwise closely related. The following characters are the result of such parallel development, and should therefore not be given phylogenetic significance.

(1) Aquatic environments. Larvae which live in continuously wet surroundings have a modified respiratory system. The spiracles may be externally sclerotised and tipped with a scalpellum for plant piercing as in *Cyrtobagous* (Eirrhiniinae), *Steriphus* (Rhytirhinini), and *Donacia* (Chrysomelidae). They may be arranged contiguously on the dorsum as in *Cyrtobagous* or laterally as in *Neohydronomus* (Eirrhiniinae) and *Steriphus*. The number of functional spiracles may be reduced as in *Neochetina* (Eirrhiniinae) and *Donacia*. The larvae of *Notonesius* (Phrynixini) living in wet peat have the pair of spiracles on the Abd VIII dorsum joined to form a telescopic siphon furnished with a float of aquifuge hairs to allow surface respiration. A similar strategy is employed by the maggots of *Eristalis* and other syrphid flies.

In watery habitats the respiratory system assumes major importance, and the hindgut is simplified so that Abd VIII,

carrying the caudal spiracles, is often developed at the expense of Abd IX, carrying the anal musculature. Several of the foregoing genera and some Indian larvae inhabiting succulent plants (Gardner 1934a, 1938) have Abd IX reduced in size and Abd X, sometimes forming a pygopod, displaced well forward ventrally by the enlargement of Abd VIII. Free-drifting larvae such as those of *Cyrtobagous* display various setal modifications. The long, slender pleural setae, especially on the terminal segments, probably function as balancers whereas the stout, hooked ventral setae are used as a holdfast while feeding.

(2) Ectophytic feeding. Larvae which feed externally are adapted for adhesion to plane surfaces by means of ventral ambulatory ampullae, as in *Listroderes* (Rhytirhinini) and *Hypera* (Hyperini); the anal lobes are developed as pygopods as in *Listroderes* and *Rhinorhynchus* (Nemomychidae); and setation may be reduced or obsolete, and coloration is cryptic, as in Gonipterini and the previous genera.

(3) Xylophagy. Larvae which feed on the hard, resistant parts of dead wood show characteristic modifications to the mouthparts: labrum longer than wide, narrowed in front and heavily sclerotised (pigmented); epipharyngeal lining with *als* arranged longitudinally; mandibles with cutting edge raised medially and either ridged or knobbed to form a grinding surface; and the hypopharyngeal bracon solidly pigmented for added strength. Examples of larvae with mouthparts adapted for xylophagy may be found in *Psepholax* and its allies (Cryptorhynchini), *Phrynixus* and its allies (Molytini), and *Ancistropterus* (Eugnomini), all in Curculioninae, in *Mesites* (Cossoninae), and in *Pachycotes* (Scolytinae).

(4) Leaf-mining. Larvae which feed in the constricted space between leaf surfaces are subject to considerable modification of the head capsule and labrum, the degree of which varies between genera in a well defined regressive cline. The head is retracted to bring the mandibles into a forward position, and depressed to fit between the upper and lower leaf cuticle. The posterior emargination of the head is increased dorsally so that the coronal suture is progressively eliminated. The endocarina becomes stronger, and extended to the full length of the frons and then posteriorly as a rod between the open epicranial halves.

Cephalic setae become short and eventually obsolete in the following sequence: *des4, fs1*; *des2, fs2,3*; *des1, fs5, les2, ves1,2*; *des3, fs4*. Setae *des5* and *les1* remain constant. Labral setae become short and acute, reducing to one pair only. The epipharyngeal setae, however, in a protected

position, are well developed and in more or less modal numbers.

Of the seventeen endemic curculionines known to be leafminers, six have been examined in detail. *Phorostichus linearis* (Broun) in *Astelia* and *Collospermum* shows the least amount of modification, in comparison with *Peristoreus* Kirsch, followed by *Peristoreus* (pending revision) *flavitaris* (Broun) in *Podocarpus totara*, *Hypotagea concolor* (Broun) in *Nothofagus*, *Notinus aucklandicus* Kuschel in *Coprosma* and *Nertera*, *Neomycta rubida* Broun in *Metrosideros*, and finally *Geochus tibialis* Broun in dead leaves of *Weinmannia* with only two cephalic setae remaining and with the endocarina extended posteriorly. The likeness of *Geochus*, in these respects, to the European *Rhamphus* Clairville and *Rhynchaenus* Clairville suggests that a similar cline may exist among leafminers in the Northern Hemisphere.

MATERIALS AND METHODS

Preservation. Larvae collected in the field should be kept temporarily in a substrate of damp soil or wood litter. Later, those not required for rearing or observation should be killed in a fixative solution such as PEA (petroleum ether, ethanol 95%, and glacial acetic acid in the proportions 1:10:2) or immersed for a few minutes in near-boiling water before storing in 75% ethanol.

Choice of specimens. Slide preparations of several larvae from each taxon need to be examined under high magnification before the mouthparts, spiracles, cuticle, and setae can be assessed. Submature larvae in the final instar are easier to work with than prepupal specimens in which the fat-body has accumulated.

Measurement. In any sample the body size of individuals shows variation and is subject to distortion in preservatives, so I have settled on maximum length and width as being the most meaningful statistic. The head capsule does not alter in size once hardened, and can be measured precisely across the widest part.

Mounting procedures. When possible, at least two specimens at a time are processed, as follows.

(1) Using a small, pointed scalpel (e.g., a mounted sliver of razor blade) the lower mouthparts are separated from the head but left attached to the prosternum.

(2) The head is removed, cutting through the oesophagus and taking care to retain the postoccipital condyles intact. The position of the ocelli should be noted since they will not be present after the clearing process (stage 6).

(3) In sizeable specimens the lower mouthparts may now be separated from the body; in very small specimens (head width 1.0 mm or less) they can be left in position.

(4) The mandibles are removed from the head capsule, helped if necessary by snipping the muscle attachments with corneal scissors through the occipital foramen. Heads less than 1.0 mm wide can be dissected in Euparal after clearing (May 1979c).

(5) Using corneal scissors, one specimen is cut along mid-dorsum and mid-venter, and the second specimen along mid-pleural lines, clipping across the anus. The halves are then pulled apart and the alimentary canal is removed intact.

(6) All parts except the alimentary canal are macerated in 10% potassium hydroxide solution until cleared, then washed in distilled water.

(7) As much fat as possible is removed from the alimentary canal without losing mycetomes, gastric caeca, or Malpighian tubules. Drawings are made at this stage, and the alimentary canal is then stored in alcohol.

(8) The skins are stained in chlorazol black solution diluted with 75% ethanol.

(9) All parts are transferred to 100% ethanol and then mounted directly into Euparal, using pellets of an inert substance such as modelling clay as spacers to support the coverslip above the head capsules. Both specimens can be mounted on the same slide by putting the heads plus mandibles under a 13 mm coverslip at one end and the cuticle halves plus mouthparts under an 18 mm coverslip centrally. Space is left for a label.

(10) Slides are dried at 30°C, and after 24 hours any marginal air spaces are filled with mountant.

Text conventions. The system for diagnosis is hierarchical. Characters defining a family are not repeated for lower taxa except where alternatives are offered. The system of nomenclature followed is substantially that of Thomas (1957).

The key to subfamilies is constructed on a basis of 90% shared attributes. In general, the couplets will hold true for the Australian Region but not necessarily for other regions; for instance, in some Nearctic and Neotropical Molytinae the labral tomiae are joined at the base (Kangas 1959, Rosado-Neto 1980).

The two-letter area codes used in collection data are as proposed by Crosby *et al.* (1976).

An asterisk means that some larvae in that particular collection were reared to the adult stage.

Specimens are deposited in the New Zealand Arthropod Collection at Mount Albert Research Centre, Auckland, unless otherwise indicated.

Nomenclature of plants follows *Flora of New Zealand* vol. 4 (Webb *et al.* 1988) and the revised edition of *Trees and shrubs of New Zealand* (Poole & Adams 1980).

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W.P. Thomas	W. Tang	

Morphological abbreviations

aa ambulatory ampulla	als anterolateral setae
ams anteromedian setae	ans anal spine
arl articulatory lobe	ats airtubes
av anterior ventriculus	c cornea
ca cuticle attachment	cd cardo
cf cuticle fold	cnp cryptonephridium
cs coronal suture	cv cardiac valve
dms dorsal malar setae	el endocarinal line
er epicranial ridge	f fulcrum
fb frontocranial bridge	fst frontal suture
gc gastric caeca	hb hypopharyngeal bracon
hg hind gut	hs hypopharyngeal sclerome
ia internal apodeme	ke keel
lig ligula	lma lateral muscle attachment
lrms labral setae	mas apical spine of mala
mes median epipharyngeal setae	
mm mandibular membrane	mr masticatory ridge
Mpto origin of Malpighian tubules	
o orifice	oc ocellus
oec oenocyte clusters	pg palpiger
plbs postlabial setae	pmsc premental sclerite
prv proventriculus	ps postlabial strut
pscl pseudoclypeus	pt peritreme
pv posterior ventriculus	pyg pygopod
rb rectal bracon	
rbm retractable basal membrane	
sc scrobe	scp scalpellum
so sensory organ	ss spiracular seta
st stipes	tr-cx trochanter-coxa
v verruca	vms ventral malar setae
→ anterior direction	

KEYS TO CURCULIONOIDEA LARVAE

(A) Families of Curculionoidea

- 1 Frontal suture not extending to mandibular membrane; antennae contiguous with frontal suture (Fig. 387, 398); postoccipital condyles usually present (Fig. 443) **Curculionidae** [→G]
—Frontal suture extending to mandibular membrane; antennae separated from frontal suture (Fig. 313, 336); postoccipital condyles absent (Fig. 25, 77) 2

- 2(1) Hypopharyngeal bracon with a complex median sclerome (Fig. 25); maxilla with articulatory lobes well developed (Fig. 30a); frons with more than 5 setae 3
—Hypopharyngeal bracon with sclerome, if present, simple; maxilla without articulatory lobes; frons with 5 or fewer setae 4

- 3(2) Head with frontoclypeal suture effaced; frons produced forwards to form a pseudoclypeus (Fig. 24); mandible with a diagonal masticatory ridge (Fig. 15); maxillary mala with lacinial spine at apex (Fig. 7); tentorial bridge entire **Nemonychidae** [→B]
—Head with frontoclypeal suture complete or partially effaced; frons not produced forward; mandible without a diagonal masticatory ridge; maxillary mala with lacinial spine below apex (Fig. 113) or absent; tentorial bridge subdivided laterally (except in *Bruchela*, Fig. 77) **Anthribidae** [→C]

- 4(2) Head retracted into thorax **Belidae** [→D]
—Head partially extrusible or free 5

- 5(4) Head retracted, longer than wide, with a posterior hyaline extension (Fig. 263); labrum with 4 primary setae; antennae 2-segmented **Attelabidae** [→E]
—Head free, subcircular, without posterior extension; labrum with 3 primary setae (except in *Antliarhininae*); antennae 1-segmented **Brentidae** [→F]

(B) Family Nemonychidae: larvae

- 1 Leg fully developed, 3- or 4-segmented, with a claw; articulatory lobe of maxilla bearing a major seta (Fig. 7a); epipharyngeal lining with 2 pairs of *mes* arranged longitudinally (Fig. 6)
..... **Nemonychinae** (*Nemonyx lepturoides*)
—Leg represented by a setose pedal papilla, or absent; articulatory lobe without setae; epipharyngeal lining with only the proximal pair of *mes* arranged longitudinally 2

- 2(1) Maxilla with a sclerotised palpiger (Fig. 17); pedal papilla 2-segmented **Doydirhynchinae** (*Cimberis*)
—Maxilla lacking a sclerotised palpiger; pedal papilla 1-segmented or absent **Rhinorhynchinae** .. 3

- 3(2) Antennae fully exposed (Fig. 24); labrum bearing 3 pairs of setae and a median, unpaired seta (Fig. 27); pedal papilla absent **Rhinorhynchini**
—Antennae partially overhanging or ventral, completely hidden from above (Fig. 34, 35); labrum bearing 4 pairs of setae (Fig. 36); pedal papilla present or absent 4

- 4(3) Labial palps strongly divergent, with distal segment displaced mesolaterally (Fig. 39a); premental sclerite not trapeziform; 1 or 2 vestigial eyespots present, in addition to primary ocellus; pedal papilla present (Fig. 61); Abd X bearing large, blunt, pigmented spines (Fig. 42) **Rhynchitomacerini**
—Labial palps not divergent or only slightly so, with distal segment not displaced; premental sclerite trapeziform (Fig. 49a); 3 vestigial eyespots present, in addition to primary ocellus; pedal papilla present or absent; Abd X without pigmented spines 5

- 5(4) Antennae ventral; Abd VIII spiracle lateral; Malpighian tubules 4 in number
..... **Rhynchitoplesiini** (*Rhynchitomacerinus*)
..... **Mecomacerini** (Neotropical element)
—Antennae frontal; Abd VIII spiracle dorsal; Malpighian tubules 6 in number (Fig. 21)
..... **Mecomacerini** (Australian element)

(C) Family Anthribidae: larvae

- 1 Labial palpi absent; tentorial bridge entire; ambulatory ampullae present on dorsum; Malpighian tubules purple **Urodontinae** (*Bruchela*)
—Labial palpi present; tentorial bridge divided laterally (Fig. 77); ambulatory ampullae absent; Malpighian tubules pallid 2

- 2(1) Abd spiracles bicameral (Fig. 84); Malpighian tubules 6 in number (Fig. 118) **Anthribinae** .. 3
—Abd spiracles unicameral (Fig. 180); Malpighian tubules 4 in number (Fig. 182) **Choraginae** .. 13

- 3(2) Head compressed posterolaterally and produced behind to form a fulcrum (Fig. 75, 76) 4
—Head evenly rounded, not produced (Fig. 87, 88) 8

- 4(3) Legs 2-segmented (Fig. 83) **Arecopais spectabilis**

- Legs 1-segmented or absent 5
- 5(4) Legs absent; lacinia and hypopharyngeal sclerome both absent. In grass culms *Euclodes suturalis*
—Legs 1-segmented (Fig. 136); lacinia present (Fig. 134); hypopharyngeal sclerome present (Fig. 135). In bark or dead wood 6
- 6(5) Mandible bearing 2 incisor teeth (Fig. 133); Abd IX bearing posteroventrally a single row of coarse spinules (Fig. 138) *Hoherius meinhertzhageni*
—Mandible bearing 3 incisor teeth (Fig. 103); Abd IX either bearing several rows of coarse spinules or uniformly spiculate 7
- 7(6) Head bearing 2 vestigial eyespots in addition to primary ocellus (Fig. 98, 99); Abd IX sternal fold uniformly spiculate *Dasyanthribus purpureus*
—Head bearing primary ocellus only (Fig. 140); Abd IX sternal fold bearing 3 or 4 rows of coarse spinules *Phymatus hetaera*
- 8(3) Epipharyngeal lining with proximal pair of *mes* aligned transversely (Fig. 91) 9
—Epipharyngeal lining with proximal pair of *mes* aligned longitudinally (Fig. 122) 11
- 9(8) Head dusky, darker on epicranium than on frons. In crustose lichen on wave-splashed rocks *Lichenobius*
—Head pallid or yellow brown. In dead wood 10
- 10(9) Mandibular mola raised to an acute tooth (Fig. 112); epipharyngeal lining without rows of dark setae between tormae; pronotal shield with a lateral, oblique band of thickening (Fig. 115); head bearing primary ocellus only *Garyus altus*
—Mandibular mola raised to a ridged grinding surface (Fig. 92); epipharyngeal lining with paired, comb-like rows of dark setae between tormae (Fig. 91); pronotal shield simple; head bearing 2 vestigial eyespots in addition to primary ocellus (Fig. 88) .. *Cacephatus*
- 11(8) Maxillary palps 2-segmented; labial palps 1-segmented (Fig. 124) *Helmoresus sharpi*
—Maxillary palps 3-segmented; labial palps 2-segmented 12
- 12(11) Maxillary and labial palps with proximal segment distinct (Fig. 156); lacinial spine wider, medially twice as wide as a lamellate seta (Fig. 156a) *Pleosporius bullatus*
- Maxillary and labial palps with proximal segment indistinctly defined; lacinial spine narrower, medially as wide as a lamellate seta (Fig. 167a) *Sharpius brouni*
- 13(2) Thoracic spiracle bicameral; legs absent; mandibles with 3 incisor teeth; Abd II–IV showing a row of plicae on prodorsal fold (Fig. 171) *Araecerus* .. 14
—Thoracic spiracle unicameral; legs 1-segmented; mandibles with 2 incisor teeth; Abd II–IV showing a rugose ridge on prodorsal (and postdorsal) fold 16
- 14(13) Head compressed posterolaterally and produced behind; Abd I lacking a prodorsal, transverse row of plicae (present on Abd II–V) *A. vieillardi*
—Head evenly rounded, not produced behind; Abd I with a prodorsal, transverse row of plicae (present on Abd I–V) 15
- 15(14) Larger species, up to 10 mm long . *A. palmaris*
—Smaller species, up to 5 mm long .. *A. fasciculatus*
- 16(13) Head evenly rounded, not produced behind; thoracic spiracle on mesothorax; Abd IX bearing a single row of coarse spinules on sternum *Dysnocyrtus inflatus*
—Head compressed posterolaterally and produced behind; thoracic spiracle intersegmental; Abd IX lacking a row of spinules on sternum *Notochoragus crassus*
- (D) Family Belidae: larvae**
- 1 Spiracles bicameral (Fig. 206); maxillary mala bilobate (Fig. 204) *Belinae* .. 2
—Spiracles unicameral (Fig. 260); maxillary mala not bilobate 3
- 2(1) Head capsule pallid; mandible bidentate apically (Fig. 203); labrum as long as wide, fringed (Fig. 202); occipital foramen closed behind (Fig. 199); pronotum pubescent on posterior half (Fig. 196); spiracles with short, non-annulate airtubes (Fig. 206) *Agathinus*
—Head capsule red-brown on anterior third; mandible tridentate apically (Fig. 214); labrum transverse, not fringed (Fig. 212); occipital foramen open behind (Fig. 210); pronotum not pubescent; spiracles with long, curved, strongly annulate airtubes (Fig. 217) *Pachyurinus*
- 3(1) Occipital foramen closed behind (Fig. 253); endocarinal line indistinctly bifurcate (Fig. 252); antennae 2-segmented, with basal membrane retractile (Fig. 254) *Aglycyderinae*

—Occipital foramen open behind (Fig. 243); endocarinal line very distinctly bifurcate (Fig. 242); antennae 1-segmented, with basal membrane not retractile **Oxycoryninae** .. 4

4(3) Abd I–V with dorsal ampullae; maxillary palps 3-segmented, with a palpiger (Fig. 227a); labrum with lateral tormae absent; epipharyngeal lining lacking a pear-shaped mesal sclerite (Fig. 225) . **Hydnorobius**
—Abd I–V without dorsal ampullae; maxillary palps 2- or 3-segmented, without a palpiger; labrum with lateral tormae present; epipharyngeal lining bearing a mesal pear-shaped sclerite 5

5(4) Head capsule with a curved, transverse ridge behind pigmented area (Fig. 232); endocarinal separation in front as wide as clypeus (Fig. 232); maxillary palps 3-segmented (Fig. 238) **Parallocorynus**
—Head capsule without a transverse ridge; endocarinal separation in front wider than clypeus (Fig. 242); maxillary palps 2-segmented (Fig. 248) **Rhopalotria**

(E) Family Attelabidae: larvae

1 Maxillary palps 2-segmented (Fig. 269); labium and postlabium fused (Fig. 269a); hypopharyngeal bracon absent. Living in box-shaped or thimble-shaped leaf rolls **Attelabinae** .. 2
—Maxillary palps 3-segmented; labium and postlabium not fused, separately sclerotised; hypopharyngeal bracon present. Living in various habitats **Rhynchitinae** .. 3

2(1) Anus subterminal, 4-lobed (1 large dorsal lobe, 3 smaller ventral lobes); spiracles with airtubes; body setae not mounted on tubercles **Attelabus**
—Anus ventral, 2-lobed (with a simple, transverse cleft); spiracles without airtubes (but present in 1st instar); body setae mounted on small tubercles .. **Apoderus**

3(1) Head and body strongly depressed. Leafminers **Eugnaptus**
—Head and body convex. Living in other habitats .. 4

4(3) Head with endocarinal line entire (Fig. 300); occipital foramen open behind (Fig. 301); maxillary mala without a lacinial tooth; Abd I–V lacking dorsal ampullae **Rhynchites**
—Head with endocarinal line forked (Fig. 277); occipital foramen closed; maxillary mala with a small lacinial tooth (Fig. 282); Abd I–V with paired dorsal ampullae 5

5(4) Head with hyaline posterior extension about one-third as long as epicranium (Fig. 288); epipharyngeal lining with *als* curving inwards away from margin (Fig. 292); thorax with prosternal sclerome present .. **Deporaus**

—Head with hyaline posterior extension about one-twentieth as long as epicranium; epipharyngeal lining with *als* parallel to margin (Fig. 280); thorax without a prosternal sclerome **Byctiscus**

(F) Family Brentidae: larvae

(Carinae and Eurhynchinae omitted)

1 Head with 5 *fs* (Fig. 310); Abd II–VI with 3 or 4 dorsal folds (Fig. 309); Abd VIII spiracle present; legs 2-segmented (Fig. 317) or absent **Brentinae** .. 2
—Head with 2–4 *fs* (Fig. 335, 355); Abd II–VI with 2 dorsal folds (Fig. 334); Abd VIII spiracle absent (except in *Nanodes*); legs absent or represented by a sclerotised plate (Fig. 343) 3

2(1) Legs 2-segmented (Fig. 317); mesothorax dorso-laterally with a rugose tubercle (Fig. 320); head lacking both endocarinal line and ocelli; anal cleft Y-shaped. **Lasiorhynchus barbicornis** (Brentinae)
—Legs absent, represented by 2 concentric sclerites (Fig. 332); mesothorax without a rugose tubercle; head with endocarinal line and 2 ocelli present; anal cleft X-shaped **Cylas formicarius** (Cyladinae)

3(1) Labrum bearing 4 setae or 1 seta (Fig. 339, 348); Abd II–VI with 7 *pds* (reduced in *Antliarhis*); anus 4-lobed **Antliarhininae** .. 4
—Labrum usually bearing 3 setae (Fig. 367); Abd II–VI with 2 *pds*; anus 2-lobed **Apioninae** .. 5

4(2) Setae minute; Abd II–VI with 2 *pds*; labrum with 1 seta; ocelli absent; maxillary palp 1-segmented (Fig. 351); head truncate behind (Fig. 346) **Antliarhis zamiae**
—Setae well developed; Abd II–VI with 7 *pds*; labrum with 4 setae; 2 ocelli present; maxillary palp 2-segmented (Fig. 342); head rounded behind (Fig. 335) .. **Tanaos interstitialis**

5(2) Abdominal spiracles bicameral (Fig. 372); labial palps cylindrical, extending above ligula (Fig. 370a) **Neocyba** sp.
—Abdominal spiracles unicameral (Fig. 362); labial palps papilliform, not extending above ligula (Fig. 360a) **Exapion ulicis**

(G) Family Curculionidae: larvae

- 1 Eggs placed ectophytically, in crevices, or in soil; larvae usually with *des3* in frontal suture (as in Fig. 474) or on frons (Fig. 506) **Brachycerinae** .. 2
—Eggs placed endophytically in prepared pits; larvae usually with *des3* on epicranial half (as in Fig. 644) 21
- 2(1) Legs present (Fig. 385, 393); head with 3 ocelli (Fig. 387); labrum with 4 *lrms*; alimentary canal with 4 Malpighian tubules **Ithycerus noveboracensis** (Ithycerini)
—Legs absent; head with 2, 1, or 0 ocelli; labrum with 3 *lrms* or more than 4; alimentary canal with 6 Malpighian tubules 3
- 3(2) Head with *fs5* much longer than *fs4* (Fig. 582); labial palps 1-segmented (Fig. 587a) **Hypera punctata** (Hyperini)
—Head with *fs5* subequal to or shorter than *fs4*; labial palps 2-segmented 4
- 4(3) Head with *des3* on epicranium (as in Fig. 572); pronotum deeply cleft medially and produced forwards to form a hood (Fig. 570); pleural intersegmental pockets present. Confined to *Eucalyptus* **Gonipterus scutellatus** (Gonipterini)
—Head with *des3* in frontal suture or on frons; pronotum entire, not produced forwards; pleural pockets absent. Not found on *Eucalyptus* 5
- 5(4) Antennal segment almost depressed (Fig. 398); Abd segments with prodorsal fold bearing as many setae as postdorsal fold (Fig. 395); epipharyngeal lining with setae in excess of modal numbers (Fig. 400); labrum with more than 4 setae **Brachycerus monachus** (Brachycerini)
—Antennal segment upstanding; Abd segments with prodorsal fold bearing fewer setae than postdorsal fold; epipharyngeal lining with setae in modal numbers or fewer; labrum with 3 or fewer setae 6
- 6(5) Antennal segment oval in cross-section **Entimini** .. 7
—Antennal segment circular in cross-section 16
- 7(6) Antennal segment strongly asymmetrical, with outer side produced (Fig. 497); epipharyngeal lining with median *ams* conspicuous, fang-like, stronger than *als* (Fig. 499); mandibles tridentate, with shorter seta proximad of the longer one (Fig. 500) **Sitona discoidea** (Sitonina)
—Antennal segment more or less symmetrical; epipharyngeal lining with median *ams* inconspicuous, usually weaker than *als*; mandibles unidentate or bidentate, the setae subequal or with shorter seta distad of the longer one 8
- 8(7) Head mainly pallid, deeply retracted into prothorax, with setae on anterior quarter only (Fig. 442, 463); thoracic spiracle ovate (Fig. 450, 470); mandibular setae subequal in length **Naupactina** .. 10
—Head pigmented, free, with setae on at least anterior half (Fig. 407); thoracic spiracle subcircular (Fig. 426); mandibular setae of unequal length 9
- 9(8) Th II/III with 2 *dls* (“alar setae” of Emden 1952) (Fig. 418); epipharyngeal lining with posterior and median *mes* pairs more or less equally separated (Fig. 422); alimentary canal without a ring of mycetomes around cardiac valve (Fig. 429) **Leptopiina** .. 13
—Th II/III with 1 *dls* (Fig. 473); posterior *mes* pair closer together than median pair (Fig. 478); alimentary canal with a ring of globular mycetomes around cardiac valve (Fig. 483) **Otiorhynchina** .. 15
- 10(8) Abd segments with minor *pds* pigmented, short, stout, spinous, particularly in younger larvae; mature larvae >10 mm long **Graphognathus leucoloma**
—Abd segments with minor *pds* pallid, slender; mature larvae <10 mm long 11
- 11(10) Antennal segment with apex wider than base, sides divergent (Fig. 444); maxilla without a group of spinules proximad of *dms* row (Fig. 448b); Abd II–V with *pds1* twice as long as *pds2*; anal lateral lobes without a strong seta **Asynonychus cervinus**
—Antennal segment with apex and base of similar width, sides parallel (Fig. 452, 457); maxilla with a group of hairlike spinules proximad of *dms* row (x100) (Fig. 453, 458); Abd II–V with *pds1* subequal to *pds2*; anal lateral lobes with 1 strong seta (Fig. 456) 12
- 12(11) Abd VIII with *pds3* half as long as adjacent setae (Fig. 456); maxilla with numerous spinules on inner surface (Fig. 453); Abd I with asperities on cuticle of prodorsal fold (Fig. 455); Th II with asperities between and behind *msts* (x100) (Fig. 454) **Atrichonotus minimus**
—Abd VIII with *pds3* about one-tenth as long as adjacent setae (Fig. 460); maxilla with few spinules on inner surface (Fig. 458); Abd I and Th II without asperities **Floresianus sordidus**

- 13(9) Abd IX with pleural lobes elongate, forming heavily sclerotised plates ventrally (Type B of Emden 1952), and dorsum reduced to a narrow triangle (Fig. 416); Abd II–VII ventrally with 2 rows of coarse spinules *Catoptes cuspidatus*
—Abd IX with pleural lobes enlarged and sclerotised but not elongate to form ventral plates (Type A of Emden 1952), and dorsum reduced to a broad triangle (Fig. 427, 439); Abd II–VII ventrally without rows of coarse spinules 14
- 14(13) Abd IX with pleural lobes rounded, and major seta in apical third (Fig. 427); anal lateral lobes with major seta strong *Brachyolus-complex; Irenimus compressus*
—Abd IX with pleural lobe sharply keeled dorsad, and major seta halfway between anterior margin and apex (Fig. 439); anal lateral lobes with both setae weak
..... *Mandalotus miricollis*
- 15(9) Abd V–VII with major spiracular seta on posterior fold caudad of spiracle (Fig. 473); Abd I–V with asperities on dorsal folds; hypopharyngeal bracon with maculae not extending along posterior margin (Fig. 475) *Otiorynchus sulcatus*
—Abd V–VII with major spiracular seta on middle fold, dorsad of spiracle (Fig. 484); Abd I–V without dorsal asperities; hypopharyngeal bracon with maculae extending along posterior margin (Fig. 486)
..... *Phlyctinus callosus*
- 16(6) Labrum with lateral *lrms* minute or absent (as in Fig. 508); antennae exposed *Rhytirhinini* .. 17
—Labrum with lateral *lrms* well developed (Fig. 551, 561); antennae concealed under frontal projection (except in *Rhadinosomus*) *Aterpini* .. 20
- 17(16) Spiracles surrounded anterodorsally by a dark crescentic area (Fig. 536); head dark brown, with blackish maculae (Fig. 527); Abd IX and X forming a pygopod (Fig. 526) *Listroderes difficilis*
—Spiracles without an anterodorsal dark area; head red-brown, without maculae; Abd IX and X not forming a pygopod 18
- 18(17) Spiracles with airtubes external, upstanding, acute (Fig. 516, 524); tormae joined in at least basal third (Fig. 520) *Steriphus diversipes lineata*
—Spiracles with airtubes internal; tormae convergent, not joined basally 19
- 19(18) Frons without endocarinal line; Abd with minor *pds* short, stout (Fig. 505); ventral folds simple
..... *Gromilus thoracicus*
—Frons with an endocarinal line (Fig. 539); Abd with minor *pds* minute, slender; ventral folds developed as ambulatory ampullae *Listronotus bonariensis*
- 20(16) Frons with 2 well developed *fs*, and endocarinal line vestigial or absent (Fig. 549); antennae partly concealed under frontal projection (Fig. 550); Abd VIII/IX with digitate projections (Fig. 548) *Anagotus helmsi*
—Frons with 5 well developed *fs*, and endocarinal line present (Fig. 559); antennae exposed (Fig. 560); Abd VIII/IX simple (Fig. 558) *Rhadinosomus acuminatus*
- 21(1) Antennae hemispherical (Fig. 593) 22
—Antennae pointed, broadly conical (as in Fig. 656) or narrowly conical (as in Fig. 677) 23
- 22(21) *Des3* in suture or on frons; larva often adapted for aquatic conditions *Eriirhinini*
—*Des3* on epicranium; larva not adapted for aquatic conditions *Ceutorhynchini*
- 23(21) Mouthparts with some setae branched (except in Sitophilini); tormae U-shaped, often joined (Fig. 1066) or quadrate (Fig. 1031) at base; pleural lobes subdivided (Fig. 1027, 1062) 24
—Mouthparts with setae simple; tormae separate or, if joined, not as above; pleural lobes entire 25
- 24(23) Head with endocarinal line absent; antennae exposed; labial palps 1-segmented; pronotal shield and Abd IX modified to perform a ‘holdfast’ function (as in Fig. 1027) *Platyopodinae*
—Head with endocarinal line present, antennae hidden; labial palps 2-segmented; pronotal shield and Abd IX unmodified *Rhynchophorinae*
- 25(23) Tormae joined or approximate at base or strongly convergent 26
—Tormae separate: subparallel, slightly convergent, bowed, or absent 27
- 26(25) Tormae joined at base with a distinct stem, Y-shaped (as in Fig. 627); Abd VIII spiracle lateral; anus 4-lobed *Curculioninae: Cryptorhynchini*
—Tormae joined at base without a distinct stem, V-shaped, approximate or strongly convergent; anus 6-lobed *Curculioninae: Eugnomini*

- 27(25) Abd II–V with 2 dorsal folds; labrum and clypeus fused (Fig. 738); tormae absent; Abd spiracles often unicameral (Fig. 743) **Curculioninae: Gymnetrini**
—Abd II–V with 3 or 4 dorsal folds; labrum and clypeus not fused; tormae present; Abd spiracles bicameral 28
- 28(27) Abd I–VI with more than 5 *pds*
..... **Curculioninae: Cleonini**
—Abd I–VI with 5 or fewer *pds* 29
- 29(28) Abd VIII spiracle on dorsum
..... **Curculioninae: Curculionini, Molytini**
—Abd VIII spiracle lateral 30
- 30(29) Ocelli 2 in number. Larvae inhabiting non-woody parts of angiosperms **Curculioninae: Baridini**
—Ocelli absent, or only 1 present. Larvae inhabiting woody plants 31
- 31(30) Frontal setae unequal in length (Fig. 899); endocarinal line absent **Curculioninae: Magdalini**
—Frontal setae subequal or unequal; endocarinal line usually present 32
- 32(31) Head with 4 *fs* (except Araucariini); 1 ocellus usually present; Abd IX with 2 *ds* **Cossoninae**
—Head with 5 *fs*; ocelli absent; Abd IX with 3 or 4 *ds* .
..... **Scolytinae**
- Tribe Cryptorhynchini: larvae**
- 1 Anus subdorsal (Fig. 611); mandibular mola raised, ridged for grinding (Fig. 616); head unpigmented except on margins 2
—Anus terminal; mandibular mola not raised or ridged; head pigmented or not 3
- 2(1) Epipharyngeal lining with *ams* on labral surface; hypopharyngeal bracon pigmented; alimentary canal with cardiac mycetomes (Fig. 620); bases of Malpighian tubules floriate (Fig. 620) ... **Psepholacina**
—Epipharyngeal lining with *ams* in situ; hypopharyngeal bracon clear; alimentary canal without cardiac mycetomes; bases of Malpighian tubules simple (Fig. 632) **Mitrastethus baridioides**
- 3(1) Thoracic spiracle subcircular 4
—Thoracic spiracle ovate (longer than wide) 8
- 4(3) Head pallid; Malpighian tubules thick (Fig. 673)
..... **Sympedius testudo**
—Head pigmented; Malpighian tubules slender 5
- 5(4) Head capsule oval in outline (sides straight); *fs1,2,3* and *des4* minute **Scelodolichus squamosus**
—Head capsule subcircular in outline (sides rounded); *fs* and *des* all well developed 6
- 6(5) Epipharyngeal lining with 2 single sensilli between distal *mes* pairs; alimentary canal with cardiac mycetomes; gastric caeca lamelliform, in a cluster of 3
..... **Paromalina vestita**
—Epipharyngeal lining with paired clusters of sensilli between proximal *mes* pairs; alimentary canal lacking cardiac mycetomes; gastric caeca absent
..... **Microcryptorhynchus** .. 7
- 7(6) Labral tormae with apex of stem rounded
..... **subgenus Microcryptorhynchus**
—Labral tormae with apex of stem bifurcate
..... **subgenus Notacalles**
- 8(3) Epipharyngeal lining with clustered sensilli between proximal *mes* pairs; posterior ventriculus with 1+3 or 1+4 coils 9
—Epipharyngeal lining with clustered sensilli between distal *mes* pairs or level with middle pair; posterior ventriculus with 1+1 coils 12
- 9(8) Head unpigmented except on margins; endocarinal line very short or absent; hypopharyngeal bracon clear 10
—Head pigmented; endocarinal line at least one-third as long as frons; hypopharyngeal bracon maculate 11
- 10(9) Mandibles with an acute molar tooth; labral tormae with apex of stem bifurcate; epipharyngeal lining with outer *als* in line on margin, directed forwards
..... **Pachyderis punctiventris**
—Mandibles without a molar tooth; labral tormae with apex of stem simple; epipharyngeal lining with outer *als* offset below margin, directed inwards
..... **Didymus impexus**
- 11(9) Mandibles with an acute molar tooth (Fig. 649); clypeal setae subequal in length; maxillary mala bearing 10+5 setae **Tychanus gibbus**
—Mandibles without a molar tooth; clypeal setae unequal in length; maxillary mala bearing 7+5 setae
..... **Clypeolus lachrymosus**
- 12(8) Maxillary mala bearing 9+5 setae; premental sclerite with posterior extension spatulate (Fig. 639a); lab-

- ral tormae with stem as long as arms or longer (Fig. 637)..... *Rhynchodes ursus*
 —Maxillary mala bearing 7+5 setae; premental sclerite with posterior extension acute; labral tormae with stem shorter than arms (as in Fig. 658) 13
- 13(12) *Pds1* shorter than *pds3* and *pds5* on Abd I–VIII .
 *Mecistostylus*
 —*Pds1* shorter than *pds3* and *pds5* on at least Abd I–V
 14
- 14(13) *Pds1* as long as *pds3* and *pds5* on Abd VIII only
 '*Acalles*' *dolosus*
 —*Pds1* as long as *pds3* and *pds5* on at least Abd VII and VIII 15
- 15(14) *Pds1* as long as *pds3* and *pds5* on Abd VII and VIII only *Indecentia*
 —*Pds1* as long as *pds3* and *pds5* on Abd VI–VIII
 *Crisius*, *Omoecalles*, *Hadracalles*

Tribe Eugnomini: larvae

- 1 Th II/III *pds* arranged short, long, short, long 2
 —Th II/III *pds* arranged short, short, long, long 8
- 2(1) Epipharyngeal lining with 4 pairs of *mes* (as in Fig. 719)..... 3
 —Epipharyngeal lining with 3 pairs of *mes* (as in Fig. 690)..... 5
- 3(2) Head convex, globose (Fig. 715); antennae narrowly conical; primary and secondary ocelli visible. Associated with *Hebe* *Oreocalus*
 —Head depressed, with sides straight or rounded; antennae broadly conical; primary ocelli alone visible. Not associated with *Hebe* 4
- 4(3) Head subquadrate. Associated with *Aciphylla*
 *Eugnomus*
 —Head subcircular. Associated with *Celmisia*
 **undescribed genus**
- 5(2) Labrum with sides straight, parallel (Fig. 708); maxilla with 12 *dms* (Fig. 711b) *Nyxetes*
 —Labrum with sides rounded (Fig. 689); maxilla with 6 or 7 *dms* 6
- 6(5) Head ovate (Fig. 687); labral tormae Y-shaped. Associated with *Nestegis* fruits *Gonoropteris*
 —Head subquadrate; labral tormae V-shaped if joined. Not associated with *Nestegis* 7

- 7(6) Head weakly depressed; maxilla with 6 *dms* (Fig. 731b); alimentary canal with all gastric caeca globose (Fig. 734) *Scolopterus*
 —Head strongly depressed; maxilla with 7 *dms* (Fig. 701b); alimentary canal with vermiform as well as globose gastric caeca (Fig. 704) *Hoplocneme*
- 8(1) Mandible ridged medially for grinding (Fig. 680); hypopharyngeal bracon pigmented; Abd I–VII spiracles unicameral (Fig. 684)..... 9
 —Mandible not ridged medially; hypopharyngeal bracon clear; Abd spiracles bicameral 10
- 9(8) Primary ocelli distinct; hypopharyngeal bracon block-pigmented (Fig. 676); epipharyngeal lining with *als* arranged longitudinally (Fig. 679); distal *mes* pair proximad of *ams* pairs (Fig. 679)... *Ancistropterus*
 —Primary ocelli absent; hypopharyngeal bracon with paired maculae on posterior margin; epipharyngeal lining with *als* arranged in a cluster anteriorly; distal *mes* pair on margin between *ams* pairs *Rhopalomerus*
- 10(8) *Fs1,2,3* well developed *Stephanorhynchus*
 —*Fs1,2,3* minute 11

- 11(10) Alimentary canal with all gastric caeca globose..
 *Pactolotypus*
 —Alimentary canal with vermiform as well as globose gastric caeca *Pactola*

Tribe Curculionini: larvae

- 1 Head free, rounded behind; coronal suture as long as frons; *des1* present (Fig. 746) 2
 —Head partially retracted, excavate behind; coronal suture shorter than frons or absent; *des1* obsolete 4
- 2(1) Cuticle asperate in transverse, linear series (as in Fig. 784); pedal area with 1 major seta (Fig. 752)
 *Peristoreus grossus*
 —Cuticle coarsely, randomly spiculate; pedal area with 2 major setae 3
- 3(2) Head unpatterned; Th II/III with 4 *pds*; labrum with lateral setae one-third as long as anterior setae (Fig. 758) *Aneuma compta*
 —Head with pallid paramedian stripes; Th II/III with 3 *pds*; labrum with lateral setae subequal in length to anterior setae (Fig. 769) *Phorostichus linearis*
- 4(1) Coronal suture present (Fig. 778); labrum with 3 pairs of setae; endocarina not extended posteriad 4

- *Hypotagea concolor*
 —Coronal suture obliterated; labrum with 2 pairs of setae; endocarina extended posteriad 5
- 5(4) Head with *des3* present; spiracles of Abd VIII on produced dorsal lobe (Fig. 788, 797); endocarinal extension short (Fig. 789) *Neomycta rubida*
 —Head with *des3* obsolete; spiracles of Abd VIII lateral; endocarinal extension elongate, reaching level with posterior angles of epicranium (Fig. 801)
 *Geochus tibialis*
- Tribe Molytini: larvae**
- 1 Abd VIII dorsum modified into a siphonate breathing tube *Notonesius aucklandicus*
 —Abd VIII not as above 2
- 2(1) Head pallid; labrum ovate, longitudinal (Fig. 854); hypopharyngeal bracon totally pigmented (Fig. 852) 3
 —Head usually pigmented; labrum trilobate, transverse; hypopharyngeal bracon maculate or clear 8
- 3(2) Antennae broadly conical; maxilla with 2 setae on palpifer and 7 dorsal malar setae (*dms*) 4
 —Antennae narrowly conical (Fig. 853); maxilla with 3 setae on palpifer and 10 *dms* (Fig. 857) 5
- 4(3) Abd spiracles bicameral; Abd VIII spiracle dorsal; alimentary canal 1+3-coiled *Phronira*
 —Abd spiracles unicameral; Abd VIII spiracle lateral. Alimentary canal 1+4-coiled *Exeiratus*
- 5(3) Epicranium with *des4* one-third as long as *des2*; labrum with lateral seta half as long as anterior seta; alimentary canal with 10–12 gastric caeca; cardiac mycetomes absent *Cuneopterus*
 —Epicranium with *des4* minute, less than one-third as long as *des2*; labrum with lateral seta one-third or less as long as anterior seta; alimentary canal with 5 or fewer gastric caeca; cardiac mycetomes present.. 6
- 6(5) Head with endocarinal line indistinct; both anterior and posterior ocelli distinct *Dolioceuthus*
 —Head with endocarinal line distinct; posterior ocelli faint or absent 7
- 7(6) Alimentary canal 1+1-coiled, with 5 elongate gastric caeca and 6 cardiac mycetomes *Astyplus*
 —Alimentary canal 1+2-coiled, with 1 or 2 elongate gastric caeca and 8–10 cardiac mycetomes (Fig. 860)
 *Phrynixus*
- 8(2) Head pallid, with *fs1,2,3* well developed (Fig. 841); Abd VIII spiracle lateral; alimentary canal 1+3-coiled (Fig. 849) *Paedaretus*
 —Head red-brown, with *fs1,2,3* minute; Abd VIII spiracle dorsal; alimentary canal 1+1-coiled 9
- 9(8) Th II/III *pds* arranged short, short, long, short; Abd *pds* with 1 major seta; maxilla with 10 *dms*; Abd VII spiracle larger than Abd I–VI spiracles. Associated with ferns 10
 —Th II/III *pds* arranged short, short, long, long (Fig. 820); Abd *pds* with 2 major setae (Fig. 820); maxilla with 7 *dms*; Abd VII spiracle subequal to Abd I–VI spiracles. Not associated with ferns 11
- 10(9) Head dark red-brown; *des3* in suture *Megacolabus*
 —Head yellow-brown; *des3* on epicranium *Rystheus*
- 11(9) Head with *fs4* shorter than *fs5* (Fig. 821); endocarinal line distinct (Fig. 821); ocelli absent.; antennae broadly rounded (Fig. 822) *Arecophaga*
 —Head with *fs4* subequal to or longer than *fs5*; endocarinal line short, faint (Fig. 831); anterior ocelli distinct; antennae acutely conical (Fig. 832) 12
- 12(11) Spiracles pear-shaped, with airtubes narrowed towards apex *Lyperobius*
 —Spiracles ovate, with airtubes of even width
 *Hadramphus, Karocolens*
- Subfamily Cossoninae: larvae**
- 1 Frons with *fs1* absent (as in Fig. 940); Abd III–VI with 4 dorsal folds (as in Fig. 939); Th II/III with 3 *pds*; Abd I–VII with 4 *pds* 2
 —Frons with *fs1* present or absent; Abd III–VI with 3 or 4 dorsal folds; Th II/III with 4 *pds*; Abd I–VII with 5 *pds* 10
- 2(1) Head partially retracted (as in Fig. 928); epicranial ridge indistinct or absent 3
 —Head free; epicranial ridge distinct (Fig. 940) 5
- 3(2) Endocarinal line absent; hypopharyngeal bracon pigmented *Pentarthrum*
 —Endocarinal line present or absent; hypopharyngeal bracon clear 4
- 4(3) Endocarinal line absent; maxillary and labial palps each with a large apical papilla; prosternum sclerotised
 *Heteropsis*

- Endocarinal line present; maxillary and labial palps without a large apical papilla; prosternum not sclerotised *Euophryum*
- 5(2) Endocarinal line present; alimentary canal without gastric caeca *Proconus*
 —Endocarinal line absent; alimentary canal with gastric caeca present 6
- 6(5) Hypopharyngeal bracon entirely pigmented
 *Torostoma*
 —Hypopharyngeal bracon clear 7
- 7(6) Major setae very long; labral tormae bowed; alimentary canal with about 20 gastric caeca 8
 —Major setae moderate; labral tormae parallel; alimentary canal with 10 or fewer gastric caeca 9
- 8(7) Head with *des3* in frontal suture (Fig. 940); frons with medially peaked colour pattern (Fig. 940); labrum evenly rounded (Fig. 942) *Arecocryptus*
 —Head with *des3* on epicranium; frons unpatterned; labrum trilobate *Toura*
- 9(7) Abd II–VI with dorsal folds 2 and 4 plicate; clypeal setae equal in length; labral tormae parallel, distally expanded *Tanysoma*
 —Abd II–VI with dorsal folds 2 and 4 simple; clypeal setae unequal in length; labral tormae convergent, slender *Agastegnus*
- 10(1) Abd III–VI with 3 dorsal folds 11
 —Abd III–VI with 4 dorsal folds 13
- 11(10) Head pallid; hypopharyngeal bracon maculate
 *Inosomus*
 —Head pigmented; hypopharyngeal bracon clear . 12
- 12(11) Frons with *fs1* absent; clypeal setae unequal in length (Fig. 921); labral tormae meeting at base (Fig. 922); alimentary canal with gastric caeca few (around 5) (Fig. 927) *Eiratus*
 —Frons with *fs1* present; clypeal setae equal in length; labral tormae not meeting at base; alimentary canal with gastric caeca numerous (around 20) *Xenocnema*
- 13(10) Frons with *fs1* present; mouthparts modified for xylophagy (Fig. 911–913); postlabium with posterior *plbs* pair closer together than middle pair (Fig. 914a); Th spiracle ovate, larger than Abd spiracles (Fig. 916) *Mesites*
- Frons with *fs1* absent; mouthparts (except mandible) not modified for xylophagy; postlabium with posterior *plbs* pair wider apart than middle pair; Th spiracle circular, similar in size to Abd spiracles 14
- 14(13) Head pallid; hypopharyngeal bracon clear; spiracles without airtubes *Unas*
 —Head pigmented; hypopharyngeal bracon entirely pigmented; spiracles bicameral 15
- 15(14) Head with epicranial ridge present; endocarinal line absent; Th II/III with 2 *msts* (Fig. 956); spiracular airtubes simple (Fig. 957) *Pachyops*
 —Head without an epicranial ridge; endocarinal line present, short; Th II/III with 1 *msts*; spiracular airtubes annulate *Phloeophagosoma*
- ### Subfamily Scolytinae: larvae
- 1 Postlabium with posterior pair of *plbs* closer together than middle pair (setae of each side forming a triangle, as in Fig. 975a) 2
 —Postlabium with posterior pair of *plbs* wider apart than middle pair (setae of each side in a straight line) . 8
- 2(1) Frons with 6 *fs* (Fig. 1019); mandibles unidentate, with cutting edge chisel-shaped (Fig. 1023); epipharyngeal lining with 1 group of sensilli, in front of proximal *mes* pair (Fig. 1022) *Scolytus multistriatus*
 —Frons with 4 or 5 *fs*; mandibles with 2–4 teeth; epipharyngeal lining with 2 groups of sensilli, in front of and behind proximal *mes* pair (Fig. 1003) 3
- 3(2) Frons with 4 *fs* (*fs1* absent) (Fig. 970); Th I–III with 2 *msts* (Fig. 976); spiracles without airtubes (Fig. 977); anus subdorsal (Fig. 969) *Chaetoptelius mundulus*
 —Frons with 5 *fs*; Th I–III with 1 *msts*; spiracles with or without airtubes; anus subdorsal or terminal 4
- 4(3) Mouthparts adapted for xylophagy (Fig. 1002–1004); maxillary mala truncate, with 13 *dms* (Fig. 1005b); anus subdorsal (Fig. 999); gastric caeca absent *Pachycotes peregrinus*
 —Mouthparts not adapted for xylophagy; maxillary mala rounded, with 7 *dms*; anus terminal; gastric caeca present 5
- 5(4) Labral tormae joined widely at base (Fig. 983); mandibles with 1 seta; gastric caeca flask-shaped, 3 or 4 on either side (Fig. 988) *Dendrotrupes costiceps*
 —Labral tormae separate or joined narrowly and tenuously at base; mandibles with 2 setae; gastric caeca vermiform, in excess of 20 arranged randomly 6

- 6(5) Head partially retracted, longer than wide (Fig. 1008); epistoma simple; Th II/III with 3 *pds*; Abd I–VIII with 4 *pds* *Phloeosinus cupressi*
 —Head free, subglobose; epistoma with a distinct, medially situated tubercle; Th II/III with 4 *pds*; Abd I–VIII with 5 *pds* 7
- 7(6) Frons bearing a pair of dark, low tubercles paramedially; labral tormae subparallel
 *Hylurgus ligniperda*
 —Frons without paramedial tubercles; labral tormae in older larvae curving to meet tenuously at base (Fig. 993) *Hylastes ater*
- 8(1) Head partially retracted, longer than wide; antennae differentiated into stem and club *Cryphalus waplери*
 —Head free, subglobose; antennae not differentiated 9
- 9(8) Epipharyngeal lining with 6–10 *mes* pairs; cuticle of frons sculptured *Ips grandicollis*
 —Epipharyngeal lining with 2 or 3 *mes* pairs; cuticle of frons simple *Xyleborinus saxeseni*

Subfamily Platypodinae: larvae

- 1 Abd IX without mediobasal armature (Fig. 1058); pronotal pattern of incomplete circles not joined by a posterior line (Fig. 1056); labral lobes separated by shallow notches (Fig. 1053); spiracles of Abd VI/VII without an airtube (Fig. 1059) *Platypus gracilis*
 —Abd IX with mediobasal armature (Fig. 1042, 1047); pronotal pattern of incomplete circles joined by a posterior line (Fig. 1034, 1046); labral lobes separated by narrow incisions (Fig. 1031, 1045); all spiracles with a single airtube 2
- 2(1) Abd IX declivity pigmented and with a blunt, rugose keel mediobasally (Fig. 1047); pronotal pattern with posterior line extended mesad (Fig. 1046); head capsule with cuticle nodulate; proventriculus asymmetrical (Fig. 1049) *P. caviceps*
 —Abd IX declivity pallid, with a hooked tubercle mediobasally (Fig. 1042); pronotal pattern with posterior line not extended mesad (Fig. 1034); head capsule smooth; proventriculus symmetrical *P. apicalis*

Subfamily Rhynchophorinae: larvae

- 1 Postlabium with posterior pair of *plbs* as far apart as middle pair; Th II/III with 2 *pds*; labial palps 1-segmented *Dryophthorus*
 —Postlabium with posterior pair of *plbs* closer together than middle pair; Th II/III with 3 or 4 *pds*; labial palps 2-segmented 2

- 2(1) Th II/III with 4 *pds*; maxillary mala with *dms* branched (Fig. 1068b); Abd VIII/IX depressed on dorsum (Fig. 1062) . *Sphenophorus brunnipennis*
 —Th II/III with 3 *pds*; all setae on mouthparts simple; Abd VIII/IX convex on dorsum (Fig. 1074)
 *Sitophilus* .. 3
- 3(2) Hypopharyngeal bracon clear; Abd segments lacking a distinct seta on ventropleural lobe *S. oryzae*
 —Hypopharyngeal bracon with paramedian maculae on posterior margin; Abd segments with *vpls* present or absent 4
- 4(3) Abd segments each with 1 ventropleural seta distinct *S. granarius*
 —Abd segments lacking ventropleural setae *S. zeamai*

DESCRIPTIONS

Family NEMONYCHIDAE

Body usually slender, less than 10.0 mm long, with 2 dorsal folds on abdominal segments often rendered indistinct by the presence of ambulatory ampullae.

Head free or partially retracted, depressed, subtruncate behind; ecdysial line effaced; coronal suture shorter than endocarinal line or effaced; frontal suture narrow, open in front, reaching articulatory membrane of mandibles; clypeus fused with frons, forming a pseudoclypeus; 1 primary ocellus and up to 3 vestigial eyespots present on either side (absent in *Nemonyx*). Antennae 1-segmented, broadly conical, on a basal membranous cushion. Mandibles with incisor section 2- or 3-dentate, molar section expanded, sometimes produced proximally and provided with a diagonal masticatory ridge; inner surface concave; 2 setae aligned longitudinally. Labrum transverse, subtruncate, with either 4 paired setae or (Rhinorhynchini) 3 paired setae and a median unpaired seta; a basal sensillus on either side. Tormae visible as lateral thickenings, or absent. Epipharyngeal lining with proximal pair of median setae always arranged longitudinally. Hypopharyngeal bracon bearing a complex median sclerome. Maxilla with or without a sclerotised palpiger; palps 3-segmented, with median and distal segments each bearing a small seta; mala subtruncate, its inner angle minutely spined or rounded. Labial palpi 2-segmented. Articulatory lobes present between submentum and stipes.

A functional spiracle on mesothorax and a vestigial one on metathorax. All spiracles circular, with paired, annulate airtubes. Legs well developed in *Nemonyx*, otherwise represented by 1- or 2-segmented papillae, or absent.

Alimentary canal with proventriculus short; mycetomes lacking around cardiac valve; anterior ventriculus occupying three-quarters of body length, the narrower posterior section not coiled below Z-bend; gastric caeca absent; Malpighian tubules 4 or 6 in number, usually coloured purple and visible through cuticle; cryptonephridium weakly developed; rectal bracon not visible.

Remarks. The diagnosis is based on larvae of *Rhinorhynchus* Sharp from New Zealand and *Mecomacer* Kuschel and *Rhynchitomacer* Voss from Chile, described herein; plus *Nemonyx* Redtenbacher from Europe and *Cimberis* des Gozis from North America, which are redescribed. Two other Chilean genera, three from Brazil, and six from Australia have also been taken into account.

The family Nemonychidae comprises a group of primitive weevils, most nearly allied to Anthribidae, whose world distribution follows the natural occurrence of the plants with which its members are associated. The majority of species are pollen-feeders, the larvae developing in the male inflorescences of Araucariaceae, Pinaceae, Podocarpaceae, and Fagaceae. Exceptions are *Cimberis elongatus* (Leconte), reported to be a secondary invader of damaged jack pine (*Pinus banksiana*) shoots (Thomas & Herdy 1961), and *Nemonyx lepturoides* (Fabricius), which is named as a pest of fodder crops in north-eastern Europe, feeding on *Delphinium* (Ranunculaceae) (Ter-Minassian 1984).

The earliest information on larvae comes from Perris (1856), who studied "*Diodirhynchus*" *attelaboides* Fabricius and *D. austriacus* Schoenherr from maritime pine (*Pinus pinaster*) in Europe. Perris discussed the head and mouthparts in some detail but the body only in general terms. He made some perceptive observations on oviposition, feeding, and pupation.

Later systematic work on nemonychid larvae was based on Anderson's (1947b) description of *Cimberis pilosus* (Leconte) from North America. The genus is included in 'Larvae of some genera in Anthribidae', where Anderson erected a provisional subfamily, Cimberinae, to receive it. Crowson (1955) based the secondary portions (referring to larvae) of couplets 1 and 2 of his 'Key to the families of Curculionoidea' on this same species.

In 1984 Ter-Minassian described the larva of *Nemonyx lepturoides* (Fabricius) from the Ukraine. Crowson (1985) questioned the systematic position of *Nemonyx* alongside the other genera in Nemonychidae on the basis, as regards

larvae, of Ter-Minassian's figures. My own observations do not support any such sharp divergence. Thoracic legs throughout the family are highly variable. Those of *Nemonyx* certainly show the most complete development, but others range through two-segmented papillae in *Cimberis*, one-segmented papillae in *Notomacer* Kuschel, and a condition indicated by sensilli only as in *Rhinorhynchus* Sharp.

The structure of the *Nemonyx* head capsule is autapomorphic for Nemonychidae, in which the clypeus is not separated from the frons by a suture as it is in Anthribidae and in all other Curculionoidea. Instead, the frons, along with its epistoma, is extended forwards to form a 'pseudo-clypeus'. This character is mentioned in Ter-Minassian's text (in Russian) but is not clear in the accompanying fig. 11. The labrum, with four setae on either side and with basal sensilli (not shown in fig. 9), is characteristic of all groups except tribe Rhinorhynchini.

Pollen-feeding in Nemonychidae. The mouthparts of nemonychid larvae are adapted to feeding on pollen. The mechanics of ingesting the grains are similar in principle to those displayed by *Palophagus* Kuschel, a chrysomeloid beetle associated with *Araucaria* in Australia (Kuschel & May 1990). The sporangia of the male strobili are pierced by the acutely tipped mandibles, then the maxilla is used to sweep in the pollen. The well developed articulatory lobe between labium and maxilla allows considerable flexibility for this purpose. Most of the pollen grains in the gut have been split open, and since the proventriculus lacks armature, the crushing process must be performed between the mandibular mola and the hypopharyngeal sclerome. The mola is provided with a 'masticatory ridge' (a term used by Ter-Minassian 1984), which is toothed or crenate in varying degree according to the type of pollen consumed. *Cimberis* feeding on the soft-walled pollen of *Pinus*, for instance, has a more or less simple ridge, whereas species of *Rhynchitomacerinus* Voss feeding on *Nothofagus* pollen are provided with well developed denticles.

Subfamily NEMONYCHINAE

Genus *Nemonyx* Redtenbacher

Nemonyx Redtenbacher, 1845: 96.

Type species *Rhinomacer lepturoides* Fabricius.

Body robust, strongly curved, widest at thorax, tapering; abdominal segments with 2 distinct dorsal folds; thoracic segments bearing 3-segmented, clawed legs. Setae exceeding modal numbers for Curculionidae.

Head free; coronal suture distinct; ocelli apparently absent; endocarinal line present; frontoclypeal suture effaced, forming a pseudoclypeus of typical form for the family. Antennae placed ventrally, beneath a frontal projection. Mandibles acutely bifid; masticatory ridge slightly crenate. Labrum indistinctly joined to clypeus, rounded, bearing 4 paired setae and paired basal sensilli. Tormae absent. Maxilla lacking a sclerotised palpiger; mala bearing strong setae and, on its inner angle, a short, robust spine. Premental sclerite narrow, with simple margins.

Legs on Th I/II consisting of basal lobe, femur, and tibiotarsus tipped by a sclerotised, non-setose claw; legs of Th III equipped with a narrow additional segment between basal lobe and femur.

Spiracle of Abd VIII lateral. Abd IX unmodified, bearing strong dorsal setae. Anus ventral. Alimentary canal not examined.

***Nemonyx lepturoides* (Fabricius)**

lepturoides Fabricius, 1801: 429 (*Rhinomacer*).

Fig. 1–10

Maximum dimensions 6.0×2.0 mm; head width 1.0 mm. Body creamy yellow, widest at thorax. Cuticle smooth. Setae fine, pallid, short. Head yellow-brown, unpatterned; articulation points and mandibles red-brown; sides rounded, almost truncate behind; frontal suture indistinct; coronal suture shorter than endocarinal line, in ratio of 5:8; ocelli absent. Epipharyngeal lining with *als* and *ams* moderately long; 2 pairs of *mes*, arranged longitudinally. Postlabium with a minute seta on margin of sclerite, a large seta on mentum, and a seta laterally displaced on articulatory lobe.

Material examined. U.S.S.R.: Polterskaya, on *Delphinium consolida*, 9 Aug 1939, 1 larva (loaned by M. Ter-Minassian). CZECHOSLOVAKIA: Sturovo, Hegyfarok, in seed capsules of *Consolida regalis*, 6 Jul 1988, 12 larvae and damaged seed capsules, PS.

Biology (from P. Švácha, pers. comm.). The adults of *N. lepturoides* are found on *Consolida regalis* (larkspur, previously in genus *Delphinium*) in summer, mainly June and July, flying around, copulating, and feeding on the host plant. They were chewing into the anthers rather destructively to eat the pollen. They also punctured the ventral spur of the corolla, to imbibe the nectar. The eggs are inserted into the young capsules and the larvae feed on the developing seeds. There is absolutely no connection with pollen. The larvae must grow in the same time – from 2 to 3 weeks – that it takes the seeds to mature. When the capsule splits

open they fall to the ground, where their legs are used for clasping and locomotion. They burrow in the soil to make a spherical cocoon in which to overwinter as prepupae. There appears to be only one generation a year.

Subfamily DOYDIRHYNCHINAE

Any diagnosis for this subfamily must remain limited until representatives of other genera are known. Key characters emerging from *Cimberis* are (1) the presence of a sclerotised palpiger on the maxilla (Fig. 16), and (2) the two-segmented pedal papillae (Fig. 18).

Genus *Cimberis* des Gozis

Cimberis des Gozis, 1881: 150.

Type species *Rhinomacer attelaboides* Fabricius.

Body slender, of even width. Abdominal segments with 2 dorsal folds, and with small ampullae on prodorsal fold of Abd I–VI; legs represented by 2-segmented papillae. Abd VIII/IX bristled ventrally. Setae exceeding modal numbers for Curculionidae.

Head free, widest behind middle; coronal and frontal sutures distinct; ocelli comprising 1 primary unit and 3 vestigial, one of them lateral near *des5*, one dorsal, and one ventral to this. Antennae partially hidden, projecting forwards. Mandibles apically bifid, with a median lobe; molar section expanded ventrad as well as mesad; masticatory ridge simple. Labrum rounded. Tormae absent. Maxilla bearing a sclerotised palpiger below the 3 palpal segments; inner angle of mala minutely bispinose. Premental sclerite narrow, obsolete medially.

Abd IX convex; dorsum and venter of equal length. Anus terminal, 4-lobed. Alimentary canal with 6 Mpts, coloured purple but fading in alcohol.

***Cimberis comptus* (LeConte)**

comptus LeConte, 1876: 2 (*Rhinomacer*).

Fig. 11–20

Maximum dimensions 4.5×1.0 mm; head width 0.7 mm. Setae pallid, moderately long. Pronotal shield pale yellow. Head yellow-brown, unpatterned, more reddish in front; endocarinal line one-third as long as frons; vestigial ocelli indistinct.

Material examined. U.S.A.: California, Napa Co., 3 km NNE of Angwin, ex male cones of *Pinus sabiniana*, 20 May 1981, 42 larvae, HBL.

Remarks. Larvae taken by H.B. Leech from *Pinus ponderosa* at the same locality in California, although very similar to *C. comptus*, may represent *Lecontellus* Kuschel or *Acromacer* Kuschel. Their larger size (7.0×1.5 mm, head width 1.0 mm) and host plant preference accord with the adults of either genus. By comparison with *C. comptus* larvae, the head and setae are more reddish and the anal lateral lobes are somewhat expanded.

These larvae were observed by the collector to crawl in the usual position, on the venter. Approximately 50% of the specimens were parasitised by a solitary hymenopterous larva, visible through the cuticle.

***Cimberis pilosus* (LeConte)**

pilosus LeConte, 1876: 2 (*Rhinomacer*).

Fig. 21, 22

Maximum dimensions 4.5×0.85 mm; head width – 3rd instar 0.65 mm, 2nd 0.45 mm, 1st 0.30 mm. Setae pallid, slender; bristles reddish. Pronotal shield pale yellow. Head yellow, with articulation points blackish; endocarinal line one-third as long as frons; vestigial ocelli faint, the dorsal one often obsolete. Alimentary canal of typical form, with 6 Malpighian tubules coloured pink, pallid at base.

Egg dimensions 0.78×0.38 mm.

Material examined. U.S.A.: Virginia, Clifton, ex male cones of *Pinus virginiana*, 26 Apr 1933, 3 larvae, JCB. CANADA: Ottawa, ex *Pinus banksiana*, May–Jun 1984, 9 larvae, eggs, adults, ATH.

Biology. In Ottawa, oviposition was observed during May when *Pinus banksiana* (jack pine) was beginning to shed pollen. The eggs were placed beneath the cone scales (Fig. 22). By mid June the cones were supporting an abundance of larvae feeding on the pollen (A.T. Howden, pers. comm.).

Cimberis elongatus (LeConte) on *P. banksiana* in the Lake Nipigon area of Ontario display a somewhat different biology, according to Thomas & Herdy (1961). Although the adults feed on the male cones, the eggs are deposited in shoots damaged by bark beetles and in old staminate clusters in such shoots. Newly hatched larvae feed first in the needles enclosed in the fascicle sheath or in the buds, hollowing them out. They then bore into the stem, working downwards. Mature larvae drop from the shoots in mid August to overwinter in the soil as prepupae. Pupation, taking 15–20 days, begins almost a year later, in July, but the adults remain in the soil for another winter to emerge in early spring. The authors state that, in general, the larva of *C. elongatus* agrees with Anderson's (1947b) generic des-

cription based on *C. pilosus*.

Cimberis attelaboides (Fabricius) in Europe was reared in May 1992 from eggs laid by females beaten from male strobili of *Pinus sylvestris*. The larvae reached maturity in a glass vial, feeding on pollen (P. Svácha, pers. comm.). The larvae I examined (2× 1st-instar, 2× 2nd, 3× 3rd) have a more deeply pigmented head capsule than *C. comptus* or *C. pilosus* but are similar in other respects, including dimensions.

Remarks. The collection from Virginia, loaned to me by the British Museum (Nat. Hist.), bears the same data as that given by Anderson (1947b) in the original description except for the date, 9 May 1933.

Doydirhynchus austriacus Olivier is sympatric with *C. attelaboides* on *Pinus* in Europe. The one mature specimen I have examined has similar pedal papillae and general conformation to *Cimberis*, but is distinguished from *C. attelaboides* by its paler head and by having fewer and paler setae.

Subfamily RHINORHYNCHINAE

Head capsule bearing 1–3 vestigial eyespots, in addition to primary ocellus. Antennae dorsal, frontal (fully exposed or partially overhung), or ventral (completely hidden from above). Maxilla lacking a sclerotised palpiger. Articular lobe of maxilla without a seta. Epipharyngeal lining with proximal pair of *mes* arranged longitudinally. Postlabium with 2 pairs of setae. Legs represented by a 1-segmented papilla, or absent. Malpighian tubules 4 or 6 in number.

Remarks. The Rhinorhynchinae represent the Gondwana element of family Nemomychidae. As indicated by the diagnosis, the larvae show considerable diversity. Nevertheless they are all pollen-feeders, *Rhynchitomacer* Voss on *Nothofagus*, the others on *Araucaria* or various podocarps. A larva of each of the four tribes is described.

Tribe Rhinorhynchini

Genus *Rhinorhynchus* Sharp

Rhinorhynchus Sharp, 1882: 88.

Type species *Rhinomacer rufulus* Broun.

Body slender, conspicuously segmented; pedal papillae absent; Abd segments with 2 dorsal folds distinct; ambulatory ampullae developed mediosternally; body terminating in a pygopod. Setae inconspicuous, fewer than modal numbers for Curculionidae.

Head partially retracted; coronal and frontal sutures distinct; primary ocellus large, with a raised cornea; 1 or 2 minute, vestigial eyespots present. Antennae fully exposed, frontal. Mandibles bifid, with margin of incisor section serrate; mola produced ventrally; masticatory ridge minutely crenate. Labrum bearing 3 pairs of setae and, medially on margin, an unpaired seta. Tormae absent. Postlabium with 2 pairs of setae. Premental sclerite a narrow band. Mala with inner angle rounded, bearing a strong, short seta.

Abd IX convex, much longer dorsally than ventrally. Anus ventral, 3-lobed; lateral lobes expanded to form a pygopod; dorsal lobe small. Alimentary canal of typical form, with 4 Malpighian tubules.

Rhinorhynchus rufulus (Broun)

rufulus Broun, 1880: 467 (*Rhinomacer*).

Fig. 23–32

Maximum dimensions 3.5×0.75 mm; head width 0.3 mm. Body orange-pink when mature (fading in ethanol). Cuticle minutely shagreened. Setae short, slender, pallid. Pronotal shield dusky brown. Head pale red-brown; endocarinal line half as long as frons. Labrum unpigmented; lateral seta much shorter than discal seta. Alimentary canal with Malpighian tubules dull purple, pallid at base.

Material examined. NEW ZEALAND: AK – Huia, on male cones of *Dacrycarpus dacrydioides*, 4 Oct 1973, 80 larvae*, BMM; Lynfield, 5 Oct 1930, 13 larvae, GK. WI – Pohangina Valley, in litter, 19 larvae, MS. NN – Wairoa Gorge, on *Podocarpus totara* and *Dacrydium cupressinum*, 22 Oct 1971, 28 larvae, GK.

Rhinorhynchus sp. indet.

Maximum dimensions 3.0×0.6 mm; head width 0.25 mm. Body yellowish, becoming bright green with maturity (fading in ethanol). Pronotal shield dark dusky brown. Head dusky brown, with anterior half of frons pallid. Mandibles reddish. Malpighian tubules coarse, bright purple. Similar in other respects to *R. rufulus*.

Material examined. NEW ZEALAND: AK – Huia, on *Phyllocladus trichomanoides*, 2 Oct 1986, 42 larvae*, BMM. TO – Mt Ruapehu, 1000 m, on *Phyllocladus alpinus*, 5 Dec 1978, 52 larvae*, GK.

Biology. The biological pattern of *Rhinorhynchus* sp. indet., abundant throughout New Zealand on Podocarpaceae, is probably typical for most pollen-feeding Nemo-

nychidae. The life cycle was studied at Huia during 1973–74 (see Table 1).

In spring (October) the eggs are inserted between the sporophylls of well developed but unripe male flowers. Newly hatched larvae enter the sporangia and feed on the pollen. When fully fed the larvae drop to the ground, where they migrate beneath surface litter and almost immediately prepare a cell in which to pupate. A period spent within the cell as a prepupa is followed by a moult to pupa and then to teneral adult. The perfect insect emerges from the cell when hardened. Emergence does not usually coincide with the next flowering time, which means that adults must maintain themselves for several months before the cycle can begin again. The periods of incubation, feeding, pupation, and hardening are relatively short, but the prepupal stage is of variable duration, and may be quite prolonged. It is during this phase of the life cycle that adjustments can occur which allow some larvae to remain quiescent for a whole year or more.

In the Australian species *Notomacer araucariae* Kuschel diapause induced by cooling lasted for 33 months (May, in press). Such an arrangement would overcome the hazard of irregular flowerings in the host plant.

Rhinorhynchus feeds within the small, pendant cones of *Dacrycarpus* by gripping with the pygopod to maintain position while thrusting forward into the pollen sacs. It progresses mainly by simple contraction and expansion. The pygopod becomes especially useful in the later stages of feeding when larvae migrate to other cones. On a flat surface *Rhinorhynchus* crawls in the 'normal' position, on its venter.

Remarks. The closest known ally to *Rhinorhynchus* on larval characteristics is without doubt *Nannomacer* Kuschel in Chile, which is also associated with Podocarpaceae. Larvae of *N. wittmeri* Kuschel, taken with adults on male cones of *Saxegothaea conspicua*, have a simple terminal segment instead of a pygopod but are separated otherwise only by small differences in setation.

Table 1 Life cycles of *Rhinorhynchus* species, showing duration of stages (days).

	<i>rufulus</i>	sp. indet.
Cones gathered	4 Oct 1973	7 Dec 1978
Incubation of eggs	14	21
Larval feeding	23	14–21
Prepupal period	174–192	126–133
Pupation	23	30–35
Teneral adult	15	28–29
Egg to adult	249–267	219–239
Adults reared (<i>n</i>)	3	3

Tribe Rhynchitomacerini
Genus *Rhynchitomacer* Voss

Rhynchitomacer Voss, 1937: 201.

Type species *Rhynchitomacer flavus* Voss.

Body slender; ventral ambulatory ampullae pronounced, less so on dorsum; pedal papilli present; abdomen terminating in a pygopod. Setae moderately long, fine, slightly in excess of modal numbers for Curculionidae.

Head more or less free, truncate behind; coronal suture very short; frontal suture distinct; ocelli distinct, with cornea; vestigial eyespot sometimes divided into two beneath a single cornea. Antennae lateroventral, hidden from above. Mandibles bifid, with incisor margin serrate, almost pluridentate; mola slightly produced ventrally; masticatory ridge armed with 3 or 4 acute teeth. Labrum bearing 4 pairs of setae and a pair of sensilli. Tormae absent. Hypopharyngeal sclerome with median and lateral projections on anterior margin. Labial palps with basal segments elongate and widely divergent, setose at apex; distal segment much smaller, placed laterally, midway along inner margin. Premental sclerite widest at middle. Articular lobes rugose. Mala with inner angle bispinuous.

Legs represented by relatively large, hemispherical papillae.

Abd IX convex, longer dorsally than ventrally. Anus ventral, with lateral lobes enlarged to form a pygopod, armed on anterior margin with 1–3 short, stout, pigmented spines. Alimentary canal of typical form; 4 Malpighian tubules.

Biology. *Rhynchitomacer* larvae feed on pollen of *Nothofagus* growing in southern parts of Chile and Argentina. There are thirteen described species, several of which can be found at any one time on the same tree. Larvae were collected during September to December by G. Kuschel while visiting Chile in 1983. Two species were later reared in Auckland from material kept in quarantine. In the laboratory, fully fed larvae migrating from the male flowers during December were placed in tubes of fine Perlite mixed with peat. Four of these pupated during March 1984. Pupation occupied 3 weeks, after which the two surviving teneral adults remained in the cell for a further 13 weeks and 15 weeks respectively.

On a flat surface, *Rhynchitomacer* larvae crawl on the venter.

Remarks. Species can be separated by differences in the number, colour, and relative size of the anal spines and to some extent by the shape of the hypopharyngeal sclerome.

***Rhynchitomacer rufus* Kuschel**

rufus Kuschel, 1954: 119.

Fig. 33–42

Maximum dimensions 5.0×1.0 mm; head width 0.5 mm. Cuticle smooth, but coarsely spiculate dorsally on Abd VII–IX and anal lobe. Setae red-brown. Pronotal shield and head dusky red. Primary and vestigial ocelli of similar size. Anal spines 2 larger, 1 smaller, red. Malpighian tubules dark purple, pallid at base.

Material examined. CHILE: Frutillar, ex male flowers of *Nothofagus dombeyi*, 16 Dec 1984, 3 larvae, GK, 2 larval exuviae, pupae, adults, BMM*.

Tribe Mecomacerini
Genus *Mecomacer* Kuschel

Mecomacer Kuschel, 1954: 97–126.

Type species *Mecomacer scambus* Kuschel.

Body of even width, with ambulatory ampullae on dorsum only of Abd II–VII; pedal papilli absent; abdomen tapering, bristled ventrally on Abd IX. Major setae long, fine, exceeding modal numbers for Curculionidae.

Head free; sutures distinct; endocarinal line two-thirds as long as frons; primary ocellus and 3 vestigial eyespots present, each beneath a separate cornea. Antennae ventral. Mandible acutely bifid, with a median projection; mola bearing a simple masticatory ridge, extended inwards but not proximad. Labrum with 4 pairs of setae, 1 pair of sensilli. Tormae present laterally. Labial membranes pubescent. Premental sclerite trapeziform, notched medially on anterior margin; a pair of minute setae at base. Mala with inner angle bispinuous.

Anus with 2 lobes only, lateral, slightly expanded; Malpighian tubules 4, dull purple, pallid at base.

Biology. Several species of *Mecomacer* feed together with *Rhynchitomacerinus kuscheli* (Voss) in male cones of *Araucaria araucana* in the Chilean/Argentine cordilleras. The life cycle, as observed in a quarantine laboratory in Auckland, follows the pattern of other Nemonychidae, i.e., pollen-feeding for 2–3 weeks, then prepupal migration and cell construction on the ground, followed by pupation either in 2–3 weeks or after a diapause lasting until the next season. The pupal stage is invariably short (14–21 days), but the adult teneral period may be extended, probably depending on suitable conditions for emergence.

Mecomacer larvae appeared to crawl on the venter for preference, but were able to perform equally well when turned to the dorsal position.

***Mecomacer scambus* Kuschel**

scambus Kuschel, 1954: 109.

Fig. 43–52

Maximum dimensions 7.0×1.3 mm; head width 1.0 mm. Cuticle smooth. Setae red-brown, very long, finely tapering or short and stiff. Pronotal shield and head red-brown. Head with sides slightly convergent. Thoracic pedal papillae absent, but position indicated by a close group of 4 setae, and 4 sensilli; major pedal seta set amongst this group. Abd IX with short, stiff setae intermixed with long setae on dorsum and pleural lobe. Anus subterminal; lateral lobes minutely spiculate anteriorly.

Material examined. CHILE: Parque Nacional de los Paraguas, 1480 m, ex male cones of *Araucaria araucana*, 13 Dec 1983, 9 larvae, RR, 4 larval exuviae, pupae, adults, BMM*.

Tribe Rhynchitoplesiini Genus *Rhynchitomacerinus* Voss

Rhynchitomacerinus Voss, 1952: 177.

Type species *Rhynchitomacer kuscheli* Voss.

The generic diagnosis differs only slightly from that of *Mecomacer*, as follows. Pedal papilli present. Head subquadrate, its sides not convergent; endocarinal line half as long as frons. Cardo inwardly explanate.

***Rhynchitomacerinus kuscheli* (Voss)**

kuscheli Voss, 1952: 177 (*Rhynchitomacer*).

Fig. 53–63

Maximum dimensions 4.5×1.0 mm; head width 0.65 mm. Cuticle smooth. Setae pale brown, tapering finely or short and stiff. Pronotal shield and head red-brown. Thoracic pedal papillae minute, overreached by 4 microsetae and well separated from major pedal seta. Abd IX with bristle-like setae at apex of dorsum. Anus subterminal.

Material examined. CHILE: Parque Nacional de los Paraguas, 1480 m, ex male cones of *Araucaria araucana*, 13 Dec 1983, 23 larvae, RR, 2 larval exuviae, pupae, adults, BMM*.

Remarks. I was able to examine the specimen, impeccably prepared as a slide mount, mentioned by Anderson (1947b, p. 516) as collected in Chile on a bromeliad, *Fascicularia bicolor*. The slide label gives "San Fran No. 6887, 1 Feb 1936". Although I have been unable to assign

Table 2 Comparison of a rhinorhynchine larva from a bromeliad with species from *Araucaria* male cones

<i>Fascicularia</i> specimen	<i>Mecomacer</i>	<i>R'macerinus</i>
Pedal papilla present	absent	present
Group of 4 minisetae associated with papilla	present	present
Major pedal seta within group of minisetae	within	separate
Labral tormae narrow, bifid	wide, bifid	narrow, simple
Premental sclerite notched	not notched	notched
Labial membranes pubescent	pubescent	pubescent
Antennae ventral	ventral	ventral

the larva to a species, it undoubtedly belongs in the *Mecomacer* / *Rhynchitomacerinus* complex. There still remains a mystery, since *F. bicolor* grows as an epiphyte on trees in the Central Valley of Valdivia but does not extend into the mountains of the Andes where *Araucaria* grows (Kuschel 1954). The salient features of the larvae are compared in Table 2.

R. kuscheli crawls on the dorsum in an 'upside-down' position (Fig. 53) similar to that adopted by the rhinorhynchine larvae associated with *Araucaria* in the Australian Region (May, in press).

Family ANTHRIBIDAE

Body with 2–4 dorsal folds, lacking ampullae (Urodontinae excepted), usually C-shaped (terminal segments recurved ventrally in situ). Setae fine, abundant on thorax, more scanty elsewhere. Head either free and subcircular in outline or partially retracted, compressed posterolaterally for cuticle and muscle attachment and narrowed behind to a downturned point or fulcrum (Fig. 76); postoccipital condyles absent; coronal suture half as long as head, joined to an internal apodeme protruding below epicranial halves; ecdysial line obsolete; frontal suture narrow, complete in front; endocarinal line present or absent; frontoclypeal suture often indistinct; primary ocellus present, plus up to 2 vestigial eyespots. Antennae 1-segmented, conical, enclosed within anterior angle of frons. Mandibles with mola developed or not, each bearing 2 setae aligned longitudinally. Labrum spatulate, bearing 4 pairs of primary setae and paired basal sensilli. Tormae lateral or mediolateral. Epipharyngeal lining having as primary setae 3 *als*, 2 *ams*, and usually only 2 *mes*, the distal pair being replaced by sensilli; proximal *mes* pair arranged either transversely or longitudinally; additional secondary setae often present. Hypopharyngeal bracon usually provided with a strong, complex, median sclerome. Tentorial bridge subdivided

laterally (except in *Bruchela*). Maxilla occasionally with a sclerotised palpiger; palps 2- or 3-segmented, with both segments (or median and distal segments) bearing a small seta; mala convex to conical, nearly always bearing a lacinial spine. Labial palps more or less contiguous, 1- or 2-segmented or absent; articulatory area well developed.

Thoracic spiracle intersegmental or on mesothorax. Spiracles with 0, 1, or 2 airtubes. Legs vestigial, represented by a 1- or 2-segmented papilla, or absent.

Alimentary canal lacking gastric caeca; Malpighian tubules 4 or 6 in number, distributed evenly around ileo-colic valve, pallid (purple in *Bruchela*); cryptonephridium asymmetrical; rectal bracon a pigmented loop.

Remarks. So many of the features which characterise Nemonychidae in the larval stage are held in common with Anthribidae that there has been uncertainty as to whether they are indeed separate families (Anderson 1947b, p. 516). Speculation regarding the placement of *Bruchela* (= *Urodon*) has been even greater. The genus was attributed to Bruchidae until Böving (cited in Bridwell 1932) pointed out the larval characters which show its very close relationship to Anthribidae and it was excluded from that family. Emden (1938, p. 5) did not agree with this finding on the grounds that a hypopharyngeal bracon and median sclerome were lacking. His specimens, however, may have been teneral, not fully hardened, because Anderson (1947b) found the sclerome to be faintly indicated, and in my specimen of *B. lillii* (Fåhraeus) it is distinct. In 1943 Anderson stressed reasons for including both *Bruchela* and *Holostilpna nitens* (LeConte)* in Anthribidae, and in 1947b called attention to the presence of air sacs in the tracheal system of the latter and their absence in *Bruchela* and in any other curculionoid larvae that he had examined. Crowson (1984) recognised a separate family, Urodontidae, after Lacordaire & Chapuis (1866), a name retained for the present subfamily. In the following assemblage of family characters, the diagnoses published by Gardner (1936), Anderson (1947b), and Lee & Morimoto (1987) have been taken into account.

Subfamily URODONTINAE

Two genera at present constitute this unit: *Bruchela* from Europe and South Africa, with larvae of two species described; and *Cercomorpha* Perris from Spain and North

Africa, larva unknown. The following features set *Bruchela* apart from the bulk of Anthribidae, the first four linking the genus with Nemonychidae: (1) frons indistinctly separated from clypeus; (2) tentorial bridge entire; (3) setae present on articulatory lobe of maxilla; (4) ambulatory ampullae present; (5) labial palpi absent.

Genus *Bruchela* Dejean

Bruchela Dejean, 1821: 78.

Type species *Urodon rufipes* Olivier.

Body moderately slender, widest at thorax, tapering gradually; dorsal ampullae prominent on Th II and Abd I–VII; legs absent.

Head deeply retracted, longer than wide, with varied colour pattern; endocarinal line present; clypeus indistinctly separated from frons; primary ocellus alone present, with a cornea. Mandibular mola undeveloped. Labral tormae present. Epipharyngeal lining lacking sensilli or asperities; proximal pair of *mes* transverse. Hypopharyngeal sclerome present. Tentorial bridge laterally entire, joined medially or not. Maxillary palps 2-segmented; mala with or without a basal lacinia. Labial palps absent. Premental sclerite reduced or obsolete.

Thoracic spiracles unicameral or bicameral; Abd spiracles unicameral; all airtubes simple. Anus terminal.

Remarks. The diagnosis above is based partly on those of Urban (1913) and Anderson (1947b). I have not seen the larva of *B. rufipes*, which is divergent in many respects from that of *B. lillii*.

Bruchela lillii (Fåhraeus)

lillii Fåhraeus in Schoenherr, 1839: 147 (*Urodon*).

Fig. 64–73

Dimensions of specimen 5.0×1.7 mm. Head width 0.65 mm. Cuticle smooth, but anal lobes coarsely spiculate. Red-brown maculae present on Abd IX dorsum, and scimitar-shaped paired maculae on anal ventral lobe. Setae fine, pallid, moderately long, numerous (approximately 20 on pleural and pedal lobes). Pronotal shield pallid. Head dusky, red-brown anteriorly, with lateral, posterior, and wide sutural areas pallid; endocarinal half as long as frons; clypeus almost entirely pigmented. Labrum rounded, pigmented in proximal half, bearing 4 setae and a sensillus. Tormae short, spindle-shaped, mediolateral. Epipharyngeal lining with 2 *als*, 2 *ams* on margin; 2 pairs of *mes* equally spaced between tormae. Hypopharyngeal sclerome concave in front. Tentorial bridge entire. Maxilla

*Footnote. The adults reared from larvae described by Anderson (1943) as *Holostilpna nitens* were misidentified, being instead an undescribed species of a choragine anthribid, *Euxenus* sp. (Valentine 1960).

bearing 5 stipital, 6 palpiferal, and 6 malar setae; lacinia prominent; articular lobe with 2 or 3 setae. Labium pubescent. Premental sclerite visible at sides only. Alimentary canal with 4 Malpighian tubules, purple; rectal bracon a short, pigmented loop.

Material examined. NEW ZEALAND: GB – Gisborne, port quarantine, ex seed of *Watsonia (Gladiolus)* hybrid from South Africa, 27 Mar 1986, 1 larva, PRB.

Subfamily ANTHRIBINAE

Legs 1- or 2-segmented, occasionally absent. Maxillary palps often 3-segmented. Abd spiracles with 2 airtubes (absent in *Phloeobius* Schoenherr). Malpighian tubules 6 in number.

Remarks. The New Zealand element is superficially homologous in appearance, but shows individual character combinations which are distinctive enough to provide good separation. *Euciodes suturalis* Pascoe, an Australian adventive, and *Lichenobius* Holloway (May 1981) are included in the key. The following features are held in common, and require no repetition in the descriptions.

- (1) Body robust, recurved and tapered in posterior third (Fig. 74).
- (2) Head and pronotum usually unpigmented; points of articulation red-brown or darker.
- (3) Coronal and frontal sutures indistinct; endocarinal line unsclerotised except on pigmented head capsules.
- (4) Antennae mounted on ventral surface of produced frontal angle (Fig. 78).
- (5) Mandibular mola raised to form a stout tooth or ridged grinding surface (Fig. 92, 112).
- (6) Hypopharyngeal sclerome produced in front of bracon, emarginate except in *Cacephatus* (Fig. 77, 94).
- (7) Epipharyngeal lining bearing 3 *als*, 2 *ams*, and 2 *mes* pairs, the distal *mes* pair replaced by sensilli (Fig. 80).
- (8) Labrum lacking setae other than the 4 primaries (Fig. 79).
- (9) Maxillary palps, when 2-segmented, carrying a miniset on each segment; when 3-segmented, lacking a miniset on basal segment (Fig. 82a, 113a).
- (10) Stipes randomly clothed with long, fine setae.
- (11) Maxillary mala invested on dorsal surface with a few slender, straight setae, some fine, curled setae, and usually a single, stiff, pigmented seta as well as significant numbers of lamellate setae.
- (12) Postlabium and articular lobe bearing a small number of setae.

- (13) Labium bearing 1 *prls* pair; usually 1 miniset mesad on palps (Fig. 82a).
- (14) Ligula bearing 1 pair of strong dorsal setae (Fig. 82b).
- (15) Thoracic spiracle approximately twice as large as Abd spiracles; that of Abd VIII not larger than the other Abd spiracles; airtubes dorsad.
- (16) Abd IX sternum usually invested with coarse spinules.

Genus *Arecopais* Broun

Arecopais Broun, 1893: 1267.

Type species *Exilis spectabilis* Broun.

Thorax with pedal papilla 2-segmented. Head partially retracted; primary ocellus alone present. Mandibles with 2 incisor teeth; molar tooth as large as apical tooth. Epipharyngeal lining with proximal *mes* pair arranged transversely. Hypopharyngeal sclerome with prominent angles; front margin undulate. Maxillary palps 2-segmented; lacinia broad, compressed, red-brown. Labial palps 2-segmented. Premental sclerite a narrow band, complete medially. Thoracic spiracle broadly ovate.

Arecopais spectabilis Broun

spectabilis Broun, 1880: 558 (*Exilis*).

'Nikau anthribid'

Fig. 74–85

Maximum dimensions 6.5×2.0 mm; head width 1.25 mm. Cuticle minutely asperate; a double row of coarse spinules posteroventrally on Abd IX. Labrum and clypeus unpigmented. Tormae narrow, red-brown. Maxillary mala bearing 7 dorsal and 10 ventral lamellate setae. Ligula pubescent, with a pair of short, strong setae.

Material examined. NEW ZEALAND: ND – Spirits Bay, 9 Nov 1967, 7 larvae, JIT. AK – Titirangi, in dead sheaths of nikau palm, *Rhopalostylis sapida*, 6 Jun 1964, 50 larvae*, BMM; 16 Jul 1969, 52 larvae, BMM; Waiwera Hill, in old flower stems, 23 Aug 1966, 43 larvae, BMM.

Biology. Larvae of *Arecopais spectabilis* are found in dead sheathing bases of fallen nikau leaves when they are brown but not decayed and in the rachides of previous season's inflorescences. They feed on the pith between the rather widely spaced fibres, in association with larvae of cossonine weevils such as *Arecocryptus bellus* Broun, *Eucossonus comptus* Broun, and *Stenotrupis* spp. Pupation takes place *in situ*.

Genus *Cacephatus* Blackburn

Cacephatus Blackburn, 1900: 143.

Type species *Cacephatus sericeus* Blackburn.

Head free, with 2 vestigial eyespots in addition to primary ocellus. Antennae narrow, acutely conical, with 2 slender papilli on basal cushion. Mandibles with 2 apical teeth on elongate incisor; mola raised to a serrate grinding surface. Epipharyngeal lining with proximal pair of *mes* transverse; a paired, longitudinal, comb-like series of dark squamae below *mes*, between tormae. Hypopharyngeal sclerome convex in front, straight-sided. Maxillary and labial palps 2-segmented. Premental sclerite distinct.

Thorax with pedal papillae 2-segmented; spiracles on mesothorax.

Remarks. The generic diagnosis is based on larvae of *C. aucklandicus* (Brookes) (May 1971), *C. huttoni* (Sharp) (May, in press), and *C. inornatus* (Sharp), which is described below.

The following features of *Cacephatus* larval mouthparts are unique among the New Zealand Anthribidae that I have studied, and may be taken to indicate a somewhat divergent type of alimentation. (1) Mandibular mola adapted for grinding wood fibres instead of tearing them apart. (2) Tormae wider than usual and forked anteriorly, giving greater support to the labrum. (3) Hypopharyngeal sclerome convex rather than emarginate in front. (4) The clusters of squamae on the epipharyngeal lining in front of the oesophagus must in some way assist ingestion. *Cacephatus* larvae are found in hard, dead wood rather than in soft, decaying branchlets.

Cacephatus inornatus (Sharp)

inornatus Sharp, 1886: 434 (*Anthribus*).

Fig. 86–97

Maximum dimensions 5.0×2.0 mm; head width 1.5 mm. Cuticle asperate; coarse, red-brown spinules present on Abd IX sternum. Clypeus pigmented on proximal half. Labrum completely pigmented. Labial palps with distal segment longer than proximal one; associated setae as long as palps. Maxillary mala bearing on dorsal surface 6–8 laminate setae apically and 7 shorter, lamellate setae basally; ventral surface lacking lamellate setae; lacinia short, broad. Premental sclerite a complete band.

Material examined. NEW ZEALAND: AK – Waitakere Ra., ex dead wood of *Agathis australis*, 5 Jul 1966, 26 larvae*, BMM.

Genus *Dasyanthribus* Holloway

Dasyanthribus Holloway, 1982: 133.

Type species *Anthribus purpureus* Broun.

Thorax with pedal papilla 1-segmented. Head partially retracted, with 2 vestigial eyespots in addition to primary ocellus. Mandibles with an apical tooth and 2 subapical teeth; molar tooth curved inwards. Premental sclerite a thin line. Articulatory lobe devoid of setae.

Dasyanthribus purpureus (Broun)

purpureus Broun, 1880: 559–563 (*Anthribus*).

Fig. 98–107

Maximum dimensions 2.25×1.0 mm; head width 0.5 mm. Cuticle smooth, but spiculate on Abd IX sternum. Labrum slightly pigmented. Maxillary mala bearing 5 dorsal and 8 ventral lamellate setae. Ligular setae stronger than prelabial setae.

Material examined. NEW ZEALAND: AK – Huia, under bark of live *Olearia furfuracea*, Oct 1967, 12 larvae*, BMM.

Biology. The presence of *D. purpureus* larvae in *Olearia furfuracea* is indicated by fairly numerous, very small (1.5 mm) exit holes in the thin, flaky bark. The workings meander in no particular pattern between the bark and the cambium layer. Pupation cells are shallowly excavated at the end of a tunnel.

Genus *Garyus* Holloway

Garyus Holloway, 1982: 82.

Type species *Anthribus altus* Sharp.

Thorax with pedal papilli 2-segmented. Pronotum with a lateral, oblique band of thickening. Head free, with a primary ocellus only. Mandibles with 2 subequal incisor teeth; molar tooth as large as these. Epipharyngeal lining with proximal *mes* pair transverse. Maxillary palps 3-segmented; lacinia narrow, acute. Labial palps 2-segmented. Premental sclerite obsolete.

Garyus altus (Sharp)

altus Sharp, 1876a: 431 (*Anthribus*).

Fig. 108–118

Maximum dimensions 5.0×2.0 mm; head width 1.5 mm. Cuticle densely spiculate in linear series on dorsum and

dorsopleuron of metathorax and Abd I–IV, with coarse spinules on Abd IX laterosternal lobe, and a double row caudad on sternal fold; otherwise smooth. Labrum lightly pigmented. Maxillary mala bearing 7 dorsal and 4 ventral lamellate setae.

Material examined. NEW ZEALAND: WO–Hamilton, in dead wood of hawthorn, *Crataegus monogyna*, 5 Oct 1971, 22 larvae*, BMM.

Biology. *G. altus* is associated with dead wood of various kinds. The workings are in branchlets which have reached the stage of soft, dry decay. Larvae commence feeding at a node or broken twig; their tunnels are elliptical in cross-section. The characteristically granular frass is loosely packed.

Genus *Helmoreus* Holloway

Helmoreus Holloway, 1982: 66.

Type species *Anthribus sharpi* Broun.

Body rather slender; pedal papilli 2-segmented. Head free, with a primary ocellus only. Mandibles with molar tooth smaller than incisor teeth. Clypeus indistinctly separated from frons. Epipharyngeal lining with proximal *mes* pair arranged longitudinally. Maxillary palps 2-segmented; lacinia set on a separate, small, fleshy lobe. Labial palps 1-segmented. Ligula devoid of pubescence. Premental sclerite obsolete. Malpighian tubules unusually coarse.

Helmoreus sharpi (Broun)

sharpi Broun, 1880: 546 (*Anthribus*).

Fig. 119–127

Maximum dimensions 3.3×1.25 mm; head width 0.75 mm. Cuticle very finely spiculate; a single row of coarse spinules caudoventrally on Abd IX. Labrum pigmented mesally; anterior pair of setae short, stiff. Maxillary mala bearing 7 lamellate setae on ventral surface; dorsal surface without lamellate setae, but with a stiff, pigmented seta. Labial palpal segment as long as distal segment of maxillary palp.

Material examined. NEW ZEALAND: AK–Huia, subcortical in dead bark of *Agathis australis*, 23 Sep 1974, 7 larvae*, BMM.

Biology. *H. sharpi* is recorded from various conifers, including the wood, bark, and cones of *Pinus radiata*, and

from beech (*Nothofagus*) and willow (*Salix*) (Holloway 1982). For many Anthribidae the type of fungus and the state of its growth in dead woody material is of more importance than the species of tree. At Huia on 16 December 1973 a damaged kauri tree was dying, the leaves turning brown. Numerous adults were on the trunk, ovipositing. The eggs were inserted singly into the bark. The resulting larvae fed subcortically, and by September 1974 the trunk was pitted with emergence holes. There were still larvae working in it, and a good many pupae in simple, unlined cells near the surface.

Genus *Hoherius* Holloway

Hoherius Holloway, 1982: 124.

Type species *Anthribus meinertzhageni* Broun.

Thorax with pedal papilli 1-segmented. Head strongly retracted, longer than wide, with a primary ocellus only. Mandibles with 2 incisors and a molar tooth. Epipharyngeal lining with proximal *mes* pair transverse. Maxillary palps and labial palps 2-segmented. Ligular dorsal seta absent. Premental sclerite moderately wide, visible at sides only. Alimentary canal with proventriculus slightly expanded.

Hoherius meinertzhageni (Broun)

meinertzhageni Broun, 1880: 563 (*Anthribus*).

Fig. 128–138

Dimensions of specimen 4.5×5 mm; head width 1.25 mm. Cuticle smooth to very finely asperate; a row of coarse spinules caudoventrally on Abd IX. Labrum pigmented at base. Maxillary mala bearing 8 lamellate setae on both dorsal and ventral surfaces. Stipes clothed laterally and dorsally with golden, curled setae.

Material examined. NEW ZEALAND: NN – Nelson, Rough I., ex dead *Plagianthus divaricatus*, 17 Nov 1972, 1 larva, GK.

Biology. *Hoherius* is unusual in being restricted as adult and larva to a single plant family, Malvaceae. Host plants mentioned by Holloway (1982) are *Hoheria glabrata*, *Plagianthus betulinus*, and *P. divaricatus*.

Genus *Phymatus* Holloway

Phymatus Holloway, 1982: 117.

Type species *Anthribus phymatodes* Redtenbacher.

Head partially retracted; ocellus only moderately distinct. Mandibles with 3 incisor teeth and a molar tooth; apical tooth largest. Epipharyngeal lining with proximal pair of *mes* transverse. Maxillary and labial palps 2-segmented. Premental sclerite a thin line. Thorax with pedal papillae 1-segmented. Spiracles with airtubes faintly annulate.

***Phymatus hetaera* (Sharp)**

hetaera Sharp, 1876a: 429 (*Anthribus*).

Fig. 139–149

Maximum dimensions 5.0×2.0 mm; head width 1.25 mm. Cuticle mainly smooth; coarse spinules on laterosternal lobes of Abd VIII/IX and in 3 or 4 rows caudoventrally on Abd IX. Labrum pigmented at base. Maxillary mala bearing 6 lamellate setae dorsally; remaining dorsal and ventral setae (approximately 20) stiff, slender; lacinia moderately broad, compressed.

Material examined. NEW ZEALAND: AK – Whatipu Beach, in dead bark of *Lupinus arboreus*, 20 Jul 1969, 52 larvae*, BMM.

Biology. Members of genus *Phymatus* are polyphagous (Holloway 1982). In the Auckland area I have reared *P. hetaera* from *Agathis australis* (Araucariaceae) dead bark and wood, *Clematis* sp. (Ranunculaceae) dead vine, *Pseudopanax lessonii* (Araliaceae) dead branch, *Schefflera digitata* (Araliaceae) dead twigs, and *Tetrapathaea tetrandra* (Passifloraceae) dead vine. The larvae were working subcortically and pupating in a shallow excavation or a subsurface cell. On *Schefflera*, first-instar larvae and a few second instars were found 4 months after branches were cut and hung; 8 months later there were many emergence holes, but with larvae and prepupae still present.

Some older larvae were harbouring the solitary larva of a proctotrupid parasite (Hymenoptera).

Genus *Pleosporius* Holloway

Pleosporius Holloway, 1982: 48.

Type species *Anthribus bullatus* Sharp.

Thorax with pedal papilli 2-segmented. Head free; frontal suture visible anteriorly; primary ocellus alone present. Mandibles with 2 incisor teeth; molar tooth as large as apical tooth. Clypeus indistinctly separated from frons. Epipharyngeal lining with proximal pair of *mes* arranged longitudinally. Maxillary palps 3-segmented. Labial palps 2-segmented. Premental sclerite obsolete. Spiracles with

airtubes faintly annulate. Alimentary canal with basal section of each Malpighian tubule expanded to 4× diameter of anterior part, and having a grainy appearance.

***Pleosporius bullatus* (Sharp)**

bullatus Sharp, 1876a: 427 (*Anthribus*).

Fig. 150–160

Maximum dimensions 4.5×1.75 mm; head width 1.0 mm. Cuticle smooth to minutely asperate; coarse spinules scattered randomly ventrocaudad on Abd IX. Pronotum and head reddish; articulation points and mandibles brown. Labrum lightly pigmented except at margin. Maxillary mala bearing 5 dorsal and 7 ventral lamellate setae; lacinia broad, compressed.

Material examined. NEW ZEALAND: WO – Hamilton, in dead hawthorn (*Crataegus monogyna*), 5 Oct 1971, 23 larvae*, BMM. TO – Ohakune, 700 m, in dead branchlets of *Nothofagus solandri*, 31 Oct 1970, 13 larvae*, BMM.

Biology. In both the host plants from which I have reared *P. bullatus*, the workings were in small (about 10 mm diameter) dead branchlets. The *Crataegus* (Rosaceae) wood was dry and rather soft, but no fungal fruiting bodies were evident. The *Nothofagus* (Fagaceae) wood, however, bore fructations of *Rosellinia* (Ascomycetes) (H.J. Boesewinkel det.) under which the larvae were feeding, ventral side uppermost, in company with larvae of *Notochoragus crassus* (Sharp). The latter were distinguished by their paler, retracted head and one-segmented legs.

Genus *Sharpius* Holloway

Sharpius Holloway, 1982: 52.

Type species *Anthribus brouni* Sharp.

Thorax with pedal papilli 2-segmented. Head free; primary ocellus alone present. Mandibles with 2 incisor teeth; molar tooth as large as apical tooth. Clypeus indistinctly separate from frons. Epipharyngeal lining with proximal pair of *mes* arranged longitudinally. Maxillary palps indistinctly 3-segmented. Labial palps indistinctly 2-segmented. Premental sclerite obsolete. Spiracles with airtubes not annulate.

***Sharpius brouni* (Sharp)**

brouni Sharp, 1876a: 426 (*Anthribus*).

Fig. 161–170

Maximum dimensions 3.25×1.5 mm; head width 1.0 mm. Cuticle smooth to minutely asperate; coarse spinules present lateroventrally on Abd IX. Labrum lightly pigmented away from margin. Labium devoid of pubescence. Maxillary mala bearing 4 dorsal and 6 ventral lamellate setae; lacinia more slender than in *P. bullatus*.

Material examined. NEW ZEALAND: AK – Auckland, Mt Smart, in dead wood of *Alectryon excelsa*, 13 Mar 1966, 46 larvae*, BMM; Wellsford, in dead twigs of *Olearia furfuracea*, 2 Aug 1966, 20 larvae*, BMM; Piha, in fungus galls (*Endothia* sp.) on *Pittosporum tenuifolium*, 14 Aug 1974, 10 larvae*, JSD.

Biology. The habits of *S. browni* are very much the same as those of *P. bullatus*. In dead wood the eggs were inserted just below the surface of thin bark. Feeding was subcortical in mines 20–30 mm long. The workings were rather wide (up to 10 mm) because larvae doubled back every so often. In the galls of *Endothia* fungus (Ascomycetes) (J.M. Dingley det.) larvae were feeding among the perithecia.

A hymenopteran parasite, *Proctotrupes* sp. (E.W. Valentine det.), emerged from some individuals. These harboured a solitary parasitic larva which pupated outside its host while remaining attached posteriorly.

Subfamily CHORAGINAE

Legs 1-segmented or absent. Maxillary palpi 2-segmented; labial palpi 1-segmented. Thoracic spiracles bicameral or unicameral; Abd spiracles unicameral. Malpighian tubules 4 in number. Similar in other respects to Anthribinae.

Remarks. Of the five choragine genera recorded from New Zealand by Holloway (1982), larval representatives of three are described here.

Genus *Araecerus* Schoenherr

Araecerus Schoenherr, 1823: 1135.

Type species *Anthribus coffeae* Fabricius.

Body of typical shape; some abdominal segments with a row of plicae across prodorsal fold. Pedal papillae absent or occasionally 1-segmented (*A. suturalis* Boheman). Pronotum simple. Head free or partially retracted; primary ocellus alone present. Mandibles with 3 incisor teeth, 1 molar tooth. Clypeus transverse, unpigmented. Labrum bearing primary setae only. Epipharyngeal lining with proximal pair of *mes* transverse. Hypopharyngeal scler-

ome trapeziform in front. Premental sclerite visible at sides only. Thoracic spiracle bicameral.

Remarks. In the generic diagnosis, work by Cotton (1921), Gardner (1932a, 1936), and Anderson (1947b) has been taken into account.

Specimens of *A. fasciculatus* (DeGeer), *A. palmaris* (Pascoe), and *A. vieillardii* Montrouzier have been examined, and are included in the key (p. 16). A description is given of *A. palmaris*, the only species to have become established in New Zealand.

Araecerus palmaris (Pascoe)

palmaris Pascoe, 1882: 27 (*Doticus*).

'Dried apple beetle', 'jumping anthribid'

Fig. 171–182

Maximum dimensions 10.0×3.0 mm; head width – 1st instar 0.26 mm, 2nd instar 0.38 mm, 3rd (final) instar 0.58–1.30 mm. Cuticle minutely spiculate; coarse spinules scattered randomly ventrocaudad on Abd IX. Abd I–V with a row of plicae across prodorsal fold. Pronotum and head yellow-brown; oral margins and mandibles dark; sutures distinct; endocarinal line absent. Labrum pigmented. Maxillary mala bearing 11 dorsal and 6 ventral lamellate setae. Labium densely pubescent. Pedal lobes bearing a minute, sclerotised, circular area (undeveloped papilla) invested with fine setae, denser and shorter than on surrounding cuticle. Alimentary canal with posterior ventriculus as wide as anterior section; cryptonephridium strongly developed, terminating in 2 ventral lobes.

First instar (Fig. 181). Spiracles proportionately larger than in mature larvae. Egg-bursting spines present above spiracle on at least Abd I–III.

Material examined. NEW ZEALAND: AK – Mt Albert, ex mummified fruits of loquat (*Eriobotrya japonica*), 21 Mar 1974, 17 larvae*, BMM. NN – Nelson, ex dry *Uromycladium* galls on *Acacia*, 1 Oct 1972, 1 larva, GK; Appleby Research Orchard, Dec 1972, 5 larvae, WPT.

Biology. Previously known as *Doticus pestilens* Olliff, the dried apple beetle originates from Australia, where it was recorded by Froggatt (1902) on wattle trees and in shrivelled apples. It was discovered in Wellington (WN) by Kirk (1895). Gourlay (1929) recorded its activities on *Acacia*, where larvae and adults were found inside the galls caused by the basidiomycete rust fungus *Uromycladium*. He also noted that mummified lemons kept in the laboratory supported continuous generations of the weevil until

the pulp was exhausted. On loquat, eggs were inserted under the wrinkled skin. First-instar larvae worked in the pith before entering the nuts, where they stayed until fully fed and then pupated *in situ*. The fungus causing mummification was *Botryosphaeria* sp. (H.J. Boesewinkel det.). Other host fruits are listed by Kuschel (1972).

Genus *Dysnocyrtus* Broun

Dysnocyrtus Broun, 1893: 1258.

Type species *Dysnocyrtus pallidus* Broun.

Body with Abd III and IV showing a rugose ridge across prodorsal and postdorsal folds. Pedal papillae 1-segmented. Pronotum simple. Head free; primary ocellus alone present. Antennae longer than usual, elongate conical, with stem as long as cone; base carrying a slender papilla and a seta overtopping cone. Mandibles with 2 incisor teeth. Clypeofrontal suture indistinct. Thoracic spiracle unicameral, situated on mesothorax.

Remarks. The position of the proximal pair of *mes* on the epipharyngeal lining and details of the lower mouthparts are uncertain owing to the small size of my specimens.

Dysnocyrtus inflatus (Sharp)

inflatus Sharp, 1876a: 434 (*Anthribus*).

Fig. 183–186

Largest specimen examined 2.5×0.75 mm; head width 0.5 mm. Cuticle minutely asperate; coarse spinules in a single row present caudoventrally on Abd IX. Head with a narrow epistomal band as well as articulation points and mandibles blackish. Labrum lightly pigmented away from margin.

Material examined. NEW ZEALAND: ND – Hen and Chickens Is., Lady Alice I., ex dead wood of *Meryta sinclairii*, 17 Oct 1971, 4 larvae, 1 pupa*, BMM.

Biology. The branchlet containing the specimens was in a state of damp decay, but no fungal fruiting bodies were in evidence. The larvae were a pinkish colour, and all were immature. The pupa became adult in November.

Genus *Notochoragus* Holloway

Notochoragus Holloway, 1982: 159.

Type species *Anthribus crassus* Sharp.

Body with Abd I–IV showing a rugose ridge across prodorsal and postdorsal folds. Pedal papilli 1-segmented.

Pronotum simple. Head slightly retracted; primary ocellus alone present. Antennae relatively large, elongate conical. Mandibles with 2 incisor teeth; molar tooth large, rounded. Clypeofrontal suture indistinct. Epipharyngeal lining with proximal pair of *mes* transverse. Hypopharyngeal sclerome parallel-sided; front margin undulate. Premental sclerite wide laterally, obsolete at middle. Thoracic spiracle unicameral, between prothorax and mesothorax.

Notochoragus crassus (Sharp)

crassus Sharp, 1876a: 432 (*Anthribus*).

Fig. 187–195

Maximum dimensions 3.0×1.25 mm; head width 0.75 mm. Cuticle minutely asperate; spicules (smaller than spinules) on Abd IX sternum randomly arranged. Head with a narrow epistomal band as well as articulation points and mandibles red-brown. Labrum lightly pigmented. Maxillary mala bearing 9 dorsal and 7 ventral lamellate setae; lacinia broad. Labium devoid of pubescence.

Material examined. NEW ZEALAND: AK – Glorit, Mt Auckland, under *Rosellinia* fungus in dead branchlets of *Carmichaelia aligera*, 10 Jan 1974, 7 larvae*, BMM. TO – Ohakune, 700 m, subcortical under *Rosellinia* fungus on *Nothofagus solandri*, 30 Oct 1970, 6 larvae*, BMM.

Biology. The larvae were feeding in a similar way to those of *Pleosporius bullatus*, in a recurved position, ventral surface uppermost, under patches of *Rosellinia* (Ascomycetes). They pupated at the end of the working.

Family BELIDAE

In the classification envisaged by Kuschel (in press), the family Belidae includes two small groups, Oxycoryninae and Aglycyderinae (= Proterhininae), previously standing on their own, as well as the much larger subfamily Belinae. This amalgamation is endorsed by characters of the larvae, in which there are no fewer than seven synapomorphies:

- (1) head deeply retracted;
- (2) head not extrusible, attached to prothoracic shield by heavy musculature (Fig. 198);
- (3) endocarinal line bifid (sometimes indistinctly);
- (4) frontal sutures obsolete;
- (5) labrum bearing 4 primary setae;
- (6) thoracic spiracle situated on mesothorax;
- (7) body setae more numerous than in Curculionidae.

In addition, the following characteristics possessed by one or another of the belid groups are shared with Ceram-

bycidae (*Somatidia* sp. examined, but see Duffy 1952) and hence with Chrysomeloidea, the closest outgroup:

- (1) head permanently retracted, with a similar type of cuticle and muscle attachment;
- (2) frontal sutures obsolete (Fig. 197);
- (3) antennae 2-segmented, retractile (Fig. 200);
- (4) maxilla with 3-segmented palps and a sclerotised palpiger (Fig. 204);
- (5) anus 3-lobed, T-shaped.

A hypopharyngeal bracon, the absence of which in Chrysomeloidea separates them from Curculionoidea, is present in Belidae and as a rule is strongly developed.

Subfamily BELINAE

Body form variable; abdominal segments each with 2 or 3 dorsal folds, often modified to form ambulatory ampullae. Setae variable in number, usually prolific. Spiracles ovate, with airtubes lateral; thoracic spiracle on mesothorax.

Head deeply retracted into prothorax, held in place by mid-epicranial and posterior ligaments; occipital foramen open or closed behind; 1–6 ocelli present; endocarinal line bifurcate or absent; frontal sutures obsolete. Antennae retractile, 2-segmented; apical segment usually cylindrical, accompanied by a sensory process. Mandibles 1–3-dentate, with 2 setae aligned longitudinally. Labrum with 4 primary setae and 1 sensillus (anterior primary seta usually hidden amongst additional setae); basal sclerotisation extended laterally. Tormae variable in position, often absent. Maxillary palps 3-segmented, with a sclerotised palpiger; medial and distal segments each bearing a seta. Postlabium with a sclerotised strut, or bracon (Snodgrass 1935, p. 293) basolaterally. Pronotum often modified. Legs absent. Anal cleft T-shaped. Alimentary canal lacking cardiac mycetomes; posterior ventriculus 2-coiled; gastric caeca vermiform; Malpighian tubules 6; cryptonephridium symmetrical; rectal bracon a ligamentous ring.

Remarks. The diagnosis is based on the endemic genera *Agathinus* Broun and *Pachyurinus* Kuschel and on three Australian genera, *Rhinotia* Kirby, *Brachybelus* Zimmerman, and *Sphinctobelus* Zimmerman. Larvae of the two New Zealand genera differ from each other in many respects, as shown in the key. They represent separate tribes.

Genus *Agathinus* Broun

Agathinus Broun, 1880: 471.

Type species *Curculio tridens* Fabricius.

Body robust, of even width, with very strong musculature;

abdominal segments without ampullae. Pronotal shield declivous, lacking a median suture, densely pubescent in posterior third. Head longer than wide, with 3 oblique, parallel ridges posterolaterally for attachment of muscles; posterior margin entire; occipital foramen closed behind; 1 ocellus visible, under convex cornea; endocarinal line absent. Antennae with basal segment elongate, cylindrical; apical segment narrow, tubular, accompanied by a stout, conical process, as in many Cerambycidae (Duffy 1952, fig. 13a). Mandibles bidentate, with a prominent basal shoulder. Labrum evenly rounded, of subequal length and width. Tormae horizontal, attached laterally. Epipharyngeal setae numerous. Maxilla with mala densely setose. Labial bracon curved, rounded apically. Ligula pubescent. Premental sclerite wide, with anterior extension obsolete, posterior margin rounded. Spiracles ovate, bicameral; airtubes caudad. Anus terminal.

Remarks (on cephalic musculature). Head capsules that are retracted into the prothorax to a greater or lesser degree occur in many curculionoid groups. In *Agathinus* the cuticle is attached midway along the parietalia and at mid-cranium, providing a space between the epicranium and pronotum for the reception of complex musculature. The short parietal muscles, attached to three obliquely parallel ridges, are directed forwards to join the pronotal shield. The dorsal muscles attached to the frontal apex and coronal suture are longer, directed posteriad, and spread fanwise. The ventral muscles are joined to a foraminal ridge. There are no postoccipital condyles. In effect, the head is held in position inextrusibly with only the frontal portion protruding. Other members of Belinae, Oxycoryninae, and Aglycyderinae that I have examined show variations on this type of musculature.

By contrast, in Naupactini (Entiminae) the cervical cuticle is attached at the epicranial margin, continuing dorsally as a fold under the pronotum. Muscles are attached ventrally to a ridge around the occipital foramen and to apodemes known as postoccipital condyles. This allows the head to come forward and downward, so that considerable vertical movement can be achieved while feeding.

Agathinus tridens (Fabricius)

tridens Fabricius, 1787: 122 (*Curculio*).

Fig. 196–207

Maximum dimensions 17.1×5.0 mm; head width 3.0 mm. Cuticle minutely spiculate. Setae fine, hair-like, rather short, numerous. Pronotal shield yellow; pubescence golden. Head pallid, but oral margins and mandibles dark

brown. Labrum with anterior setae obscured by fringe hairs. Epipharyngeal lining bearing multiple submarginal rows of setae, forming a dense fringe; 12–18 *mes* in front of and between tormae; 2 groups of sensilli present. Tormae flared at apex. Alimentary canal with gastric caeca short, slender, numerous, scattered irregularly on middle portion of posterior ventriculus.

Material examined. NEW ZEALAND: AK – Piha, dead wood of *Corokia buddleioides*, 10 Nov 1965, 2 larvae*, BMM. TO – Pureora, in *Coprosma* sp., 19 Jun 1963, 5 larvae, JSD. NN – Mt Arthur, 1100 m, dead wood of *Dracophyllum traversii*, 23 Nov 1969, 5 larvae, BMM.

Biology. Although *Agathinus* adults are usually found in association with Podocarpaceae, they utilise sound, dead wood of many kinds for oviposition and larval development. Pupation occurs *in situ*. *Cyrotypus* Pascoe of Australia is closely allied to *Agathinus*, and the larvae have likewise been reared from dead wood (May, *in press*).

Genus *Pachyurinus* Kuschel

Pachyurinus Kuschel, 1959: 253.

Type species *Pachyura stictica* Broun.

Body somewhat depressed, straight, cerambycid-like, widest at thorax; abdomen distinctly segmented, with dorsal ampullae on Abd I–VI. Pronotum slightly declivous, bearing scattered setae and a posterior fringe but no pubescence; median suture present.

Head of subequal width and length; a strong mid-dorsal muscle spreading fanwise from apex of frons; posterior margin of epicranium deeply excavate; occipital foramen open behind; 2 ocelli present, the anterior unit beside antenna, under convex cornea, the posterior one smaller; endocarinal line bifurcate. Antennae as in *Agathinus*. Mandibles tridentate apically. Labrum transverse, subtruncate. Tormae short, divergent. Epipharyngeal lining with a row of marginal and submarginal setae, 2 *mes*, and 2 clusters of sensilli. Maxillary galea with a curved row of setae. Ligula not pubescent. Premental sclerite wide, with short median extensions. Spiracles ovate, with airtubes lateral, elongate, curved ventrad, distinctly annulate; vestigial spiracle distinct on metathorax. Anus terminal.

Remarks. *Pachyurinus* larvae scarcely differ from those of *Pachyurella* of Australia, despite the frontal horn of the latter. *Brachybelus* is more divergent, but both genera have the open occipital foramen of *Pachyurinus*.

Pachyurinus rubicundus (Broun)

rubicunda Broun, 1880: 469 (*Pachyura*).

Fig. 208–218

Maximum dimensions 9.8×2.0 mm; head width 1.3 mm. Cuticle smooth. Setae fine, short, pallid, more scanty than in *Agathinus*. Prothorax with pronotal shield bright yellow-brown; prosternum densely clothed with short, golden setae. Head red-brown on anterior third; hind portion pallid. Antennae bearing a stout, conical, supplementary process as long as apical segment, a narrow cone of similar length, and 2 much shorter sensoria. Epipharyngeal lining invested with 9 or 10 submarginal setae and, between tormae, a median unpaired *mes* and an *mes* pair with clusters of 3 or 4 sensilli above and below it. Spiracles with airtubes having up to 21 annuli. Alimentary canal with gastric caeca in a cluster of 3–5 on either side, midway along posterior ventriculus.

Material examined. NEW ZEALAND: AK – Huia, under dead bark of *Toronia toru*, 21 Oct 1975, 10 larvae*, BMM.

Biology. *P. rubicundus* larvae were discovered on *Toronia toru* (Proteaceae) under the bark of a dead branch, of which they were evidently the primary invaders. The branch was fairly thick, about 100 mm diameter with bark 5 mm. The larvae were abundant, but each maintained an individual blotch-shaped feeding area wherein the frass was tightly packed. Submature larvae, pupae, and emergent adults were present together in October, but no young larvae were seen. Pupation took place *in situ* in a shallow depression surrounded by fibres scraped from the cambium layer. Part of the branch was placed in a rearing tin; many adults emerged, leaving the bark peppered with exit holes.

Larvae of the small cossonine weevil *Proconus asperirostris* Broun were found feeding amongst the frass. Adults were also present, and eggs had been deposited randomly between the bark and frass layer.

Pachyurinus adults are beaten most often from podocarpaceous trees (as with *A. tridens*), but the host trees (*Toronia* and *Nothofagus*; see below) of the only larvae so far discovered are both angiosperms.

Pachyurinus sticticus (Broun)

stictica Broun, 1893: 1379 (*Pachyura*).

Fig. 219

Maximum dimensions 10.0×3.1 mm; head width 1.5 mm.

Differing from *P. rubicundus* in having prosternal setae more scanty; epipharyngeal lining with 12–16 submarginal setae, and anterior *mes* paired and set close together; and spiracles with airtubes longer, more strongly curved, having up to 25 annuli. Alimentary canal with gastric caeca numbering up to 16 in each cluster.

Material examined. NEW ZEALAND: MB – Upper Wairau Vly, in dead branch of *Nothofagus cliffortioides*, 7 Sep 1966, 25 larvae, JCW.

Subfamily OXYCORYNINAE

In addition to the synapomorphic characters given for Belidae, the following features are shared by the three genera examined, all of which feed in live tissue of primitive plants (larvae of *Oxycorynus* Chevrolat from South America and *Metrixena* Pascoe from palm fruits in the East Indies were not available for study):

- (1) head longer than wide;
- (2) head pigmented on anterior portion only (Fig. 221);
- (3) endocarinal line widely bifurcate (Fig. 221);
- (4) epicranium deeply emarginate;
- (5) occipital foramen open behind (Fig. 222);
- (6) antennae 1-segmented;
- (7) postlabial bracon absent;
- (8) spiracles unicameral, with simple airtube (Fig. 229);
- (9) body recurved terminally, with anus ventral.

Crowson (1955) posited that Oxycoryninae, unless given family status, about which he had reservations, would fit in somewhere amongst Belidae, Attelabidae, and Proterhinidae (=Aglycyderinae) on adult characters. Larval characters show greater divergence from Attelabidae than from the other groups, especially in the head capsule and spiracles, although the permanently retracted head, a tendency to forking in the endocarina, and the three-segmented maxillary palps maintain a close affinity.

Genus *Hydnorobius* Kuschel

Hydnorobius Kuschel, 1959: 263, 268.

Type species *Oxycorynus hydnorae* Pascoe.

Body sturdy, tapering abruptly, widest at mid-abdomen; ambulatory ampullae present dorsally on Abd I–V. Pronotal shield declivous, lacking a median suture. Head with dorsal excavation occupying approximately one-ninth of distance from hind margin to front; 1 ocellus visible beside antenna; endocarinal line with distance between apices as wide as clypeus. Antennae with basal cushion steeply

convex, as long as wide and twice as long as antennal cone, bearing 3 slender sensoria. Mandibles tridentate. Labrum transverse, pigmented in proximal two-thirds. Tormae mesal, short, slender, convergent. Epipharyngeal setae scanty. Maxilla bearing a distinct, sclerotised palpiger; palps 3-segmented; mala bilobate. Premental sclerite wide, poorly defined. Postlabium sclerotised. Thoracic pedal areas bearing numerous setae surrounding a few sensilli. Alimentary canal not examined.

Hydnorobius sp. indet.

Fig. 220–230

Maximum dimensions 6.0×2.0 mm; head width 1.0 mm. Cuticle minutely spiculate. Setae pallid, inconspicuous, longer and more numerous on Th I than elsewhere. Pronotum dark red-brown. Head dark red-brown in front, pallid beneath pronotal fold. Labrum with 5 setae. Epipharyngeal lining with 3 *als*, 1 *ams* + a sensillum, and below tormae 1 unpaired *mes*, 1 paired *mes*, and 1 paired cluster of 3 sensilli. Hypopharyngeal bracon pigmented.

Material examined. ARGENTINA: La Rioje, in *Prosopanche*, 1987, 4 larvae (associated with adult), ALT.

Remarks. *Prosopanche* (Hydnoraceae) is parasitic on plant roots.

Genus *Parallocorynus* Voss

Parallocorynus Voss, 1943: 59.

Type species *Allocorynus bicolor* Voss.

Body very stout, with a dense white fat body, widest at mid-abdomen; dorsal ampullae absent. Pronotal shield declivous, with a median suture. Head with dorsal excavation occupying approximately one-third of distance from hind margin to front; pigmented anterior portion terminating behind in a curved ridge at cuticle attachment; 2 ocelli present, the posterior one faint; endocarinal line with distance between apices as wide as clypeus. Antennae not visible (in these specimens). Mandibles tridentate. Labrum transverse, truncate. Tormae short, lateral. Epipharyngeal lining with a mesal, pear-shaped sclerite; setae as long as labral setae. Maxillary palps 3-segmented, without a palpiger; mala simple, narrow. Premental sclerite broad, V-shaped posteriorly. Postlabium sclerotised. Thoracic pedal areas scantily setose; sensilli absent. Alimentary canal with numerous short caeca scattered over lower coil of posterior ventriculus.

***Parallocorynus* sp. indet.**

Fig. 231–240

Maximum dimensions 5.0×2.0 mm; head width 0.7 mm. Cuticle minutely spiculate on dorsum, otherwise smooth. Setae very short, pallid, fewer than on *Hydnorobius*. Pronotum pale red-brown. Head red-brown on anterior half, otherwise pallid. Epipharyngeal lining with 3 *als*, 2 *ams*, 2 long *mes*, and a cluster of 4 sensilli.

Material examined. MEXICO: 16 miles W of Linares, 800 m, in male cone of *Dioon* (Cycadaceae), 11 Sep 1958, 2 larvae (associated with adult), CO*B.

Genus *Rhopalotria* Chevrolat

Rhopalotria Chevrolat, 1878: 130.

Type species *Rhopalotria dimidiata* Chevrolat.

Body robust, sharply curved; dorsal ampullae absent; anus ventral. Head retracted, longer than wide, with occipital foramen open behind; epicranium deeply emarginate; 1 ocellus present; endocarinal line bifurcate, with distance between apices wider than clypeus. Antennae small, conical, on a convex basal cushion. Mandibles bifid, with a small subapical projection; 1 seta present. Labrum transverse, subtruncate. Tormae lateral and short, or absent. Epipharyngeal lining with a mesal, pear-shaped sclerite; setae reduced in number. Maxilla with palps 2-segmented; mala narrow, parallel-sided, with apex rounded. Premental sclerite indistinct. Postlabium lightly sclerotised. Spiracles unicameral, minute; airtube simple, caudad on Abd segments. Abd VIII spiracle lateral.

Remarks. The genus *Rhopalotria* (= *Allocorynus*), endemic to Mexico and Cuba, is associated with the cycad genus *Zamia*. The weevils were transported along with their host plants to Florida (Fairchild Tropical Gardens), where one species has been shown (Norstog & Fawcett 1989) to play an important role in pollination. Of the three known *Rhopalotria* species, *R. dimidiata* is treated by Muniz & Barrera (1969) and *R. slossoni* (Schaeffer) is included in Emden's key (1938, p. 9).

***Rhopalotria mollis* Sharp**

mollis Sharp, 1889: 3.

Fig. 241–250

Maximum dimensions 3.5×1.3 mm; head width 0.5 mm. Cuticle minutely asperate. Setae inconspicuous. Pronotum pallid. Head pale red-brown in front, pallid under pronotal

fold. Labrum with 4 *lrms*; epipharyngeal lining with 3 *als*, 1 *ams*, and 1 *mes*, all of similar size to *lrms*; maxilla with 2 *stps*, 5 *dms*, and 3 *vms*. Setae of mouthparts otherwise in modal numbers.

Material examined. U.S.A. Florida, Fairchild Tropical Gardens, ex male cones of *Zamia furfuracea*, 8 Aug 1987, 6 larvae (associated with adults), WT.

Biology (after Norstog & Fawcett 1989). *R. mollis* and probably the other *Rhopalotria* species are considered to be host-specific to cycads in genus *Zamia*. The adults congregate on the male cones, where mating, feeding, and oviposition occur. Pollination is effected when the pollen-dusted weevils are attracted to the female cones, which grow on separate plants. Eggs are laid into holes chewed in the outer ends of the sporophylls, and the larvae feed on the parenchymatous tissue inside. They do not damage the sporangia, which are ranged on the outer surface, closely appressed within the cone. Although several larvae may hatch and start feeding in the same sporophyll, only one individual survives to pupate in a cell constructed at the axial end. When hardened, the adult emerges through a hole bored in the outer wall of the sporophyll. The cycle from egg to adult is short, probably taking only 7–9 days, and thus allowing time for up to six generations in a season. Late larvae have a thicker, more opaque cuticle, and as prepupae build a thick-walled cell where they overwinter, to pupate and emerge in April or May the following year.

Subfamily AGLYCYDERINAE

Body slender; dorsal ampullae weakly developed on Abd II–VI. Pronotum declivous. Head longer than wide, with occipital foramen closed; 1 ocellus present; endocarinal line indistinctly bifurcate. Antennae retractile, 1-segmented, cylindrical; apical cone narrow. Mandibles bifid, with one tooth or both bearing a lamellate projection. Labrum transverse. Tormae lateral, extended from labral sclerite. Maxillary palps 2-segmented, without a palpiger; mala entire. Labial palps 2-segmented. Postlabium unpigmented. Spiracles all of similar size, circular, unicameral; airtube oval, simple. Anus 3-lobed, terminal.

Remarks. This subfamily comprises three genera, of which *Proterhinus* Sharp is by far the most prolific, with over 150 known species, mostly in Hawaii. *Aglycyderes* Westwood occurs in the Canary Islands and Morocco. The third genus, *Aralius* Kuschel, is represented in New Zealand and New Caledonia. Differences between the genera

appear to be minimal. The diagnosis is based on larvae of *P. anthracius* Perkins, figured in Böving & Craighead (1931), and the Hawaiian species treated by Anderson (1941), as well as on the endemic species *Aralius wollastoni* (Sharp).

The larval habitats of Aglycyderinae are remarkably diverse, varying from living tissue of leaf mines to the degraded or dead tissue of fern stems, pith of dead twigs, and the bark of dead or dying branchlets.

Genus *Aralius* Kuschel

Aralius Kuschel, 1990: 79.

Type species *Platycephala olivieri* Montrouzier.

Aralius wollastoni (Sharp)

wollastoni Sharp, 1876a: 28 (*Platycephala*).

Fig. 251–261

Maximum dimensions 3.0×0.75 mm; head width 0.5 mm. Cuticle smooth to minutely asperate. Setae pallid, slender, moderately short. Pronotum and exposed portion of head pale red-brown. Pronotum clothed with evenly scattered setae; cephalic setae greatly reduced in number. Epipharyngeal lining with 3 *als*, 2 *ams*, and 1 *mes*; sensilli not visible. Maxillary palps with distal segment twice as long as proximal segment; mala rounded, bearing 11 lamellate setae. Pedal lobe with about 10 setae; sensilli absent. Alimentary canal with gastric caeca minute, globular, numbering about 6 on either side of lower coil; Malpighian tubules 4 in number, arising from a thickened ring; cryptonephridium weakly developed; rectal bracon not visible.

Material examined. NEW ZEALAND: CL – Cuvier I., in dead bark of *Pseudopanax lessonii*, 22 Jan 1972, 14 larvae*, BMM. NN – Whangamoia, 230 m, in dead *Pseudopanax*, 29 Nov 1963, 8 larvae, JIT.

Biology. The larvae were working in recently dead branchlets of the coastal araliad *Pseudopanax lessonii*, where the thin bark layer had not yet become dry. Pupation took place *in situ*. Larvae of *Eiratus parvulus* Pascoe (Cossolinae) and *Pactola variabilis* Pascoe (Eugnomini) were working in the same branch.

Family ATTELABIDAE

Body with 2 dorsal folds, often with ampullae. Setae in excess of modal numbers for Curculionidae. Head retracted, with a striated, hyaline posterior extension (apo-

deme); postoccipital condyles absent; frontal sutures complete in front; endocarinal line divided or not; primary ocellus present, and usually 2 secondary units, with 3 vestigial eyespots. Antennae 2-segmented, enclosed within anterior angles of frons. Mandibles apically bifid, with supplementary teeth and with 2 setae aligned longitudinally. Labrum bearing 4 pairs of setae and paired basal sensilli. Tormae subparallel, elongate, extended proximally beyond epistoma. Epipharyngeal lining with 3 *als*; *ams* and *mes* variable. Hypopharyngeal bracon thin or obsolete. Maxilla with 2- or 3-segmented palps; mala usually bearing a small lacinial tooth. Labial palps 2-segmented. Spiracles circular, bicameral or without airtubes. Thoracic spiracle intersegmental. Legs absent. Anus 4-lobed, with a large dorsal lobe and 3 smaller ventral lobes.

Biology. Members of the Attelabidae are predominantly leafrollers. The type of roll is to a large extent diagnostic; for instance, *Attelabus* and *Apoderus* species make box-shaped or thimble-shaped rolls fashioned from the folded distal part of the leaf, which is separated from the base by a transverse incision and left to hang by a narrow strip. *Byctiscus* species make cigar-shaped rolls without cutting the leaf, whereas *Deporaus* species make funnel-shaped leaf rolls characterised by two curved lines of incision and the unfolded condition of the rolled distal portion of the leaf (Prell 1924, Emden 1938, Scherf 1964). Typically one or two eggs are placed in the leaf roll, which soon falls to the ground. The larvae feed inside, and either pupate in the soil or overwinter in the roll to emerge next spring. Usually only one generation a year is produced, but *A. bipustulatus* Fabricius in North America is reported to be bivoltine (Blatchley & Leng 1916). The larval feeding sites of *Rhynchites* species are commonly in young fruit, but some utilise flower buds, shoot buds, stems, and roots. Larvae of *Eugnamptus* Schoenherr are leaf miners (Emden 1938).

Remarks. The Attelabidae are well represented in the Northern Hemisphere, especially in Europe through to Asia Minor and in North America. One genus has reached Japan. There are no representatives in New Zealand. I have therefore relied heavily on Emden (1938), where tribes and genera are covered in the keys, and on specimens of the European element loaned from the British Museum (Natural History). I have included *Apoderus* and *Eugnamptus* in the key but have not described them. The phylogenetic position of Attelabidae as now placed between Belidae and Brentidae seems logical in view of the transitional nature of certain larval characters. For example:

- (1) The head capsule, although retracted as in Belidae, is restricted by a posterior apodeme and can probably be

exserted to a limited extent. In Brentidae, the head capsule is free.

- (2) In *Rhynchites* the occipital foramen is open behind, as in certain Belidae.
- (3) The segments of the maxillary palps vary in number between the tribes of Attelabidae. There are two segments in Attelabinae and three in Rhynchitinae. The number for Belidae is three, and for Brentidae two.
- (4) The endocarinal line is divided in some attelabine genera but not in others. In Belidae it is usually forked, but never so in Brentidae.
- (5) The antennae in both Attelabidae and Belidae are two-segmented, but the character is not obvious in Attelabidae, where the basal segment is hidden. Brentidae have one-segmented antennae.

Subfamily ATTELABINAE Genus *Attelabus* Linnaeus

Attelabus Linnaeus, 1758: 387.

Type species *Curculio nitens* Scopoli.

'Box-rolling weevils'

Body robust, abruptly curved before middle, tapering; dorsal ampullae absent. Head capsule longer than wide; sides divergent; posterior extension one-third as long as epicranium, undulate, with margin trilobate; endocarinal line obsolete; 3 primary ocelli close together in a line beside antenna, and 3 vestigial eyespots further back, well separated. Labrum trilobate. Tormae thick, slightly bowed. Epipharyngeal lining with *als* curving away from margin, 1 *ams* pair, and proximal *mes* pair longitudinal. Maxillary mala subtruncate, bilobed, with dorsal setae in a curved line; lacinial tooth present; palps 2-segmented, with a small seta on both segments. Labial palps bearing a seta on basal segment. Labium and postlabium (prementum and mentum of Emden 1938) fused, sclerotised medially and at sides. Spiracles bicameral, caudad. Anus subterminal.

Attelabus nitens (Scopoli)

nitens Scopoli, 1763: 25 (*Curculio*).

Fig. 262–275

Maximum dimensions 6.0×1.8 mm; head width 0.85 mm. Cuticle minutely asperate. Setae golden, moderately long on prothorax, short elsewhere. Pronotum pale brown. Head pallid, but frons red-brown, and oral margins and mandibles black. Pedal area with 3 long setae, lacking sensilli. Spiracles 12–14-annulate.

First instar (Fig. 272–274). Differing from mature larva

as follows. Head width 0.52 mm. Setae proportionately longer. Postlabium strongly pigmented, bearing "a curious sclerotised process" (Emden 1938) consisting of a horn-like projection basally on each side contiguous with a transverse sclerome on prothoracic sternum terminated at each extremity by a mammiform, setose tubercle. Egg-bursting spines present above spiracle on Abd V/VI (Emden 1946, Cox 1988).

Material examined. ENGLAND: N. Devon, Braunton, Jun 1931, 7 larvae, KGB. DENMARK: Aug–Sep 1941, 23 Mar 1942, 16 larvae including 3 1st instar, JPK (BM 1946–30).

Remarks. This species has previously been described and figured by Emden (1938) and Fenili (1952).

Subfamily RHYNCHITINAE

Differing from Attelabinae, as represented by *Attelabus*, in having posterior extension of head capsule evenly rounded, maxillary palps 3-segmented, with a small seta on each of 2 distalmost segments, labium and postlabium separately sclerotised, hypopharyngeal bracon present but tenuous, and spiracles with airtubes dorsad or slightly oblique.

Genus *Byctiscus* Thomson

Byctiscus Thomson, 1859: 130.

Type species *Curculio betulae* Linnaeus.

'Cone-rolling weevils'

Body robust, strongly curved; dorsal ampullae present on Abd I–V. Head capsule longer than wide; sides subparallel; posterior extension reduced to a narrow plate; endocarinal line indistinctly, narrowly forked; ocelli not visible (in specimens to hand). Mandibles with apical tooth chisel-shaped. Labrum trilobate. Tormae very long, slender, subparallel. Epipharyngeal lining with *als* at margin, 1 *ams* pair, and proximal *mes* pair as long as *als*, longitudinal. Maxillary mala bilobate, with dorsal setae in 2 separate groups; lacinial tooth present. Labium with premental sclerite poorly defined. Postlabium strongly pigmented. Spiracles with airtubes dorsad. Anus subterminal.

Byctiscus betulae (Linnaeus)

betulae Linnaeus, 1758: 381 (*Curculio*).

Fig. 276–285

Maximum dimensions 6.0×2.0 mm; head width 0.85 mm.

Cuticle coarsely spiculate on dorsum, smooth below. Setae fine, pallid, moderately long. Pronotum pale brown. Head pallid, but frons red-brown, sharply defined, expanded anteriorly. Pedal area with 8 long and 3 short setae; 3 or 4 sensilli within a small, defined circle. Abd I–VII with 7 long *pds* and 7 shorter setae anterior to them. Spiracles 11- or 12-annulate.

First instar. Head width 0.5 mm. Setae fewer than in mature larva; anterior row of *pds* absent. Egg-bursting spines absent.

Material examined. DENMARK: Frerslev Hegn, ex *Corylus*, Jul–Aug 1939, 24 larvae including 2 1st instar, JPK (BM 1939-607).

***Byctiscus populi* (Linnaeus)**

populi Linnaeus, 1758: 381 (*Curculio*).

Fig. 286

Maximum dimensions 4.3×1.5 mm; head width 0.7 mm. Scarcely differing from *B. betulae* except in its smaller size.

Material examined. SWEDEN: Hallands Aas, ex *Populus tremula*, 25 Jul 1939, 25 larvae, JPK (BM 1939-607).

Genus *Deporaus* Leach

Deporaus Leach, 1819: 201.

Type species *Attelabus betulae* Linnaeus.

'Funnel-winding weevils'

Body slightly curved, scarcely tapering; weakly developed ampullae present on prodorsal fold of Abd I–V. Head capsule longer than wide; sides subparallel; posterior extension narrower than epicranium, tapering; endocarinal line distinct, widely bifurcate in front; 3 primary ocelli close together beside antenna, and 3 vestigial eyespots further back, well separated. Antennae with basal segment having a sclerotised collar and bearing 2 slender sensoria, one of which overtops apical cone. Labrum trilobate. Tormae elongate, bowed mesad below sensilli. Epipharyngeal lining with *als* curving away from margin, 1 *ams* pair, and 2 *mes* pairs close together. Maxillary mala bilobate, with dorsal setae in 2 separate groups; lacinial tooth present. Labium with premental sclerite weakly defined. Postlabium unpigmented. Prothoracic sternum sclerotised. Spiracles with airtubes prominent, external, rounded at apex, dorsad.

***Deporaus betulae* (Linnaeus)**

betulae Linnaeus, 1758: 387 (*Attelabus*).

Fig. 287–298

Maximum dimensions 4.5×1.5 mm; head width 0.6 mm. Cuticle coarsely spiculate. Setae pale red-brown, short. Pronotal shield pale brown, slightly declivous. Head pallid, but frons red-brown, darker on epistoma, suffuse behind, expanded anteriorly. Pedal area with 5 long and 6 short setae; sensilli absent. Spiracles with 9 or 10 annuli.

First instar (Fig. 298). Head width 0.3 mm. Egg-bursting spines present above spiracles on Abd I–V (Emden 1946, Cox 1988). Spiracles with airtubes external. Prothoracic sternum simple.

Material examined. GERMANY: Dresden, Hosterwitz, ex *Carpinus* and *Fagus*, Jun 1935, 6 larvae including 2 1st instar, FIE (BM 1937-405).

Remarks (on aquatic modification). After the leaf rolls have fallen, humidity or wetness is essential for *Deporaus* larvae to prevent the leaf roll from desiccating (Scherf 1964). This requirement may have initiated the modification shown by the spiracles. In *D. betulae* the adaptation is slight: the airtubes are of normal form but are external, lying outside the body cuticle. However, in *D. nidificus* Sawada & Lee, in Japan, the paired airtubes form a spine upstanding well beyond the peritreme (Sawada & Lee 1986). A similar but more extended progression can be observed in *Steriphus* Erichson (= *Desiantha* Pascoe) (*Rhytirhinini*), ranging from the external but rounded airtubes of *S. variabilis* (Broun) through the lateral, spinous airtubes of *S. diversipes lineata* (Pascoe), which are comparable with those of *D. nidificus*, to the dorsally arranged, spinous airtubes of the totally aquatic *S. ascita* (Pascoe) (May 1977). A detailed account of the leaf-rolling activities of *Deporaus betulae* is given by Buck (1952).

Genus *Rhynchites* Schneider

Rhynchites Schneider, 1791: 82.

Type species *Platyrynchus nebulosus* Thunberg.

Body stout, strongly curved, tapering; dorsal ampullae absent. Head capsule longer than wide, widest in front; posterior extension narrower than epicranium, tapering; occipital foramen open behind; endocarinal line not divided; 3 ocelli close together, in a line beside antenna. Labrum truncate. Tormae strong, elongate, divergent proximally. Epipharyngeal lining with *als* at margin, 1 *ams* pair, and 5 *mes* pairs, the proximal *mes* pair longitudinal. Maxillary mala evenly rounded; lacinial tooth absent.

Premental sclerite broad, arrow-shaped. Postlabium with a pigmented sclerite. Thoracic spiracle with airtubes cephalad; Abd spiracles smaller than thoracic ones, with airtubes dorsad. Anus terminal.

***Rhynchites auratus* (Scopoli)**

auratus Scopoli, 1763: 26 (*Curculio*).

Fig. 299–308

Maximum dimensions 14.0×4.0 mm; head width 1.3 mm. Cuticle coarsely spiculate on dorsum, more or less smooth below. Setae pallid, rather short. Pronotum pale brown, slightly rugose, coarsely spiculate behind, declivous. Head pallid, but frons red-brown, sharply defined, foveate anteriorly; oral margins black; genae quadrate, prominent. Pedal area with 4 long and 2 shorter setae; 5 or 6 sensilli in a small, defined semicircle. Abd I–VII with 6–8 long *pds* preceded by 6–8 shorter setae.

Material examined. IRAQ: Sulaimania, Penjwin, in kernels of yellow plums, 25 Jun 1928, 9 larvae, HS. GERMANY: Meissen, ex fruit of *Prunus spinosa*, 3 Aug 1936, 2 larvae, HW (BMNH).

Remarks. The general habitus of *R. auratus* closely resembles that of *Curculio* Linnaeus, which occupies a similar niche in the enclosed space of fruit kernels. These genera are readily separated by the free, completely pigmented head of *Curculio* as well as by the absence there of the less obvious, but very significant, primitive features of *Rhynchites*. First-instar specimens of *R. auratus* were not available to me, but egg-bursting spines are recorded on Abd II–VIII of *R. aequatus* (Linnaeus) and on Abd IV–VIII of *R. germanicus* Herbst (Cox 1988).

Family BRENTIDAE

The family Brentidae – comprising Carinae, Brentinae, Cyladinae, Antliarhinae, and Apioninae (of which all but Carinae have been available to me as larvae) – exhibits three synapomorphic characters in common with the foregoing families:

- (1) frontal sutures reaching mandibular membrane;
- (2) antennae enclosed by frontal plate;
- (3) postoccipital condyles absent.

Three other primitive features are present in one or another of the subfamilies:

- (1) abdominal segments with two dorsal folds;
- (2) the presence of legs or vestiges thereof such as sclerotised areas and sensilli on the pedal lobes;

(3) labrum with four primary setae (Antliarhini).

Derived characters such as three or four dorsal abdominal folds, one-segmented antennae, one or two ocelli, two-segmented maxillary palps, and more or less modal numbers of setae, including three labral setae, indicate a trend towards the 'higher weevils' in Curculionidae.

Subfamily BRENTINAE

Body elongate, cylindrical, with 2–4 dorsal abdominal folds, usually expanded at metathorax and Abd IX, truncate posteriorly; 2-segmented legs present except in Calodromini. Head free, subglobose. Antennae 1-segmented. Mandibles apically bifid, with sharp incisor edge. Tormae short, strong, convergent. Epipharyngeal setae variable in number. Hypopharyngeal bracon clear or pigmented. Tentorial bridge sometimes subdivided laterally. Maxillary palps 2-segmented, with a small seta on proximal segment only. Labial palps well separated, 1- or 2-segmented. Premental sclerite with median extensions weak or absent. Pronotum strongly transverse. Mesothorax dorsolaterally with a triangular area which is rugose and often pigmented (absent in Calodromini). Spiracles variable in shape, with or without airtubes.

Remarks. Relative to the number of adults described in Brentinae (over 100 genera), only a few of the larvae have been identified. Previous work has mostly been confined to Dehra Dun, India, where Gardner (1935) provided diagnoses and keys to Indian brentines in thirteen genera. Sanborne (1981) described the first-instar larva of *Arrhenodes minutus* (Drury) from Ontario. These studies have been taken into account in the above assemblage of characters. The subfamily, which is mainly of tropical and subtropical distribution, is represented in New Zealand by only one species, *Lasiorynchus barbicornis* Fabricius.

Brentinae have proliferated in the warmer forested regions of the world, where they are primary wood-borers in dead and dying trees before the timber has started to decompose, and often when it is very hard. As far as is known all species live on fungi, and most are xylomycetophagous, with habits resembling those of the ambrosia beetles (Milligan 1970). Some species in the tribe Calodromini have become myrmecophilous, either as ant-guests or ant-robbers, while others utilise the galleries of Scolytinae and Platypodinae, which may be killed or ejected in the process (Beeson 1925). The larvae of Calodromini are peculiar among Brentinae in lacking any trace of segmented legs (Gardner 1935).

Genus *Lasiorhynchus* Lacordaire

Lasiorhynchus Lacordaire, 1866: 469.

Type species *Brenthus barbicornis* Fabricius.

Body and head of typical shape. Thoracic legs 2-segmented. Head with ecdysial line and sutures distinct; frontal suture narrow, angled at *des3* and *fs1*, its apex almost straight across; tentorial bridge divided laterally. Antennae very small, lateral. Clypeus transverse. Labrum two-thirds as wide as clypeus, evenly rounded, densely fringed. Mentum depressed, more or less free laterally. Labial palps 2-segmented, not reaching level of maxillary palpifer. Maxillary mala narrow, conical, with setae in a curved row, the basal ones rather long; stipes slender, elongate. Thoracic spiracle intersegmental, ovate-fringed, with 2 minute airtubes ventrocaudally on margin of peritreme; vestigial spiracle distinct on Th III. Abdominal spiracles one-quarter as large as that of thorax, subcircular, with 2 minute airtubes on posterior margin. Abd VIII spiracle positioned subdorsally. Abd IX with dorsum expanded and curved downwards, truncate. Anus 3-lobed; cleavage U-shaped, with a short ventral slit. Alimentary canal with proventriculus globose; cardiac mycetomes absent; anterior ventriculus relatively short; posterior section narrow, proceeding in 2 or 3 loose coils; gastric caeca absent; Malpighian tubules 4 in number; cryptonephridium symmetrical; rectal bracon not visible.

Lasiorhynchus barbicornis (Fabricius)

barbicornis Fabricius, 1792: 491 (*Brenthus*).

'Giraffe weevil'

Fig. 309–322

Maximum dimensions 25.0×5.0 mm; head width 3.1 mm. Cuticle shagreened or smooth; Th II with prodorsal fold upstanding and with a pigmented, rugose tubercle dorso-laterally; Th III with a similar but smaller tubercle. Setae short, slender, pallid, longer on head and Abd IX, differing in modal numbers from Curculionidae as follows. Maxilla 18 *dms*, 3 *vms*; epipharyngeal lining 2 *als*; pronotum 6 setae; Th II/III 2+2 *prs*, 2 *dls*, 3 *ss*, pedal area 5, 4, 6 respectively on coxal area and leg segments; Abd I 2+2 *prs*; Abd II–VII 2 *prs*; Abd VIII 1 long *prs*; Abd IX 6 *ds*, 2+2 *ps*. Pronotal shield red-brown in front and at sides, pallid behind. Head red-brown; sides paler and with a pallid stripe; oral margins and mandibles black; endocarinal line absent. Labrum with 3 setae and a basal sensillus. Epipharyngeal lining with 2 *als* close together, 6 evenly spaced submarginal setae (interpreted as 2 *ams* pairs and an anterior *mes* pair), 1 *mes* pair and sensilli clusters between tormae, and 1 short, contiguous *mes* pair amongst coarse

pubescence at base of tormae. Hypopharyngeal bracon pigmented. Premental sclerite a narrow, arcuate band.

First instar (Fig. 321). Maximum dimensions 4.1×1.0 mm; head width 3.75 mm. Antennae more cylindrical than in mature larva. Egg-bursting spines present on Abd I–V above spiracle and well separated from it.

Material examined. NEW ZEALAND: AK – Waitakere Range, in recently dead wood of *Olearia rani*, 5 Jul 1966, 5 larvae, BMM; Te Henga (Bethells), in sound stump of *Corynocarpus laevigatus* (karaka), 14 Nov 1967, 15 larvae, emergent adults, BMM*; Matuku Reserve, in dead, standing *Corynocarpus laevigatus*, 13 Jan 1985, 23 larvae, pupae, RCC, GK*. NN – Aorere Vly, Kaituna, in *Hedycarya* stump, 6 May 1965, 4 larvae, GK; Pelorus Bridge, in 1-year felled *Prumnopitys taxifolia* (matai), 25 Jul 1967, 10 larvae including 7× 1st instar, JSD.

Biology. Oviposition sites of *L. barbicornis* are prepared by the female weevil chewing a cavity in the bark of dying or suppressed trees and in freshly felled logs. The newly hatched larva bores radially into the wood. The diameter of the tunnel is enlarged as the larva grows, except in the short initial section, which remains narrow. 'Ambrosia' fungi and yeasts grow in the larval tunnels (Milligan 1970). The gut contents of submature larvae from Te Henga contained fungal material including coelomycete spores (*Seimatosporium* or *Monochaetia*; E. McKenzie det.) but no wood fragments. Pupation occurs in a cell along the axis of a tunnel near the exit, which has been enlarged but not extended through the original entry tunnel in the bark. It is left for the emergent adults, when hardened, to chew through the final section. Some of them perish at this time with the rostrum protruding (observed at Te Henga in 1967), having apparently failed to make sufficient space to clear their rather wide shoulders.

Remarks. *L. barbicornis* is close to *Prophthalmus heikertingeri* Klein from Bengal (Bangla Desh), according to Gardner's (1935) description of the larva. In the male pupa the antennae (Fig. 322) are held erect beside the head as in *Cylas formicarius* (Fabricius) (Fig. 323). The shorter antennae of the female are curved dorsad behind the pronotal tubercles.

Subfamily CYLADINAE

Genus *Cylas* Latreille

Cylas Latreille, 1802: 196.

Type species *Brenthus brunneus* Fabricius.

Body weakly curved; dorsal abdominal folds indistinct.

Head small in relation to body; 2 ocelli of similar size present. Labrum bearing 3 setae and a basal sensillus. Epipharyngeal lining with 2 proximal pairs of *mes* arranged in a line across, and 3 *als* on anterior margin. Labial palpi 2-segmented. Premental sclerite broadly V-shaped. Postlabium with an additional median pair of *plbs*. Spiracle present on Abd VIII; all spiracles circular, bicameral with annulated airtubes, ventrocaudad. Pedal lobes with 2 concentric seta-bearing sclerites. Anus terminal, 4-lobed.

Remarks. *Cylas* has been placed variously in Brentidae (Fabricius 1798), Eurhynchinae (Crowson 1955), and Apioninae (Emden 1938). Both subfamilies are included in Brentidae in Kuschel's new scheme, but *Cylas* and its allies (three genera) are now placed in a separate subfamily. The following characters show the *Cylas* larva, represented by *C. formicarius*, as relating rather more closely to the true Brentines than to the apionines. The abdomen has more than two dorsal folds (except on Abd I), eight pairs of spiracles are present, and the anus is four-lobed. The pedal lobes show two concentric sclerites, a disc within a ring, corresponding to the two-segmented legs of Brentinae, and the frons has a full complement of five setae. In addition, the pupal antennae (Fig. 323) are held erect beside the head as in *Lasiorrhynchus* (Fig. 322), whereas in Apioninae they are curved dorsad.

***Cylas formicarius* (Fabricius)**

formicarius Fabricius, 1798: 174 (*Brentus*).
'Sweet potato weevil'

Fig. 323–333

Maximum dimensions 8.1×1.5 mm; head width 0.9 mm. Body elongate, slender; Abd I with 2 dorsal folds; Abd II–VI with paired ampullae in front of the row of *pds*. Cuticle coarsely spiculate. Setae short, fine, pallid, differing in modal numbers from Curculionidae as follows. Maxilla 14 *dms*, 5 *vms*; postlabium 4 *plbs*; pedal lobe 3+5 setae; pronotum 13 setae; Th II/III 3 *ss*; Abd VIII 6 *pds*; Abd IX 3 *ds*. Pronotal shield weakly pigmented. Head pale brown; oral margins dark; endocarinal line half as long as frons. Labrum rounded, with lateral seta well developed. Tormae short, strong, fringed on outer margin.

Material examined. NIUE: Paliati, ex kumara, 29 Sep 1964, 15 larvae, 5 pupae, ACE. NEW ZEALAND: Auckland, ex kumara shipment, 8 Dec 1971, 2 larvae, 3 pupae, Port Quarantine Authority.

Biology. *C. formicarius*, thought to have originated in

Indonesia, has become a serious pest of sweet potato (kumara; *Ipomoea batatas*) throughout the Pacific and in Australia. It is found on wild species of *Ipomoea* such as *I. brasiliensis* as well as on the cultivated varieties. Although frequently intercepted, *C. formicarius* has not become established in New Zealand. Up to 250 eggs per female are inserted separately into the tubers, where they hatch within a week. Larvae tunnel into the flesh where, after three moults, they pupate in the roots or lower stems. The life cycle occupies 40–44 days. The tissue turns brown around the larval workings, and general decay follows (Dammerman 1929, Sherman & Tamashiro 1954).

C. formicarius is distinguishable from another pest of sweet potato, *Euscepes postfasciatus* (Cryptorhynchini), as follows. Larva: Abd I with 2 dorsal folds (cf. 3); Abd II–VI with conspicuous ambulatory ampullae on anterior fold (cf. no ampullae); labral tormae subparallel, separate (Fig. 00) (cf. convergent, united into a short basal stem); maxillary mala with a dorsal row of 13–15 setae (cf. 7 setae). Pupa: antennae straight, directed anteriorly (cf. elbowed, directed dorsocaudally).

Subfamily ANTLIARHININAE

Body robust, very convex, scarcely tapering; Abd I–VI with 2 dorsal folds; legs absent. Head free, small in relation to body. Antennae 1-segmented. Mandibles short, apically bifid. Labrum bearing 1 or 4 setae. Tormae short, thick. Hypopharyngeal bracon clear. Maxillary palps 1- or 2-segmented. Labial palps 1-segmented. Spiracles circular, bicameral, absent on Abd VIII. Anus subterminal, 4-lobed.

Remarks. Members of this group are associated with the reproductive parts of plants in southern Africa, *Tanaos* Schoenherr on *Protea* and *Antliarhis* Billberg on cycads. The acquisition of larvae in *Tanaos* has facilitated a diagnosis of the subfamily, since larvae of *Antliarhis zamiae* (Thunberg) are so modified that many characters are suppressed. Sanborne (1981) has provided a detailed description of this species in the context of his study on *Ithycerus* Schoenherr.

Genus *Tanaos* Schoenherr

Tanaos Schoenherr, 1826: 63.

Type species *Tanaos sanguineus* Thunberg.

Body of typical shape. Head subglobose, entire behind and slightly produced; ecdysial line and coronal suture of equal length; endocarinal line almost reaching epistoma; frontal

suture not angled before apex; *des3* in suture; primary ocellus and a faint eyespot present. Antennae very small, lateral, with 4 sensorial papillae at base. Clypeus transverse. Labrum two-thirds as wide as clypeus, trilobate, with 4 setae and a basal sensillus. Maxillary palps 2-segmented; mala with *dms* in a curved row. Labial palps cylindrical. Premental sclerite complete. Thoracic pedal areas well defined, circular, sclerotised. Spiracles of thorax and abdomen similar in size. Alimentary canal of modal form, lacking cardiac mycetomes; gastric caeca vermiform; 4 Malpighian tubules present; cryptonephridium symmetrical, joined by only 2 Malpighian tubules.

***Tanaos interstitialis* Fähræus**

interstitialis Fähræus, 1871: 241.

Fig. 334–344

Maximum dimensions 6.0×2.5 mm; head width 1.3 mm. Cuticle coarsely spiculate. Setae moderately long, slender, tapering, differing in modal numbers from Curculionidae as follows. Head 3*fs*; maxilla 10 *dms*, 4 *vms*; labrum 4 *lrms*; pronotum 13 setae; Th II/III 7 *pds*, 2 *dls*, 3 *ss*, 2 *vpls*; pedal area 5 setae and 5 sensilli; Abd I 9 *pds*; Abd II–VII 7 *pds*; Abd VIII 6 *pds*; Abd IX 2 *ds*, 1 *ps*, 1 *sts*. Pronotal shield pale brown. Head red-brown, darker in front. Ocellus under a convex cornea. Epipharyngeal lining with anterior *mes* pair submarginal, median *mes* wider apart between tormae, posterior *mes* pair slender, curved, between tormal bases, with sensilli clusters above and below. Labial palps as long as basal segment of maxillary palps. Premental sclerite a broad trident with anterior and posterior median extensions acute. Postlabium coarsely asperate at sides. Spiracles 7–9-annulate, caudad. Alimentary canal with gastric caeca arranged in 2 rows of 8 in a tight cluster near ileo-colic valve.

Material examined. SOUTH AFRICA: Pretoria, ex flower heads of *Protea caffra*, 28 Feb 1988, 3 larvae associated with adults, RO.

Genus *Antliarhis* Billberg

Antliarhis Billberg, 1820: 43.

Type species *Curculio zamiae* Thunberg.

Body of typical shape. Setae reduced in size and number. Head small in relation to body, widest behind middle, truncate posteriorly, sides convergent; endocarinal line faint; frontal suture indistinct; ocelli absent. Antenna fully exposed, minute with 4 sensorial papillae. Labrum as wide as clypeus, truncate in front. Maxillary palps 1-segmented;

mala with *dms* at apex only. Labial palps papilliform. Premental sclerite medially obsolete. Thoracic pedal areas unsclerotised. Spiracles all of similar size; thoracic spiracle on mesothorax.

***Antliarhis zamiae* (Thunberg)**

zamiae Thunberg, 1784: 28 (*Curculio*).

Fig. 345–353

Maximum dimensions 8.0×2.5 mm; head width 0.5 mm. Cuticle covered with minute, asperate pimples. Setae minute, mostly reduced to sensilli. Pronotal shield unsclerotised, invested with skin-points as for other cuticle. Head pale red-brown. Labrum with a minute discal seta. Epipharyngeal lining with 3 *als* of moderate length, 2 *ams*, and 1 *mes* pair below and wider apart than the *ams* pairs. Tormae short, broad, widest distally. Spiracles 5- or 6-annulate, obliquely dorsad.

Material examined. SOUTH AFRICA: Grahamstown, ex seeds of *Encephalartos altensteinii*, 29 Nov 1983, 2 larvae, 2 exuviae, RO.

Subfamily APIONINAE

Body strongly convex, abruptly tapered; abdominal segments with 2 distinct dorsal folds (except in leaf-miners, e.g., *Apion columbinum* Germar, figured in Scherf 1964); legs absent. Setae reduced in size and number. Head free, subglobose; endocarinal line and either 1 or 2 ocelli present. Antennae 1-segmented. Mandibles apically bifid, with mola undeveloped. Labrum bearing 1–3 setae. Tormae short, subparallel. Premental sclerite broadly V-shaped. Postlabium with posterior pair of *plbs* as far apart as median pair. Maxillary palps 2-segmented; mala narrow, parallel-sided. Labial palps 1-segmented. Spiracles circular, unicameral or bicameral; thoracic spiracle intersegmental; Abd VIII spiracle vestigial or absent. Anus a terminal, transverse cleft. Alimentary canal with 4 Malpighian tubules.

Remarks. The Apioninae are small to very small weevils comprising numerous species and with a worldwide distribution. Their larvae are more or less sedentary, feeding in live plant tissue: stems and roots (where galls may be formed), seeds, or leaves. The restricted space of their habitat is reflected in their characteristically convex body shape. Those that are leaf-miners are more depressed and elongate. Apioninae are usually host-specific to a particular plant or plant group. *Nanodes* Schoenherr (= *Nanophyes*

Schoenherr), with the Abd VIII spiracle entire and the anal cleft four-lobed, is linked as closely to *Cylas* as it is to *Apion*. The subfamily diagnosis is based on the genus *Apion* Herbst as treated by Emden (1938), Scherf (1964), Parnell (1964), and Williams (1968) as well as on the New Zealand element represented by *Neocyba* Kissinger and the introduced gorse seed weevil *Exapion ulicis* (Forster).

Genus *Exapion* Bedel

Exapion Bedel, 1887: 360.

Type species *Attelabus fuscirostris* Fabricius.

Exapion is characterised by having seven abdominal spiracles (*Podapion* Riley six; *Nanodes* eight). In other respects *Exapion* conforms to the subfamily diagnosis.

Exapion ulicis (Forster)

ulicis Forster, 1771: 31 (*Curculio*).

'Gorse seed weevil'

Fig. 354–363

Maximum dimensions 3.0×1.3 mm; head width 0.5 mm. Body of typical shape. Cuticle sparsely and minutely spiculate. Setae minute, reduced from modal numbers for Curculionidae as follows: head 2*fs*, 4*des*, 1*les*, 0*ves*, 1*cls*; maxilla 5*dms*-*vms*; labrum 1*lrms*; epipharyngeal lining 1*mes*; pronotum 6 setae; Th II/III 1*prs*, 2*pds*, 3*ss*; pedal area 2 setae; Abd I–VIII 0*prs*, 2*pds*, 1*dpls*, 1*vpls*, 3*lsts*, 1*msts*; Abd IX 2*ds*, 1*ps*, 1*sts*. Pronotal shield unpigmented. Head pale yellow, with oral margins and mandibles red-brown; ocelli obsolete; endocarinal line short, indistinct. Antennae narrowly conical, with 2 basal, hair-like sensoria. Labrum bearing 1 discal seta. Labial palps short, papilliform. Thoracic spiracle bicameral, with airtubes 6–8-annulate, caudad; Abd spiracles unicameral, with airtubes 5-annulate, caudad.

Material examined. NEW ZEALAND: AK – Huia, 15 Dec 1968, 20 larvae*, BMM.

Biology. *Exapion ulicis* was introduced into New Zealand from Britain in 1927 and released generally during 1931–41, in an attempt to control the spread of gorse (*Ulex europaeus*). In the early flowering period, September to October, the female oviposits in the green pods, placing a cluster of eggs in each one. Larvae feed on the developing seeds, pupate within the pod, and are ejected as adults when the dry pod bursts open. The weevils have become well established, and may destroy up to 100% of seed from the

spring flowering. However, their effectiveness is limited by their failure to attack pods produced at other times of the year (Miller 1971, Hill 1986, Gourlay 1989).

Genus *Neocyba* Kissinger

Neocyba Kissinger, 1968: 17.

Type species *Apion metrosideros* Broun.

Body of characteristic shape. Head subcircular in outline, slightly depressed; endocarinal line distinct. Antennae narrow, elongate. Labrum with 3 setae. Labial palps cylindrical. Hypopharyngeal bracon clear. Spiracles bicameral, absent on Abd VIII.

Neocyba metrosideros (Broun)

metrosideros Broun, 1880: 466 (*Apion*).

Fig. 364–372

Maximum dimensions 3.0×1.25 mm; head width 0.5 mm. Cuticle shagreened or almost smooth. Setae very fine, short, pallid, reduced from modal numbers for Curculionidae as follows. Head 3*fs*; 1*cls*; maxilla 9*dms*, 4*vms*; pronotum 5 setae; Th II/III 2*pds*, 1*dls*; pedal area 1+1 setae; Abd I–VII 2*pds*, 3*ss*, 1*dpls*, 1*vpls*, 0*lsts*; Abd VIII 3*pds*, 1*dpls*, 1*vpls*, 0*lsts*; Abd IX 2*ds*, 0*ps*. Pronotal shield unpigmented. Head pallid, with oral margins and mandibles red-brown; sutures indistinct; *fs*4 longer than *fs*5, *fs*3 minute, *fs*1 and *fs*2 absent; anterior ocellus dark; posterior eyespot faint; endocarinal line two-thirds as long as frons. Epipharyngeal lining with 2 pairs of *mes* arranged quadrately between tormae. Premental sclerite a thin, V-shaped line. Pedal areas smooth, not sclerotised.

Material examined. NEW ZEALAND: ND – Coopers Beach, ex *Metrosideros excelsa*, 25 Feb 1966, 30 larvae*, BMM. AK – Wenderholm, 18 larvae*, BMM. CL – Te Hope Beach, 32 larvae, JST.

Biology. Larvae of *N. metrosideros* are found in small subcortical mines in the green cambium layer of pohutukawa trees on 1–5-year-old growth. The workings are short and compact. Pupation occurs *in situ*. Exit holes were found in the thickened epidermis of second-year growth, suggesting that development must take at least one season. The weevil shows a preference for trees in exposed coastal situations. Possibly as a result, the bark of such trees is noticeably more cracked and rugged than on trees planted inland or growing around the Manukau Harbour (AK), where the weevil does not seem to be present.

Some *Neocyba* larvae were harbouring solitary hymenopterous larvae, one of which pupated to produce a pteromalid wasp. The larva of a meloid beetle was discovered feeding on a *Neocyba* larva within its mine.

Neocyba species A

Fig. 373

Dimensions of largest specimen 3.5×1.5 mm; head width 0.75 mm. Cuticle smooth. Setae minute, in numbers as for *N. metrosideros* except head with *fs4* only. Head colour pattern distinctive: frons, parietal areas, oral margins and mandibles bright red-brown, epistoma darker; frontal sutures wide with irregular margins, pallid, as is epicranium. Endocarinal line short. Labrum membranous. Premental sclerite obsolete. Pedal areas sclerotised. Similar in other respects to *N. metrosideros*.

Material examined. NEW ZEALAND: NN—Mt Arthur, 1000 m, Flora Track, ex galls on live stems of *Nothofagus menziesii*, 4 Feb 1965, 10 larvae associated with adults, GK.

Neocyba species B

Fig. 374–384

Maximum dimensions 3.0×1.5 mm; head width 0.5 mm. Cuticle spiculate. Setae inconspicuous, but longer than on larvae of sp. A, in numbers as for *N. metrosideros* except pedal lobe with 3 setae. Head pale red-brown, darker in front; ocellus large; endocarinal line half as long as frons. Labrum rounded, with discal seta long, tapering, anterior seta strong, blunt, and lateral seta well developed. Premental sclerite broadly V-shaped. Postlabium with scattered spicules at base. Pedal areas sclerotised.

Material examined. NEW ZEALAND: TO—Mt Ruapehu, Turoa, in fruits of *Libocedrus bidwillii*, 14 Apr 1989, 5 larvae, SP & RF.

Biology. The larvae were feeding on developing seeds within the green capsule. One of them pupated in October, inside the capsule (S. Pilkington, pers. comm.).

Family CURCULIONIDAE

The family Curculionidae comprises the bulk of the weevil fauna, the non-orthocerous species whose frontal sutures do not meet the mandibular membrane and whose antennae are not completely enclosed by the frontal plate. Other family characters are as follows.

Typical abdominal segments (Abd II–VI) with 3 or 4 dorsal folds. Legs absent except in *Ithycerus* (2-segmented) and *Gymnetron* (expanded pedal lobes). Head with postoccipital condyles usually present and often conspicuous; 1 primary ocellus and 1 secondary (one or both of these may be obsolete; 1+2 ocelli in *Ithycerus*). Antennae 1-segmented, on a basal membranous cushion. Mandibles with mola undeveloped except in certain lignivorous genera. Labrum with 3 setae (4 in *Ithycerus*, 5 or 6 in *Brachycerus*). Maxilla without a sclerotised palpiger; mala lacking a lacinia or lacinial spine; palps 2-segmented. Articulatory lobe between stipes and postlabium absent.

Subfamily BRACHYCERINAE

The subfamily Brachycerinae as now envisaged comprises the broad-nosed weevil tribes Ithycerini, Brachycerini, and Entimini (Adelognatha of authors) together with Rhytirhinini, Amycterini, Aterpini, Gonipterini, Hyperini,

Table 3 Modal numbers of setae for curculionid larvae (parentheses denote minute setae; v, variable)

HEAD		MESO-, METATHORAX	
dorsal	5	prodorsal	1
posterior	(4)	postdorsal	4
lateral	2	dorsolateral	1 or 2
ventral	2	spiracular area	1–3
frontal	5	dorsopleural	1
clypeal	2	ventropleural	1
labral	3	mediosternal	1
mandibular	2	pedal area	v
EPIPHARYNGEAL LINING		ABDOMEN I–VIII	
anterolateral	3	prodorsal I–VII	1
anteromedian	2	VIII	0 or 1
median	3	postdorsal I–VI	5
MAXILLA		VII	5
malar: dorsal	v	VIII	v
ventral	v	spiracular I–VI	2
basiventral	1	VII	1
palpal	1	VIII	1
stipital	1	dorsopleural	2
palpiferal	2	ventropleural	2
LABIUM		laterosternal	1
prelabial	1	mediosternal	2
postlabial	3	ABDOMEN IX	
ligular	2	dorsal	v
PROTHORAX		pleural	2
pronotal	v	sternal	2
dorsopleural	0–3	ABDOMEN X	
ventropleural	2	anal lateral	1–3
mediosternal	1		
pedal area	v		

and other family-groups (G. Kuschel, in press). Although these groups show considerable divergence in appearance and lifestyle, they are linked together by a shared mode of oviposition. Eggs are laid randomly, either singly or in clusters, in the soil or cemented to foliage. The site is not prepared in plant tissue by the mandibles. Morphologically the subfamily is difficult to characterise as a unit, but the tribes are distinctive, and hence will be treated individually. In the majority of Brachycerinae examined, *des3* is situated either within the frontal suture or on the frontal plate. However, the feature cannot stand as an autapomorphy since it also occurs in Erihirhini and in *Sitophilus* Schoenherr but not in Ithycerini, Gonipterini, and Hyperini. In Brachycerini, Entimini, and Aterpini the antennae are apically rounded or almost plane, and tend to be oval in cross-section.

Tribe Ithycerini

The tribe Ithycerini is represented by a single genus, *Ithycerus* Schoenherr, in North America. *I. noveboracensis* (Forster) in its larval form as treated by Sanborne (1981) shows closer affinities with Brentidae and Attelabidae than with Curculionidae. However, I cannot agree with Sanborne's interpretation of the character states around the anterior termination of the frontal sutures, and hence the antennal position in the frons. The two together are crucial in determining (from the larva) whether the systematic position of a taxon should be among the primitive (orthocerous) families or among the more advanced Curculionidae (Emden 1938).

In the mature specimen of *I. noveboracensis* I have examined, with the head capsule in frontal view (Fig. 387), a sclerotised frontocranial bridge can be seen connecting the frons to the epicranium and separating the sutures from the mandibular membrane. Above the bracon the sutures merge with the antennal cushion, so that the antenna is not completely enclosed within the frons. This is a derived character state by comparison with the out-group Chrysomeloidea.

Ithycerus has thus been restored to Curculionidae, where it was originally placed (as *Curculio*) by Schoenherr in 1823, but is now in a separate tribe among the broad-nosed Brachycerinae. It is truly transitional, having two-segmented thoracic legs, three ocelli, four labral setae, and four Malpighian tubules, features which occur in Brentidae and other orthocerous families but not otherwise in Curculionidae. Its affinity with Brachycerinae is shown firstly by the habits of oviposition in the soil and of feeding on roots instead of performing these functions arboreally, as in the preceding families; and secondly by the presence in the

pupa of mandibular setae (Sanborne 1981, fig. 89), which are thought to be associated with the deciduous cusps present on the teneral mandibles of most broad-nosed weevils (May 1978).

Genus *Ithycerus* Schoenherr

Ithycerus Schoenherr, 1829: 55.

Type species *Curculio noveboracensis* Forster.

Ithycerus noveboracensis (Forster)

noveboracensis Forster, 1771: 35 (*Curculio*).

'New York weevil'

Fig. 385–394

Maximum dimensions: length 24.8 mm; head width 5.1 mm. Body robust, convex, strongly curved; abdominal segments with 2 or 3 dorsal folds; pedal areas bearing 2-segmented legs. Cuticle coarsely spiculate. Major setae moderately long. Pronotal shield lightly sclerotised. Setae differing from modal numbers as follows: head 3 *cls*, 4 *lrms*; epipharyngeal lining 7 *als*, 1 *mes*; maxilla 17 or 18 *dms*, 4 *vms*; pronotum 9 setae; Th II/III 2 *dls*, 4 *ss*, 2 *dpls*; pedal area 9+6+5 setae respectively on coxa and leg segments; Abd I–VIII 4 *pds*, 4 *ss*, 3 *dpls*; Abd IX 1 *prs*, 4 *ds*, 2 *dpls*, 1 *vpls*; anal lateral lobes 3 setae.

Head yellow, grading to brown at oral margins; 3 ocelli present; endocarinal line half as long as frons; antennal cone as wide as long, with a large papilla and several smaller basal papillae. Mandibles somewhat elongate, weakly bifid, with 3 median incisor projections; molar area undeveloped; 2 setae of equal length, arranged transversely. Clypeus and labrum transverse. Labrum with 4 strong setae. Epipharyngeal lining with *als* in excess of modal number; *mes* reduced to 1 (3 in 1st instar). Tormae elongate, subparallel. Maxilla with 2-segmented palps; mala with a curved line of 17 or 18 lamellate setae. Labial palps 2-segmented. Premental sclerite distinct, with a posteromedian extension. Spiracles circular, bicameral in 1st instar, becoming progressively more elliptical in later instars and with airtubes smaller relative to orifice. Thoracic spiracle intersegmental. Alimentary canal with proventriculus ridged internally; anterior ventriculus bulky; posterior ventriculus much narrower, 2-coiled, carrying numerous vermiform gastric caeca randomly around lower coil; 4 Malpighian tubules arising from simple bases posterior to caeca; cryptonephridium symmetrical (Sanborne 1981, fig. 48). Anus terminal, 4-lobed.

Material examined. CANADA: Ontario, 1978, 1 mature

larva, 10 1st-instar larvae, ex eggs in soil, reared on roots of *Quercus alba*, MS.

Biology (after Sanborne 1981). The eggs of *Ithycerus* are laid singly in small depressions in the soil during summer (June, July). Each is covered with faecal matter by the female drawing the tip of her abdomen back and forth across it. The eggs hatch after 3–6 weeks. Larvae feed on tree roots, and in captivity were reared on roots of *Quercus alba* (white oak) and *Q. macrocarpa* (bur oak). Feeding is primarily on the lower surfaces of lateral roots, where the external bark is removed, exposing the inner xylem layer. Larvae travel on their backs in the tunnels thus formed. Ecdysis to new instars takes place in expanded tunnel endings.

Larval development under laboratory conditions passed through a minimum of seven instars, with adults emerging about two years after oviposition. The second winter was spent as seventh-instar larvae.

Host plants are restricted for the most part to trees in Betulaceae, Juglandaceae, and Fagaceae, but adults have developed a liking for apple, plum, and peach trees (Rosaceae).

Tribe Brachycerini

Genus *Brachycerus* Olivier

Brachycerus Olivier, 1790: 181.

Type species *Brachycerus barbarus* Linnaeus.

Body very robust; abdomen with 3 dorsal folds, the prodorsal fold more prominent than the postdorsal one and bearing as many setae. Setae tending to proliferate, especially on mouthparts. Head more or less free; postoccipital condyles very narrow; coronal and frontal sutures distinct; endocarinal line vestigial; 2 ocelli present, beneath raised corneae. Antennae oval, almost plane, surrounded by a narrow pigmented band. Mandibles bifid, with a prominent median tooth. Labrum evenly rounded. Tomiae short, parallel. Spiracles ovate-fringed, lacking airtubes in mature larvae, unicameral in 1st-instar larvae.

Remarks. *Brachycerus* is included in Emden's (1952) key to the genera of Adelognatha. The characters used and discussed in his text are based on *B. albidentatus* Gyllenhal from Italy. Brachycerine larvae are associated with the bulbs and stems of succulent liliaceous plants.

The Australian Amycterinae (May, in press) are close to *Brachycerus* in several respects: the lower malar setae for instance are upswept; *Dialeptopus* Pascoe has increased numbers of setae; and the type of oviposition is similar.

Brachycerus monachus Fähræus

monachus Fähræus, 1871: 52.

Fig. 395–405

Maximum dimensions 22.0×6.0 mm; head width 3.25 mm. Cuticle coarsely spiculate on dorsum. Setae dark, rather short on older larvae, very long on 1st instar, differing from modal numbers as follows. Maxilla 24–30 *dms*, 4 *vms*; labrum 5 or 6 *lrms*; epipharyngeal lining 20 *als*, 27 *mes*; pronotum 6 setae; Th II/III 2+2 *prs*, 2 *dls*, 3 *ss*, *vpls* 2, pedal lobe 7 setae, *msts* 3–5; Abd I–VI 6–8 *prs*; Abd VII 4 *prs*; Abd VIII 2 *prs*; Abd IX 5 *ds*, 3+3 *ps*. Pronotal shield pale red-brown. Head red-brown, with median epicranium pallid; *des* 4 and *fs* 1, 2, 3 well developed. Clypeus transverse, with lower half pigmented. Labrum completely pigmented. Maxillary and labial palps cone-shaped. Labial palps bearing a small seta. Ligula densely pubescent. Premental sclerite broad, with posterior margin rounded; anterior median extension elongate. Spiracles conspicuous; Abd VIII spiracle lateral. Anus subterminal, 4-lobed.

Material examined. SOUTH AFRICA: Transvaal, Nylstroom, in rotting stem of *Aloe davyana*, 15 Nov 1984, 3 larvae; Pretoria, on underground stem of *A. davyana* and in soil, 20 Dec 1984, 4 eggs, 2× 1st-instar larvae, ATH.

Biology. In the Transvaal (A.T. Howden, pers. comm.) the large (3.5×2.5 mm) eggs of *B. monachus* were found in December, on an underground stem of *Aloe davyana* and in the soil beside it. The eggs are extremely hard, pearly white to pinkish, and were mostly encased in soil. When damp, the texture becomes leathery. In captivity, two larvae emerged the day after the eggs were moistened, the chorion having become soft enough for the larvae to free themselves using their very impressive mandibles. Large, well grown larvae were cut out of the rotting stem of another plant which had been dislodged by machinery and damaged by fire. Under the leaves on the ground was a mating pair of freshly emerged *B. monachus*. An adult and a larva of *B. fortunatus* Haaf were discovered in a clump of lilies nearby.

Tribe Entimini

The tribe Entimini embraces those groups, now subtribes, previously known collectively as Adelognatha or 'broad-nosed weevils'. It contains most of the species with root-feeding larvae which are of concern to the agricultural and horticultural industries. Entimine larvae are characterised by their transverse antennae, which are much shorter than wide and oval in cross-section. The Abd VIII spiracles are lateral.

Subtribe Leptopiina

Head free; endocarinal line absent. Mandibles bifid (unless eroded), with a median projection at base of incisor lobe; scrobe usually conspicuous; setae unequal in length, close together within scrobe. Maxillary mala usually with 8 dorsal and 4 ventroapical setae. Epipharyngeal lining with posterior and median pairs of *mes* more or less equally spaced, and with clusters of sensilli in between. Th II/III with 2 dorsolateral setae ("alar setae" of Anderson 1947a). Terminal segments often strongly modified. Alimentary canal of modal form, lacking cardiac mycetomes; gastric caeca vermiform, occasionally absent; cryptonephridium weakly developed, symmetrical; rectal bracon membranous.

Remarks. All the New Zealand endemic broad-nosed weevils and a large proportion of those in Australia belong in this subtribe, which ranges southwards to Campbell Island (latitude 53°S). A few native species are regarded as pests when they occur in pasture on light soils. The remainder either do not occur in cultivated areas or do not inhibit plant growth to any significant extent (May 1977).

Genus *Catoptes* Schoenherr

Catoptes Schoenherr, 1842: 243.

Type species *Catoptes obliquesignatus* Boheman.

Body robust, with coarse musculature, widest behind thorax. Cuticle sclerotised around setal groups and on all lobes of Abd VIII and IX. Head slightly depressed, evenly rounded in outline, emarginate behind; *des4* and *fs1,2,3* reduced to sensilli. Mandibles wide, smooth, with inner surface concave. Hypopharyngeal bracon maculate. Labrum with a 5-pointed median colour pattern; lateral and anterior setae of similar length. Tormae subparallel or slightly convergent. Maxilla with apical malar seta broad, blunt. Abd I–VIII with major spiracular seta on middle fold, above spiracle; ventral folds each with a transverse row of coarse spinules. Spiracles circular, bicameral. Terminal segments strongly modified (type B of Emden 1952). Anal segment longitudinally compressed, 4-lobed, ventral. Alimentary canal with gastric caeca tapering, flask-shaped.

Catoptes cuspidatus (Broun)

cuspidatus Broun, 1881: 694 (*Tigones*).

Fig. 406–417

Maximum dimensions 7.0×3.0 mm; head width 1.25 mm. Cuticle without asperities on dorsum or pleural lobes.

Setae red-brown; dorsal setae fusiform, finely tapering; ventral setae stronger. Setae differing from modal numbers as follows: maxilla 8 *dms*, 4 *vms*; pronotum 8 setae; Th II/III 2 *dls*, pedal lobe 6+1 setae; Abd VIII 2+2 *pds*; Abd IX 1+1 *ds*. Pronotal shield pallid. Head pallid, with a red-brown, 3-peaked frontal band, the median peak bifid; epistoma and mandibles red-black; *fs5* weaker than *fs4*; sutures indistinct; ocelli faint. Clypeus membranous. Labrum weakly lobed, with posterior extension reaching epistoma. Maxilla with proximal palpal segment twice as long as distal segment. Premental sclerite broken before middle; posterior extension truncate. Postlabium at base 4× wider than labium. Terminal segments modified as follows. Abd VIII with dorsum and pleural lobes expanded; ventropleural lobe sclerotised, showing an internal apodeme for muscle attachment. Abd IX dorsum reduced to a small triangle with apex caudad; sternal area a larger, equilateral triangle with apex cephalad; pleural lobes heavily sclerotised, grossly expanded, with a longitudinal furrow (internal apodeme).

Material examined. NEW ZEALAND: CO, Otago, Millers Flat, 500 m, under tussock and oversown pasture, 31 Oct 1978, 17 larvae, 4 pupae*, BMM.

Biology. *C. cuspidatus* occurred in considerable numbers in the complex of weevil species sampled on improved pasture in the Central Otago hill country in 1978. The pasture consisted of the original tussock grasses *Chionochloa rubra* and *Festuca novae-zelandiae* oversown with more palatable introduced grasses. The larvae were associated with larvae of *Nicaeana cervina* Broun. Both species had previously been recorded from *C. rubra* (May 1977). At Millers Flat they showed a preference for the introduced grasses, especially on the drier north-facing slopes. The modified terminal segments are an adaptation for root-feeding, the soft anal lobes grasping the root while the sclerotised area is used as a rocking base to balance the movements of the head.

Genus *Irenimus* Pascoe

Irenimus Pascoe, 1876: 54.

Type species *Irenimus parilis* Pascoe.

Larvae of the *Brachyolus* complex – *Irenimus*, *Nicaeana* Pascoe, and *Brachyolus* White – differ from those of *Catoptes* as follows. Maxillary mala with apical seta narrow, acuminate. Ventral Abd folds not bearing a single, transverse row of spinules. Spiracles bicameral, unicameral, or lacking airtubes. Terminal segments less strongly modified (Type A of Emden 1952). Anal segment subcircular.

Irenimus compressus (Broun)

compressus Broun, 1880: 429 (*Catoptes*).

'Compressed weevil'

Fig. 418–429

Maximum dimensions 9.0×2.75 mm; head width 1.5 mm. Cuticle finely spiculate. Setae pallid, slender; ventral setae as long as major dorsal setae. Setae differing from modal numbers as follows; maxilla 8 *dms*, 4 *vms*; pronotum 9 setae; Th II/III 2 *dls*, pedal lobe 6+2 setae; Abd VIII 4 *pds*; Abd IX 3 *ds*. Pronotal shield pale yellow. Head pallid, with a pale red, medially peaked frontal band; epistoma, genae, and mandibles dark red-brown; *fs5* as long as *fs4*; *des2* weak, *des4* minute; sutures not visible; ocelli faint. Labrum trilobate, with posterior extension reaching epistoma. Maxilla weakly pigmented. Premental sclerite a complete trident. Spiracles bicameral; airtubes on Th II twice as wide as peritreme, annulate; airtubes on Abd I–VIII shorter, reaching peritreme margin, non-annulate. Terminal segments modified as follows. Abd VIII with pleural lobes slightly expanded. Abd IX with dorsal area trapezoidal, ventral area rectangular; pleural lobe grossly expanded, angled at apex, not extended ventrad; major seta in apical third. Anus 4-lobed, retractile. Alimentary canal bearing 3 gastric caeca on each side; Malpighian tubules rather wide.

Material examined. NEW ZEALAND: AK – Karaka, pasture, 16 Sep 1964, 13 larvae*, JGB. RI – Ohakune, pasture, 28 Oct 1970, 7 larvae, BMM. CO – Macraes Flat, pasture, 3 Jun 1964, 3 larvae*, JGB.

Biology. *I. compressus* occurs throughout New Zealand in pastures on free-draining soils. The larva is polyphagous, with a preference for the clovers (Fabaceae). Mating and oviposition occur during summer. In captivity the soft, cylindrical eggs (0.7×0.3 mm) were pushed into hollow clover stems in groups of from five to ten. Incubation took 18–21 days in January. Prepupae were found in August, at a depth of about 30 mm. They pupated after 9–12 days, to emerge 8–25 days later. In some years adults can become very numerous during late summer, and houses near grassland may be invaded. Reproduction is sexual.

Genus *Mandalotus* Erichson

Mandalotus Erichson, 1842: 193.

Type species *Mandalotus crudus* Erichson.

Mandalotus is an Australian genus of well over 100 species. It is represented in New Zealand by one endemic species, *M. miricollis* (Broun). Since only this species has been examined, I have made no generic statement.

Mandalotus miricollis (Broun)

miricollis Broun, 1917: 418 (*Bryodrassus*).

Fig. 430–440

Maximum dimensions 7.0×2.5 mm; head width 1.5 mm. Differing from *Irenimus compressus* most obviously in the profile of Abd IX and in other respects as follows. Head pale yellow, with reddish paramedian stripes; lacking a frontal colour band above epistoma; *des2* as strong as *des1*, *des4* absent; ocelli absent. Labrum with median area pigmented but not proximal extension. Premental sclerite broken before middle. Thoracic spiracle bicameral, with airtubes 2–4-annulate. Spiracles of Abd I/II unicameral, with airtubes simple. Spiracles of Abd III–VIII lacking airtubes. Terminal segments modified as in Type A of Ermden (1952). Abd VIII with dorsopleural lobes 4× larger than those of Abd VII; Abd IX with pleural lobes abruptly angled; caudal face almost plane; a major seta midway between apex and anterior margin; dorsum triangulate; ventral area trapezoidal. Anal lateral lobes bearing a strong seta. Alimentary canal with 2 gastric caeca.

Material examined. NEW ZEALAND: AK – Kaipara South Head, in pasture, 17 Sep 1962, 11 larvae*, BMM; Mt Albert, in ryegrass/clover sward, 2 Aug 1963, 64 larvae*, BMM.

Biology. *M. miricollis* is distributed only in the North Island, north of latitude 37°30'S. As with many other soil weevils, it thrives in grassland which includes white clover (*Trifolium repens*). Mating occurs during summer and autumn, but oviposition (in captivity) continued throughout the year, with a peak period in March–April. Eggs are inserted into the hollow stems of clover, pressed tightly in a double row, or deposited in clusters of 15–25. Incubation time varied between 28 days in September and 7 days in March. First-instar larvae move downwards soon after hatching, and older larvae were found at a depth of 250 mm. They appeared to feed exclusively on clover roots. Pupation takes place nearer the surface, adults emerging during summer. Reproduction is sexual.

Subtribe Naupactina

Body robust, slightly curved, widest at thorax; terminal segments simple. Dorsal setae *pds1,2,4* much shorter than *pds3,5*; Abd V–VIII with major spiracular seta on postdorsal fold. Setal numbers differing from the modal pattern as follows: maxilla 8 *dms*, 4 *vms*; pronotum 8 or 9 setae; Th II/III 2 *dls*, 3 *ss*, pedal lobe 8 setae; Abd VIII 4 *pds*; Abd IX 4 *ds*; Abd X 3 or 4 setae. Pronotal shield pallid. Head

usually colourless, deeply retracted into prothorax, much longer than wide; genae and mandibles dark; postoccipital condyles subtriangular; *des3,5*, *fs4,5*, and *les2* long, subequal; other setae minute; ocelli small; sutures not visible. Mandibles rather wide, concave inwardly, with 2 setae set transversely in scrobe. Hypopharyngeal bracon maculate. Labrum with a 5-pointed median colour pattern; lateral setae as long as discal and anterior setae. Tormae short, broad, bifurcate distally. Epipharyngeal lining with median *mes* pair much wider apart than posterior *mes* pair. Premental sclerite broken before middle; posterior extension truncate. Abd V–VIII with major spiracular seta on postdorsal fold. Thoracic spiracles ovate-fringed; Abd spiracles much smaller, subcircular, with airtubes vestigial or lacking. Abd VIII and IX with a sclerotised posterodorsal ridge; terminal segments not otherwise modified. Anus terminal, 4-lobed. Alimentary canal without mycetomes around cardiac valve; gastric caeca in a row of 4–10 on either side of lower coil, and a single pair further cephalad.

Remarks. Originating in Argentina and Uruguay, four naupactine species have found their way to New Zealand. Three of them, *Asynonychus cervinus* (Boheman), *Atrichonotus minimus* (Blanchard), and *Floresianus sordidus* Hustache, probably arrived via Australia, whereas *Graphognathus leucoloma* (Boheman) is reported to have come from the U.S.A. All of them are pests on roots of fodder crops, especially lucerne (*Medicago sativa*). *A. cervinus* (Fuller's rose weevil) is common amongst ornamental shrubs and citrus, and *G. leucoloma* (white-fringed weevil) is also a major horticultural pest. Reproduction in these species is parthenogenetic, i.e., viable eggs are produced by unmated females. Adults are flightless. As a group, the larvae are distinguished by their strongly retracted, mainly colourless head, bearing setae only on the anterior third.

Genus *Asynonychus* Crotch

Asynonychus Crotch, 1867: 388.

Type species *Asynonychus godmanni* Crotch (= *cervinus* Boheman).

Asynonychus cervinus (Boheman)

cervinus Boheman, 1840: 17 (*Naupactus*).

'Fuller's rose weevil'

Fig. 441–451

Maximum dimensions 9.0×4.0 mm; head width 1.5 mm. Cuticle smooth except ventrally on Abd I–V. Setae red-

brown, evenly tapered; minor dorsal setae fine in all instars. Antennae slightly asymmetrical, with sides strongly rounded. Maxilla with a group of spinules on inner surface below palpus; no spinules below malar setae. Anal lateral lobes with 3 minute setae.

Material examined. NEW ZEALAND: AK – Mt Albert, in soil under clover, 8 Nov 1962, 14 larvae*, BMM. NN – Nelson, 22 Aug 1965, 10 larvae, GK.

Biology (after May 1979a). The golden-yellow eggs are deposited in clusters of up to 60, cemented together, in any convenient crevices on shrubs and vines as well as on the ground. They can survive long periods of desiccation. Newly hatched larvae in aerial situations drop to the soil before feeding. Oviposition peaks in autumn; larvae are most numerous during winter and spring. Prepupal larvae move upwards after July to pupate in a smooth-walled cell during summer. There is only one, extended generation each year. The larvae appear to be unselective in their choice of roots.

Remarks. Fuller's rose weevil has been established in New Zealand since before 1940, and is now common in most parts of the country. It has a world distribution in warm-temperate climates, mainly through human agency.

Genus *Atrichonotus* Buchanan

Atrichonotus Buchanan 1939: 15.

Type species *Naupactus taeniatus* Berg.

Atrichonotus minimus (Blanchard)

minimus Blanchard, 1851: 317 (*Naupactus*).

'Little fringed weevil'

Fig. 452–456

Maximum dimensions 7.0×3.0 mm; head width 1.25 mm. Cuticle asperate on prodorsal fold of Abd I and on sternal folds of thorax and Abd I–VII. Setae pallid, fine, coarser on ventral folds. Abd VIII with a strongly sclerotised postdorsal ridge; *pds3* half as long as adjacent setae. Antennae with sides subparallel. Maxilla with more than 10 spinules in clusters on inner surface at base of palpus and below malar setae. Anal lateral lobes with 1 strong seta and 3 minute setae. Similar in other respects to the larva of *A. cervinus*.

Material examined. NEW ZEALAND: HB – Bridge Pa, under lucerne, 28 Nov 1974, 3 larvae, MJE; 17 Jun 1975,

15 larvae, MJE, PJW, BMM. Not reared, but associated with adults and compared with slide preparations from Alabama, U.S.A., determined by W.H. Anderson.

Remarks. *A. minimus* is one of the complex of weevils that are becoming a threat to lucerne. Discovered at Napier in 1970, it is at present confined to Hawkes Bay. It may be significant that Napier airport is involved in the transport of racehorses, and their attendant fodder, across the Tasman from Australia.

Genus *Floresianus* Hustache

Floresianus Hustache, 1939: 39.

Type species *Floresianus sordidus* Hustache.

Floresianus sordidus Hustache

sordidus Hustache, 1939: 39.

'Flores weevil'

Fig. 457–460

Maximum dimensions 5.0×2.0 mm; head width 1.0 mm. Cuticle smooth except for a row of spinules between setae on sternal Abd folds. Abd VIII with *pds3* minute, about one-tenth as long as adjacent setae. Antennae with sides subparallel. Maxilla with 4–6 long spinules on inner surface at base of palpus and 3 or 4 spinules below malar setae. Spiracles conspicuously pigmented in fresh specimens. Anal lateral lobes with 1 strong seta and 3 minute setae. Similar in other respects to larvae of *A. cervinus*.

Material examined. NEW ZEALAND: HB—Hatuma, in pasture, 19 Jun 1973, 19 larvae, KB; 28 Jun 1973, 52 larvae*, KB, BMM.

Biology. At Hatuma in 1973 larvae of *F. sordidus* were fully fed in late June, and were three times more plentiful under clover than under ryegrass (*Lolium perenne*). In the laboratory one of them pupated after 124 days, to emerge as a hardened adult after 40 days.

Remarks. *F. sordidus* is at present confined to Hawkes Bay, where it was discovered in 1973.

Genus *Graphognathus* Buchanan

Graphognathus Buchanan, 1939: 11.

Type species *Naupactus leucoloma* Boheman.

Graphognathus leucoloma (Boheman)

leucoloma Boheman, 1840: 62 (*Naupactus*).

'White-fringed weevil'

Fig. 461–472

Maximum dimensions 15.0×5.0 mm; head width 2.5 mm. Cuticle smooth except for a row of spinules between setae on sternal folds of Abd I–V. Setae pale red with dark bases; minor dorsal setae of younger larvae short, stout. Head of mature larvae yellowish in front. Antennae slightly asymmetrical; sides strongly rounded. Maxilla with a group of long spinules on inner surface below palpus and below malar setae. Anal lateral lobes without a strong seta. Similar in other respects to larvae of *A. cervinus*.

Material examined. NEW ZEALAND: AK—Mt Albert, under ryegrass/clover, 3 Dec 1962, 10 larvae*, BMM. MC—Fairton, in potatoes, 5 Apr 1972, 13 larvae, GHG.

Biology. The life history differs in several respects from that of Fuller's rose weevil. Larvae are present year-round, but the peak of oviposition (in Auckland) is in summer rather than autumn. The eggs, white rather than yellow, are cemented together in drought-resistant clusters and pushed between adjoining surfaces on or near the ground. They can hatch 8 days after being moistened. Mature larvae are stout and vigorous, unmistakable by their size, but younger individuals are difficult to separate from other naupactines present at the same time. Pupation occurs during the warmer months. The overlapping generations span a minimum of 10 months, but may approach 2 years in adverse conditions. *G. leucoloma* consumes the taproots, tubers, and crowns as well as the finer roots of a wide variety of horticultural and pastoral plants (May 1975).

Remarks. *G. leucoloma* is established in the eastern U.S.A., south-eastern Australia, and the southern part of South Africa. It was first recorded in New Zealand in 1944, since when it has become widespread in both islands.

Subtribe Otiorhynchina

Body robust, evenly curved. Cuticle sclerotised around setal groups. Dorsal setae *pds1,2,4* much shorter than *pds3,5*. Th II/III with 1 *dls*. Head free, pigmented, with sutures distinct; *des4* and *fs1,2,3* minute or reduced to sensilli. Antennae oval, symmetrical. Mandibles with double, serrate cutting edges; setae unequal. Labrum medially pigmented. Epipharyngeal lining with median *mes* pair wider apart than posterior *mes* pair. Hypopharyngeal bracon maculate. Premental sclerite a complete trident

shape, with posterior extension expanded before apex; anterior extension of similar length.

Remarks. *Otiorrhynchus* Germar (three species) and *Phlyctinus* Schoenherr of this subtribe are represented in New Zealand. Rosenstiel (1987) made a detailed taxonomic study of five genera (as Polydrosinae) present in Oregon: *Nemocestes* Van Dyke, *Peritelinus* Casey, *Sciopithes* Horn, *Trachyphloeus* Germar, and *Otiorrhynchus*. These are taken into account in the diagnosis.

Genus *Otiorrhynchus* Germar

Otiorrhynchus Germar, 1824: 343.

Type species *Curculio sulcatus* Fabricius.

Body widest near thorax, tapered; terminal segments well sclerotised but not otherwise modified. Cuticle of dorsal folds on Abd I–V asperate. Setal numbers differing from the modal pattern as follows: head 4 *des*, 2 *fs*; maxilla 8 *dms*, 4 *vms*; pronotum 8–10 setae; Th II/III 1 *dls*, 3 *ss*, pedal lobe 7 setae; Abd VIII 4 or 5 *pds*; Abd IX 3 *ds*; Abd X 3 setae. Abd V–VIII with major spiracular seta on postdorsal fold. Head subcircular in outline, widest behind middle, emarginate behind; postoccipital condyles conspicuous. Labral tormae moderately long, convergent, tapering. Spiracles circular, those of older larvae usually bicameral with simple airtubes, those of 1st-instar larvae with longer, annulate airtubes. Terminal segments unmodified. Anus terminal, 4-lobed. Alimentary canal with globular mycetomes around cardiac valve; gastric caeca tapering; cryptonephridium elongate, slender; rectal bracon membranous.

Otiorrhynchus sulcatus (Fabricius)

sulcatus Fabricius, 1775: 155 (*Curculio*).

'Black vine weevil'

Fig. 473–483

Maximum dimensions 10.0×4.0 mm; head width 1.75 mm. Body with dorsopleural lobes angularly produced, especially on Abd VIII. Cuticle finely spiculate, pigmented at setal bases. Setae red-brown, strong, finely tapered. Pronotum yellow-brown, with darker fascia in front. Head bright yellow-brown, with reddish parietal stripes, pallid at setal bases; oral margins and mandibles blackish; ecdysial line dark. Ocelli distinct under raised corneae. Labrum with lateral seta half as long as anterior seta. Premental sclerite with angle between lateral and posterior arms emarginate. Spiracles with a broad, pigmented peritreme; airtubes not reaching margin. Abd ventropleural lobes with major *vpls* 10× as long as minor *vpls*. Anal setae strong.

Alimentary canal with 6–8 gastric caeca on either side of lower coil.

Material examined. NEW ZEALAND: MC – Christchurch, in roots of blackcurrant (*Ribes nigrum*), 11 Nov 1972, 8 larvae*, MS. DN – Palmerston, in crowns of polyanthus (*Primulapolyantha*), 18 Nov 1972, 12 larvae*, BMM.

Biology. The flightless adults reproduce parthenogenetically, and each may produce over 1000 eggs. The spherical, translucent eggs are laid on or near the soil, in plant crevices, or beneath litter. The larvae are strong and very active. The effects of their feeding become most noticeable during winter and early spring. Larvae recovered from blackcurrant roots in Christchurch became adult in October, but larvae feeding in cyclamen corms in an Auckland glasshouse matured somewhat earlier. Fully fed in June, they pupated and emerged during August.

Remarks. *O. sulcatus* is a European species now established in most cool-temperate parts of the world. It was first recorded in New Zealand in 1866 at Mt Eden, Auckland, but has become more common in southern parts of the North Island and in the South Island, where it is a persistent pest of berryfruits and nursery plants.

Genus *Phlyctinus* Schoenherr

Phlyctinus Schoenherr, 1826: 196.

Type species *Phlyctinus callosus* Boheman.

The generic diagnosis differs from that for *Otiorrhynchus* as follows. Cuticle smooth on dorsum, asperate on venter. Head widest at middle. Hypopharyngeal bracon with maculae extending along posterior margin. Premental sclerite with anterior median extension longer than the posterior one. Abd I–VII with major spiracular setae on middle fold above spiracle. Terminal segments strongly sclerotised, often pigmented, unmodified except Abd IX with pleural lobe expanded.

Phlyctinus callosus Boheman

callosus Boheman, 1834: 523.

'Garden weevil', 'banded fruit weevil'

Fig. 484–494

Maximum dimensions 9.0×3.0 mm; head width 1.75 mm. Cuticle sclerotised around setal groups, strongly so on dorsopleural lobes. Setae bright red-brown, moderately long. Pronotum yellowish. Head red-brown, with paler

paramedian area and darker parietal stripes, smaller in proportion to thorax than that of *O. sulcatus*; ocelli faint. Labrum with lateral seta as long as anterior seta. Abd ventropleural lobes with major *vpls* twice as long as minor *vpls*. Anal setae minute. Alimentary canal with 5 gastric caeca.

Material examined. NEW ZEALAND: AK—Mt Albert, under clover, 28 Jun 1967, 19 larvae*, BMM. CO—Invermay, in nursery soil, Jun 1986, 9 larvae, TW.

Biology. Although the parthenogenetic adults of *P. callosus*, along with those of *Asynonychus cervinus*, have a habit of climbing, the eggs are most often found among weeds and litter at ground level. They are cigar-shaped, measure 0.9×0.4 mm, and are laid in batches of up to 70, not cemented together, at intervals of about 7 days. Captive weevils pushed them into the hollow petioles of clover leaves. Barnes (1989) reported oviposition sites in *Cyperus esculentus* (nut sedge), where the slit through which the eggs had been deposited had clearly been made by the ovipositor and not the mandibles. In Auckland, eggs were laid throughout summer and winter. Larvae were present in all months, but pupation peaked in spring and early summer. Adult wings are not functional even though pterothecae (wing covers) are visible in the pupa.

Remarks. *P. callosus* has been known in New Zealand since 1893. It is indigenous to South Africa, where the adult stage is a major problem in orchards and vineyards. It is also present in southern Australia and Tasmania, and on Norfolk Island and the Kermadecs.

Subtribe *Sitoina* Genus *Sitona* Germar

Sitona Germar, 1817: 341.

Type species *Curculio gressorius* Fabricius.

Body slender. Head free, pigmented; *des4* small but distinct; *fs4* and *fs5* of similar length; ocelli faint or absent; endocarinal line present; sutures distinct. Antennae strongly asymmetrical, angulate on outer aspect. Mandibles often pluridentate; setae of unequal length. Labrum trilobate, with a single median sensillus. Epipharyngeal lining with inner *ams* pair strong; either 2 or 3 *als* pairs present. Premental sclerite complete, with posteromedian extension acute at apex. Th II/III with 1 *dls*. All spiracles bicameral; airtubes annulate. Terminal segments unmodified. Anus subterminal, 4-lobed.

Remarks. This genus is of economic importance in Europe, and is treated in considerable detail by Emden (1952). Eight species are described and keyed.

Sitona discoidea Gyllenhal

discoidea Gyllenhal, 1834: 112.

'Sitona weevil', 'lucerne weevil'

Fig. 495–504

Maximum dimensions 6.0×2.0 mm; head width 1.0 mm. Body of even width, bent medially rather than curved. Cuticle minutely asperate ventrally, smooth elsewhere. Setae pallid, slender, moderately long; numbers differing from the modal pattern as follows: head 2+2*fs*; epipharyngeal lining 2 *als*; maxilla 7 *dms*, 4 *vms*; pronotum 8 setae; Th II/III 1 *dls*, 1 *ss*; pedal area 5+1 setae; Abd VIII 3 *pds*; Abd IX 3+1 *ds*; anal lateral lobes 3 setae. Head pale reddish-brown, with pallid, convergent paramedian stripes; endocarinal line short, one-quarter as long as frons. Antennae partially overhung. Mandibles tridentate; smaller seta proximad of the larger one. Clypeus pigmented at base. Labrum with a strong V-shaped colour pattern; lateral setae half as long as anterior setae. Epipharyngeal lining with inner *ams* conspicuously fang-like; 2 *als* present; proximal *mes* hairlike. Tormae vestigial. Hypopharyngeal bracon clear. Thoracic spiracle with airtubes 6- or 7-annulate, obliquely dorsad, those of Abd 4- or 5-annulate, caudad. Alimentary canal lacking mycetomes around cardiac valve; gastric caeca lamelliform, 1 on either side of lower coil. Malpighian tubules unusually thick; cryptonephridium weakly developed; rectal bracon membranous.

Material examined. NEW ZEALAND: HB—Napier, Awatoto foreshore, under burr clover (*Medicago polymorpha*), 15 Sep 1974, 3 larvae, MJE; Tangoio to Clifton, 8–9 Oct 1974, 23 larvae*, MJE, PJW, BMM.

Biology (after Wightman 1981). The small, seed-like, spherical eggs are dropped randomly wherever the female happens to be feeding. She can produce up to 2000 eggs between April and December. Larvae burrow into the soil in search of the roots of *Medicago* and *Trifolium*, where they hollow out the nitrogen nodules. In lucerne the life cycle is governed by the growth period of roots and nodules, hence larvae are present only during spring and summer. Adults migrate in autumn before overwintering. They are strong fliers, and are capable of dispersing widely. There is one generation a year. Reproduction is sexual. The combined effects of adult and larval feeding can be devastating to a lucerne crop. An infestation can be recognised

by scalloped or skeletonised leaves, followed by stunting and yellowing caused by nitrogen deficiency. Several other species of *Sitona* are reported to feed as larvae within nitrogen-fixing nodules of leguminous crop plants in the U.S.A. (Manglitz *et al.* 1963).

Remarks. Originating in Europe, *S. discoidea* adults were first intercepted at Napier in 1970, but it was not until 1974, when live larvae were identified and reared, that the species was known to be established in New Zealand. The larvae were present beneath weeds on the Napier foreshore (May 1977, as *S. humeralis* Stephens). Later that year sitona weevils were found on lucerne in mid Canterbury in numbers suggesting that this locality may have been an earlier focus of invasion. The species has been recognised as a pest of lucerne in southern Australia since 1954 (Chadwick 1978).

Tribe Rhytirhinini

Body shape and vestiture variously modified. Th II/III with 1 or 2 *dls*. Head free, pigmented; postoccipital condyles triangular; *des*3 in suture or on frontal plate; *fs*4 constant, stronger than *fs*5; other *fs* minute or absent; 2 pairs of ocelli present. Antennae circular, subglobose to conical. Mandibles bifid, with a small median tooth; setae unequal. Labrum with lateral seta reduced in length. Epipharyngeal lining with 2–4 *als*; proximal 2 pairs of *mes* equidistant, with clusters of sensilli in between. Spiracles circular, bicameral, with airtubes on Abd caudad (dorsad in water-adapted species); Abd VIII spiracle dorsolateral or dorsal. Anus terminal or forming a ventral pygopod.

Remarks. The rhytirhinine group of weevils appear to be in a highly plastic, transitional state of evolution. In their larval feeding habits they are radiating from wholly subterranean, as in Entimini, to both ectophytic and endophytic aerial feeding, as in *Listronotus* Jekel and *Listroderes* Schoenherr (from which the arboreal Gonipterini are a natural extension); and, in another direction, to an aquatic lifestyle, as in *Steriphus ascita* (Pascoe) (culminating in the water-weevil group Eriirhinini), or reverting to a subterranean habit while retaining some aquatic features, as in other species of *Steriphus* Erichson.

The type genus, as represented by *Rhytirhinus inaequalis* (Fabricius) of South Africa, shows the following transitional similarities with *Sitona discoidea*. Its life in the soil is sheltered (by the construction of a feeding cell in contact with the plant: Scott & Way 1989), its cuticle has ventral asperities only, the head has paramedian pallid stripes, and the airtubes of abdominal spiracles are caudad.

Genus *Gromilus* Blanchard

Gromilus Blanchard, 1853: 208.

Type species *Gromilus insularis* Blanchard.

Body evenly curved, slightly tapering. Cuticle sclerotised around setal bases. Major *pds* very long, slender; minor *pds* short, spine-like. Setal numbers differing from the modal pattern as follows: head 4 *des*, 1+1 *fs*; maxilla 7 *dms*, 5 *vms*; pronotum 8 setae; Th II/III 1 *dls*, 1 *ss*, pedal lobe 6 setae; Abd VI/VII 4 *pds*, Abd VIII 3 *pds*, Abd IX 3 *ds*; anal lateral lobes 3 setae. Head widest at middle, with sides slightly convergent; endocarinal line absent; *fs*4 long, *fs*5 variable; anterior ocelli large. Antennae hemispherical. Clypeal setae minute. Labrum pigmented medially. Tormae strong, convergent, not joined at base. Hypopharyngeal bracon maculate. Anus 4-lobed. Alimentary canal with proventriculus internally striate; mycetomes usually present around cardiac valve; gastric caeca vermiform; cryptonephridium symmetrical; rectal bracon membranous.

Remarks. The endemic *Gromilus* complex of more than forty species has a focus of speciation in the south, particularly on oceanic islands. Only four species are known from the North Island. Some larvae feed on roots of low-growing dicotyledonous plants and others on fern roots (Kuschel 1964, 1971; May 1971, 1981).

Gromilus larvae are close to those of *Canonopsis* Waterhouse (Ectemnorhinini) from Heard Island, one of the Indian Ocean subantarctic group. *Canonopsis* differs from other Ectemnorhinini in having the short Abd dorsal setae stout and spine-like, and the airtubes of Abd spiracles dorsocaudad (May 1970b). These features and others, including antennal shape, are in agreement with a diagnosis of *Gromilus* based on seven southern species and one from the North Island. However, *Gromilus* pupae do not have the important setae on the mandibular theca which are present on *Canonopsis* pupae.

Gromilus thoracicus (Broun)

thoracicus Broun, 1893: 1211 (*Clypeorrhynchus*).

Fig. 505–515

Maximum dimensions 7.0×2.5 mm; head width 1.5 mm. Cuticle sparsely asperate on folds. Setae red-brown. Head bright red-brown, with oral margins and mandibles blackish; *fs*4 and *fs*5 subequal; sutures narrow but distinct; posterior ocelli obsolete. Tormae contiguous at base. Premental sclerite with posterior extension arrow-shaped. Thoracic spiracle with airtubes 5–7-annulate, dorsad; airtubes of Abd spiracles 3–5-annulate, caudad; Abd VIII spiracle on dorsum. Alimentary canal with 13 small, globu-

lar mycetomes at cardiac valve; anterior ventriculus rugose; gastric caeca long, slender, with 2–6 widely spaced on either side of lower coil.

Material examined. NEW ZEALAND: ND – Tutamoe, 12 Oct 1968, 11 larvae*, BMM.

Biology. Adults of *G. thoracicus* were beaten after dark, with *Megalocolabus* Broun, from fronds of *Blechnum* sp. Larvae were found among fern roots on roadside verges bordering farmland with some forest remnants. They pupated in November, and emerged 3 weeks later.

Genus *Steriphus* Erichson

Steriphus Erichson, 1842: 193.

Type species *Steriphus solidus* Erichson.

Body moderately robust, evenly curved (except *S. ascita*); Abd I–VII with major *ss* progressively further caudad. Setal numbers differing from the modal pattern as follows: head 4 *des*, 1+1 *fs*, maxilla 7 *dms*, 5 *vms*; pronotum 7–10 setae, Th II/III 1 *dls*, 1 *ss*, pedal area 6 setae; Abd VII 4 *pds*, Abd VIII 3 *pds*, Abd IX 3 *ds*, anal lateral lobes 3 setae. Head evenly rounded; ocelli without raised corneae; endocarinal line absent. Antennae broadly conical. Clypeal setae and labral lateral setae minute. Tormae joined in proximal third. Premental sclerite with posteromedian extension longer than the anterior one, arrow-shaped. Spiracles with paired airtubes external, usually joined to form a spine. Alimentary canal of modal form.

Remarks. *Steriphus* (previously known as *Desiantha* Pascoe) has a focus of speciation in southern Australia. *S. variabilis* (Broun) and *S. ascita* (Pascoe) are endemic to New Zealand, and the subspecies *S. diversipes lineata* (Pascoe) occurs in both countries. The larvae are characterised by their spiracles, which are of the plant-piercing type, modified for an aquatic environment. *S. ascita*, however, is the only species known to be truly aquatic (May 1977). *S. variabilis* prefers well watered places such as marshy ground and cotula bowling greens. The *S. diversipes* complex and *S. caudata* (Pascoe) have adapted to the drier soil conditions of pasture and crops while retaining their aquatic spiracles.

Steriphus diversipes lineata (Pascoe)

lineata Pascoe, 1873: 196 (*Brexius*).

‘Victoria weevil’

Fig. 516–525

Maximum dimensions 7.0×2.0 mm; head width 1.0 mm. Body widest behind middle. Cuticle asperate on sternal folds only. Setae red-brown, short, fusiform. Head pale red-brown, with pallid paramedian stripes and circular areas at base of *des5* and *fs4*; oral margins and mandibles red-black; *fs4* long, *fs5* and other *fs* minute; sutures of uneven width. Hypopharyngeal bracon clear. Thoracic spiracle with airtubes short, rounded at apex; Abd I–VII spiracles with airtubes elongate, 5× longer than width of peritreme, lateral, and with scalpellum present at apex; Abd VIII spiracle shorter, less acute, lateral. Alimentary canal with 8 globular mycetomes around cardiac valve; 4 gastric caeca in a row on either side of lower coil.

Material examined. NEW ZEALAND: AK – Pukekawa, in pasture, 5 Sep 1962, 9 larvae*, JGB. MC – Dorie, roots of lucerne, 12 Sep 1972, 3 larvae, DMM; Christchurch, strawberry roots, 22 Sep 1972, 52 larvae*, BMM, KGS.

Biology. *S. d. lineata* was first found in New Zealand near Auckland in 1933. The larvae are polyphagous, recorded as feeding on roots of pine seedlings, strawberry (*Fragaria* sp. cult.), lucerne, pasture grasses, and roadside weeds. They seem to prefer light, friable soils. The life cycle follows a pattern close to that of *S. caudata* in South Australia (Allen 1973). A regimen of adult emergence in spring, summer quiescence, and mating and oviposition in the soil in autumn is found also in the related pest species *Listroderes difficilis* Germain (May & Ferguson 1979). There is one generation a year.

Genus *Listroderes* Schoenherr

Listroderes Schoenherr, 1826: 158.

Type species *Listroderes costirostris* Schoenherr.

Body cuticle shagreened, without asperities; terminal segments tapering, with acutely expanded pleural lobes; pedal and sternal lobes developed as ampullae, with setae obsolete. All dorsal setae very short, peg-like. Setal numbers differing from the modal pattern as follows: maxilla 6 *dms*, 4 *vms*; pronotum 10 setae; Th II/III 3 or 4 *pds*, 2 *dls*, 2 *ss*, pedal area 0; Abd VIII 3 *pds*; Abd IX 3 *ds*; anal lateral lobes 0. Head small in proportion to body width, wider than long; *fs5* minute; ocelli distinct under raised corneae; endocarinal line absent. Antennae conical, with hairlike sensoria. Mandibles short, wide, with a serrate cutting edge and 2 acute median teeth. Labrum completely pigmented, with anterior margin depressed. Tormae obsolete. Epipharyngeal lining with 2 or 3 *als*. Hypopharyngeal bracon fragile. Premental sclerite obsolete except at sides. Spir-

acle of Abd VIII lateral. Anal lobes forming a pygopod. Alimentary canal with proventriculus expanded, as large as ventriculus or larger; mycetomes absent; anterior ventriculus short, 4-lobed; posterior ventriculus with coils ill defined and lacking gastric caeca. Malpighian tubules evenly distributed. Cryptonephridium symmetrical; rectal bracon membranous; rectum as long as cryptonephridium.

Remarks. Larvae of *Listroderes* are modified for ectophytic feeding in the open. Their coloration is cryptic, and setae are reduced or obsolete. Pedal and sternal lobes are developed as ambulatory ampullae, and the anal lobes as a pygopod for adhesion to leaf surfaces. Three species have become pests in both Australia and New Zealand. *L. difficilis* Germain, treated below, is the most commonly encountered. *L. foveatus* (Lea), of similar adult appearance, is probably indistinguishable in the larval form. The subterranean clover weevil *L. delaiquei* Germain, found mainly in pastures, is separated on antennal proportions (May 1977). The Australian *Ethemaia* Pascoe and *Ophryota* Pascoe are very close.

***Listroderes difficilis* Germain**

difficilis Germain, 1895: 64, 63.

'Vegetable weevil'

Fig. 526–537

Maximum dimensions 11.5×3.5 mm; head width 1.75 mm. Body greenish cream to bright green, according to food plant. Pronotum dull brown with darker maculae. Head dull brown with well defined, darker maculate pattern; *fs*⁵ minute; *des* all of similar length, *des*³ on frontal plate; sutures distinct. Antennae with cone one-fifth as long as width of basal cushion; 2 basal hairs, 1 longer than cone. All spiracles of similar size, surrounded anterodorsally by a dark crescentic area; airtubes 5–7-annulate, dorsad on thorax, caudad on Abd I–VIII.

Material examined. NEW ZEALAND: AK – Karaka, beneath *Stellaria* sp., 4 Jun 1964, 15 larvae*, JGB; Mt Albert, 1 May 1967, 20 larvae reared from eggs*, BMM.

Biology (after May & Ferguson 1979). The vegetable weevil is widely distributed in Australia, Pacific islands, the southern United States, and South Africa. It has been known in New Zealand since the 1920s. Both males and females are present in its native South America, but elsewhere reproduction is parthenogenetic. The eggs of *L. difficilis* are very similar to those of *Sitona discoidea*, being spherical, free, and deposited randomly. The larvae pass

through four instars, feeding and sheltering in new, low growth while young. Older larvae, like the adults, are more inclined to be nocturnal and burrow into the soil by day. The pupal cell is made just below ground level. As with *Steriphus* species, pre-adult development is restricted to the cooler, moister months and the life cycle is relatively short. Adults emerge in spring, aestivate during hot, dry weather, and do not produce eggs until late summer. There is one generation a year. Food plants include most vegetables; brassicas are especially favoured. Weeds such as hog cress (*Coronopus didymus*), chickweed (*Stellaria* sp.), and cat's ear (*Crepis* sp.) provide shelter and sustenance.

Genus *Listronotus* Jekel

Listronotus Jekel, 1865: 566.

Type species *Rhynchaenus caudatus* Say.

Body slender, tapering; terminal segments depressed, with pleural lobes prominent; Abd I–VI with ventral lobes developed as ambulatory ampullae. Head subglobose, with distinct sutures; endocarinal line and 2 pairs of ocelli present. Antennae broadly conical. Labrum with lateral setae minute or absent. Tormae slender, convergent. Premental sclerite with posterior margin arrow-shaped. Spiracles bicameral; airtubes of Abd I–VII lateral, caudad, those of Abd VIII on dorsum. Anus ventral, extended as a pygopod. Alimentary canal with cardiac mycetomes; gastric caeca absent; cryptonephridium weak, symmetrical.

Remarks. Genus *Listronotus* comprises numerous species native to South America. Apparently only *L. bonariensis* Kuschel, present in both New Zealand and Australia, has extended its range to become a threat to pasture grasses. The larva of another species, *L. cinnamoni* (Hustache), mines in the floating leaves of *Limnobium stoloniferum* and is modified in the same way as *L. bonariensis* and *Listroderes* species, for mobility on leaf surfaces.

***Listronotus bonariensis* (Kuschel)**

bonariensis Kuschel, 1955: 289 (*Hyperodes*).

'Stem weevil', 'Argentine stem weevil', 'ryegrass stem weevil'

Fig. 538–547

Maximum dimensions 5.0×1.5 mm; head width 3.75 mm. Cuticle finely asperate. Setae pallid; body setae reduced in size except 1 *pds* and 1 *vpls* on Abd I–VIII and 2 trailing *ds* on Abd IX. Setal numbers differing from the modal pattern as follows: head 4 *des*, 1 *fs*; mandible 1 seta; maxilla 6 *dms*, 4 *vms*; pronotum 3+4 setae; Th II/III 1 *dls*, 2 *ss*; pedal area

4 setae; Abd VIII 1+2 *pds*; Abd IX 2 *ds*. Head orange, with pallid paramedian stripes; frontal suture angulate above *des3*; endocarinal line short. Epipharyngeal lining with *als* unusually long. Hypopharyngeal bracon maculate.

Material examined. NEW ZEALAND: AK – Mangere, in ryegrass, 2 Nov 1959, 23 larvae*, BMM. BP – Te Aroha, in seedling maize, 9 Dec 1961, 3 larvae, PFIC. MC – Ashburton, in ryegrass, 11 Apr 1958, 12 larvae, JMK.

Biology (after May 1961, Power 1974). *L. bonariensis* was discovered in New Zealand in 1927, since when it has spread to high-fertility pastures throughout the country. Until 1960 it was recorded as *Hyperodes griseus* Hustache. Overwintered females start egg-laying in very early spring, when the first new growth appears, usually the annual meadow grass *Poa annua*. The cylindrical eggs are pushed into leaf sheath tissue, where the larvae feed as stem miners. They migrate readily in search of fresh tillers. Three moults occur before the larvae are full-grown and ready to pupate in the soil. First-generation adults emerge in November. Oviposition and larval activity reach a peak during December and January, 2 or 3 weeks earlier in Auckland than in Canterbury. There are two generations a year. Italian ryegrass (*Lolium perenne*), cocksfoot (*Dactylis glomerata*), and the meadow grasses (*Poa* spp.) are preferred hosts, but seedling cereals and maize are also utilised.

Tribe Aterpini

Th II/III with 1 or 2 *dls*. Head free or partially retracted, pigmented; postoccipital condyles prominent; frontal sutures distinct, angled before apex; *fs3* in suture or on frontal plate; *fs4* constant, usually stronger than *fs5*; 2 pairs of ocelli present. Antennae circular, hemispherical, or conical, usually overhung. Mandibles usually unidentate at apex, with 1 or 2 setae. Labrum with lateral seta well developed. Epipharyngeal lining with setae in modal numbers; proximal 2 pairs of *mes* more or less equidistant. Spiracles circular or pear-shaped; airtubes strongly annulate, dorsad on Th, caudad on Abd segments. Abd VIII spiracle dorsal. Anus terminal or ventral.

Remarks. The larvae of Aterpini for the most part are associated with live plant tissue: roots, leaf bases, green wood, and stems. One species is a leaf-miner in its early stages. Many are host-specific at the plant generic level. Some larvae work in recently dead trees, a habit evolved perhaps from feeding on dead tissue, which is the end result of root and crown feeding. Although the general appear-

ance of the adults is more rugged than those in Rhytirhini, and they tend to be larger, the larval characters differ only slightly. In Aterpini the antennae are usually concealed beneath a frontal projection (overhung), mandibles are unidentate (except in *Rhadinosomus*) and the spiracle of Abd VIII is unequivocally dorsal. Five Australian genera as well as *Anagotus* Sharp, *Heterotytes* Broun, *Lyperopais* Broun, and *Rhadinosomus* Schoenherr from New Zealand are considered in the following summary of tribal characters. *Rhadinosomus* is clearly in a different category (perhaps subtribe) from *Anagotus* and its allies.

Genus *Anagotus* Sharp

Anagotus Sharp, 1882: 90.

Type species *Anagotus helmsi* Sharp.

Body sturdy, with heavy musculature and fat-body; terminal segments depressed, often with pleural lobes protruding. Th II/III with 1 *dls*, 6 pedal setae; Abd VIII with 3 *pds*; Abd IX with 2 *ds*; setae otherwise in modal numbers. Head free, evenly rounded, slightly emarginate behind; *fs5* small or minute; endocarinal line often vestigial. Mandibles with 1 seta. Epipharyngeal lining with sensilli clusters between proximal *mes* pairs (in *Heterotytes* and *Lyperopais* between distal *mes* pairs). Anus ventral, 4-lobed. Alimentary canal without cardiac mycetomes; gastric caeca present.

Remarks. *Anagotus* is endemic to New Zealand, with close relations in Australia, e.g., *Aesiotes leucurus* Pascoe feeding in wood, *Chrysolophus spectabilis* (Fabricius) on woody roots, and *Pelororhinus* sp. on herbaceous stems. The genus contains at least 25 species, medium-sized to large, with an offshore (rat-free) island distribution as well as a predominantly southern element extending into the subalpine zone. Food preferences range from leaf bases of *Phormium*, *Astelia*, *Chionochloa*, and *Celmisia* through green woody stems of *Coprosma* to sound, dead wood of *Nothofagus* and the introduced *Pinus radiata*.

Anagotus helmsi Sharp

helmsi Sharp, 1882: 90.

'Helms's beech weevil'

Fig. 548–557

Maximum dimensions 20.0×8.0 mm; head width 3.5 mm. Body with thorax not much wider than head, widest between Abd IV and Abd VI, with pleural lobes subdivided (as in Rhychophorinae); Abd VIII and Abd IX depressed, with dorsopleural lobes extended into finger-like projections each bearing a long seta. Cuticle invested with minute,

seriate skin-points; all segments with a mid-sternal, triangular pocket on caudal margin, decreasing in size from Th I. Setae pallid, mostly minute; major setae present as follows: head 4 *des*, 2 *fs*, 1 *les*; maxilla 11 *dms*, 2 *vms*, 2 *pfs*, 1 *stps*; labium 1 *prls*, 1 *plbs*; pronotum 4 setae; Th II/III 1 *pds*, 1 *dpls*, 1 *vpls*, 1 pedal seta; Abd I–V 1 *dpls*, 1 *vpls*; Abd VI/VII 2 *pds*, 1 *dpls*; Abd VIII 1 *pds*, 1 *ss*, 1 *dpls*; Abd IX 2 *ds*, 1 *ps*. Head red-brown, with paramedian, mid-cranial, and lateral pallid stripes; oral margins and mandibles darker; postoccipital condyles large, rounded; endocarinal line vestigial; ocelli faint; ecdysial valve dark. Labrum strongly trilobate, completely pigmented. Tormae dark, convergent. Premental sclerite a full trident, with anterior extension as long as posterior one. Ligula pubescent. Hypopharyngeal bracon maculate. Thoracic spiracle 12–15-annulate, twice as large as spiracles on Abd I–VII, of similar size to Abd VIII spiracle. Anus ventral. Alimentary canal with 12–15 vermiform caeca in a row on either side of lower coil.

Material examined. NEW ZEALAND: NN – Port Nelson, ex *Pinus radiata* logs, 18 Mar 1969, 2 larvae, VH. BR – Paparoa Range, Mt Dewar, 1050 m, ex *Nothofagus menziesii*, 5 Dec 1969, 2 larvae, JIT. WD – Mahinapua S.F., ex *Pinus radiata*, Jan 1959, 6 larvae; 10 Dec 1961, 4 larvae; 24 Apr 1974, 9 larvae*, JMcB; Kopara, Ahaura, ex *Nothofagus fusca* sapwood, 6 Nov 1965, WAH.

Biology (after McBurney 1976). *A. helmsi* is an example of a native insect previously existing in low numbers and increasing to pest proportions when a new and acceptable food plant was introduced. The species is recorded by Hudson (1934) in beech forests (*Nothofagus* species) of both the North and South islands, but when areas of Westland and Nelson beech forest were converted into exotic conifer plantations *A. helmsi* became a threat to the timber. It will enter trees, logs, or stumps of *Pinus radiata* which have been dead or felled for not less than 4 months.

Between August and November the eggs (1.5×1.0 mm) are placed singly in furrows on the bark, hatching in 7–14 days. The larva bores through to the cambium layer of the wood, moulting on the way and having blocked the entry tunnel with frass. It works with the grain for about 25 mm before tunnelling into sapwood. From this burrow it travels to and from the bark layer, where it feeds. The cambium working is enlarged to become a pupal chamber where, after sealing it off with shredded wood, the fully fed larva spends up to 32 months as a prepupa, 2 weeks as a pupa, and another 2 weeks as a teneral adult before chewing its way out to the surface. The circular exit hole is 10.0 mm in diameter. Pupation and emergence occur from mid Nov-

ember to mid March. Adult activity is nocturnal.

A. helmsi is distributed from Te Aroha (latitude 37°30'S) southwards to Stewart Island. Larval food plants include all five species of *Nothofagus* and the exotic conifers *Pseudotsuga menziesii* and *Pinus ponderosa* as well as *Pinus radiata*.

Genus *Rhadinosomus* Schoenherr

Rhadinosomus Schoenherr, 1840: 473.

Type species *Curculio acuminatus* Fabricius.

Body slender, elongate. All setae well developed. Head free, subspherical; endocarinal line present; ocelli with raised corneae. Antennae exposed. Mandibles bifid, with a median projection; 1 or 2 setae present. Labrum transverse, trilobate, with lateral seta as long as anterior seta. Tormae contiguous or joined at base. Epipharyngeal lining with clusters of sensilli between proximal *mes* pairs. Premental sclerite a complete trident. Spiracles of typical form for the tribe. Anus subterminal.

Remarks. The genus *Rhadinosomus* is present in both Australia and New Zealand, with one species in each country. *R. lacordairei* Pascoe extends southwards to Tasmania, and like *R. acuminatus* is herbivorous. *Rhadinosomus* has hitherto stood in a monophyletic subfamily, but is now more rationally accommodated in Aterpini. Its larval diagnosis agrees broadly with that of the tribe, and in particular it carries the brachycerine feature of *des3* situated within the frontal suture.

Rhadinosomus acuminatus (Fabricius)

acuminatus Fabricius, 1775: 152 (*Curculio*).

Fig. 558–568

Maximum dimensions 8.0×2.0 mm; head width 1.0 mm. Body pale yellow, darkening with age, evenly cylindrical; ventral lobes ampulliform. Cuticle minutely spiculate. Setae pallid, fine, moderately long on head and terminal segments. Setal numbers differing from modal pattern as follows: maxilla 7 *dms*, 5 *vms*; pronotum 10 setae; Th II/III 2 *dls*, 3 *ss*, pedal lobe 5 setae; Abd VIII 3 *pds*; Abd IX 3 *ds*; anal lateral lobes 1 seta. Pronotum pale yellow. Head yellow-brown, with frons dusky, oral margins and mandibles dark brown; epistoma narrow; frontal suture not angled before apex; endocarinal line half as long as frons; all setae well developed, but *des4* and *fs1,2,3* slightly shorter than the others. Airtubes of thoracic and Abd VIII spiracles with 5 or 6 evenly spaced annuli; Abd I–VII spiracles smaller, with 4 or 5 annuli. Alimentary canal with

gastric caeca subequal to diameter of adjacent tube, 4–6 on either side of lower coil.

Material examined. NEW ZEALAND: ND – Paihia, 22 Jun 1967, 52 larvae, 2 pupae, adults, RAC. AK – Huia, 8 May 1967, 35 larvae, 2 pupae, adults, BMM; Dec 1984 to Dec 1985, eggs, 1st- to 3rd-instar larvae, pupae, adults*, BMM. NN – Nelson, Botanical Reserve, 6 Oct 1961, 8 larvae, ESG. All from *Haloragis erecta*.

Biology. *R. acuminatus* is host-specific to the widespread endemic herb *Haloragis erecta*. Its life history was studied at Huia, Auckland, where at any time of the year adults can be collected from the plants and larvae can be found in the hollowed-out stems.

The cycle observed began with a mating pair in late September. The eggs, only slightly convex, were laid singly on unprepared sites on the underside (abaxial) of young leaves. They were cemented in position with anal mucus and then covered with green, liquid excreta which, when dry, made them almost invisible. Newly hatched larvae were free-living, some feeding in developing flower clusters before boring into the stem, others chewing leaf tissue around the egg site, penetrating both surfaces, to reach the main stem via the midrib and petiole. A 30 cm length of stem could accommodate up to four larvae working separately along its length. Pupation occurred *in situ*. Development from egg to adult took about 3 months in early summer, but the second, overwintering generation was much more extended.

The habit among leaf-dwelling weevils of protecting their eggs with excrement may not be uncommon. It is reported by Read (1985) for *Phytobius comari* (Herbst) (Ceutorhynchinae) when ovipositing on *Potentilla palustris*, and the egg capsule of *Gonipterus scutellatus* Gyllenhal is composed of excremental material (Tooke 1953).

The parasites *Xanthocryptus novozealandicus* Dalla Torre (Ichneumonidae) and an undetermined species of Pteromalidae emerged from the sample material.

Tribe Gonipterini

Body variously pigmented and sculptured; ventral folds arranged as ambulatory ampullae. Head deeply retracted into prothorax except when feeding; *des3* on epicranium. Labrum subtruncate. Tormae strong, separate. Premental sclerite broadly arrow-shaped. Hypopharyngeal bracon clear. Abd spiracles with airtubes caudad; Abd VIII spiracle lateral. Intersegmental pleural pockets present.

Remarks. The tribe Gonipterini has its centre in Australia, where *Eucalyptus* trees are host to a number of genera, including *Gonipterus* Schoenherr, *Bryachus* Pascoe, and *Oxyops* Schoenherr. The arboreal larvae are strongly modified in their morphology and cryptic coloration for ectophytic feeding. The eggs are deposited on the surface of leaves or bark, enclosed in a capsule formed from anal secretion. The mouthparts are not used for modelling or to prepare a site, hence the inclusion of this tribe in Brachycerinae.

Genus *Gonipterus* Schoenherr

Gonipterus Schoenherr, 1833: 456.

Type species *Gonipterus lepidotus* Gyllenhal.

Species of *Gonipterus* have been introduced into many warmer parts of the world with their eucalypt host plants. *G. scutellatus* Gyllenhal is the only one to have reached New Zealand, where it has been known since 1893. The larva of *G. gibberus* Boisduval in Brazil, as described and figured by Rosado-Neto & de Freitas (1982), can be separated from it only by minor differences in cephalic and labial setae. The caudad Abd airtubes and mandible with a single seta indicate an affinity with Rhytirhinini. A general diagnosis follows, under *G. scutellatus*.

Gonipterus scutellatus Gyllenhal

scutellatus Gyllenhal, 1833: 458.

'Gum tree weevil'

Fig. 569–580

Maximum dimensions 12.0×5.0 mm; head width 1.3 mm. Body convex above, almost plane below, with shallow ampullae, coloured yellow-green with a wide, dark, lateral stripe; Abd segments with 2 dorsal folds. Setae short, curved, with raised, shining, brown, circular bases. Setal numbers differing from the modal pattern as follows: head 4 *des*, 1+3 *fs*, 0 *les*, 0 *ves*; mandible 1 seta; labrum with *lrms* minute or obsolete; epipharyngeal lining 2 *mes*; maxilla 7 *dms*, 5 *vms*; pronotum 12–14 setae; Th II/III 1 *dls*, 3 *ss*; pedal lobe with sensilli only; Abd VIII 4 *pds*; Abd IX 3 *ds*; anal lateral lobes 3 or 4 setae. Head dark brown, retracted halfway into prothorax and declined ventrad when at rest, longer than wide, emarginate behind; *des1,3,4,5* in line beside frontal suture; endocarinal line absent; ocelli close together, both with raised corneae. Antennae minute, concealed. Mandibles short, broad, bidentate, with a small subapical projection. Labrum pigmented. Epipharyngeal lining with proximal *mes* pair represented by sensilli.

Tormae dark, thick, bowed inwardly. Pronotum produced forwards to form a hood, deeply cleft medially. Spiracles with peritreme dark; airtubes large, 14-annulate, caudad, all of similar size. Anus 6-lobed, terminal. Alimentary canal with proventriculus expanded; irregular-shaped mycetomes present around cardiac valve; anterior ventriculus transversely ridged, with dorsal and ventral longitudinal sulci; about 30 gastric caeca present in a single row on either side of lower coil; Malpighian tubules arising from a thickened ring, arranged 3+3.

Material examined. NEW ZEALAND: NN—Nelson, ex *Eucalyptus globulus*, 1 Dec 1929, 8 larvae, AFC; ex blue gum, 5 Nov 1946, 3 egg cases, 6 larvae*, JMK.

Biology (after Tooke 1953, Bain 1977a). During the winter months adults shelter under loose strands of bark on the trunk. In early spring, after feeding and mating, they move to the young growth, where the female lays up to 16 eggs in a capsule which she attaches to the leaf with a gelatinous anal secretion. The eggs are placed in rows and covered in successive layers by excremental material which hardens into a dark brown mass. Incubation takes 14–16 days. The larvae feed voraciously on leaf tissue, covering themselves with slime and leaving behind them a black trail of frass. Their development occupies 4–5 weeks; they undergo four moults, after which they fall to the ground to pupate in a cell lined with mucus. Adults of the new generation emerge during December and January to produce a second, overwintering generation by March or April. In cooler areas of the South Island there is only one generation a year.

Patasson nitens (Girault), an introduced mymarid egg parasite, appears to exercise effective control.

The pentatomid shield bug *Cermatulus nasalis* Westwood attacks both larvae and adults.

Tribe Hyperini

The tribe Hyperini, included in Brachycerinae on account of the oviposition habits of its members, holds little in common with Entimini, for instance, or Sitonina, but can be regarded as transitional between the aerial-feeding element of Rhytirhini (*Listroderes*, *Listronotus*) and the almost wholly aerial-living tribe Curculionini in subfamily Curculioninae. Moreover, Hyperini appear to be transitional in the matter of oviposition also, since *Hypera nigrirostris* (Fabricius) is reported as using its mandibles when preparing egg sites in the leaf blades of red clover (Sechriest & Trecece 1963). *Hypera* species are remarkably similar in general morphology to *Listroderes* and its allies.

Genus *Hypera* Germar

Hypera Germar, 1821: 335.

Type species *Curculio arator* Linnaeus.

=*Phytonomus* Schoenherr, 1823: 143.

Body slender, with terminal segments tapering to a pygopod and ventral lobes developed as ambulatory ampullae. Setae pallid, short, differing from modal numbers as follows: head 3 or 4 *fs*; mandible 1 or 2 setae; maxilla 6 *dms*, 5 *vms*, palp 0; pronotum 8 setae; Th II/III 2 *dls*, 2 *ss*, pedal area 2–5 setae; Abd I–VIII 1 *msts*; Abd IX 3 *ds*. Head free, subquadrate, often darkly pigmented; frontal suture distinct, narrow; 2 ocelli distinct beneath raised corneae; endocarinal line absent; *des3* on epicranium; *fs5* much longer than *fs4*. Antennae exposed, acutely conical, with hairlike sensoria. Mandibles short, wide, with 2–4 teeth. Labrum transverse, emarginate in front. Tormae indistinct. Epipharyngeal lining with reduced number of *ams* and *mes*. Hypopharyngeal bracon obsolete. Labial palpus 1-segmented. Premental sclerite a narrow semicircle without median extensions. Postlabium with posterior *plbs* pairs much closer together than median pair. Spiracles bicameral; spiracle of Abd VIII dorsal. Alimentary canal without gastric caeca; Malpighian tubules grossly thickened; cryptonephridium symmetrical; anal tube retractile.

Remarks. *Hypera* is a Northern Hemisphere genus with several species native to North America; those which have become pests of leguminous fodder crops were accidentally introduced from Europe in the mid 1800s. The diagnosis is based on specimens of *H. postica* Gyllenhal and *H. punctata* (Fabricius) and on the work of Anderson (1948b).

Hypera punctata (Fabricius)

punctata Fabricius, 1775: 150 (*Curculio*).

'Clover leaf weevil'

Fig. 581–590

Maximum dimensions 12.0×4.0 mm; head width 1.25 mm. Body yellowish or pinkish green; cuticle shagreened. Pronotum pale dusky brown, speckled with dark setal bases. Head pale dusky brown, with a maculate pattern and a dark fleck above posterior ocellus; frons with a broad median projection; epistoma rather wide; *fs5* twice as long as *fs4*, *fs3* absent; *des* all well developed. Mandibles with an apical tooth, a smaller subapical tooth, and a larger median projection; 2 setae present. Thoracic pedal areas with a well defined circular lobe bearing 3 setae. Spiracles all of similar size, with dark peritreme and annuli; airtubes short, obliquely dorsad. Anus 3-lobed, with dorsal lobe twice as large as laterodorsal lobes.

Material examined. CANADA: Quebec, Beauharnois, 1979, 3 larvae, BB.

Biology (after Herrick & Hadley 1922). The life cycle of the clover weevil, allowing for a colder climate, is comparable with that of *Listroderes difficilis*. Oviposition takes place mainly in autumn, with both eggs and adults overwintering. Larval development occupies 4–6 weeks during summer, with late larvae overwintering under surface debris. Pupation and emergence occur in spring and early summer. There is considerable overlap of generations. The eggs are laid in loose clusters or are pushed into hollow stems. Pupation takes place above ground in a cocoon spun to form an open meshwork, and usually attached to a plant. Host plants include alfalfa, lucerne (*Medicago sativa*), red clover (*Trifolium pratense*), crimson clover (*T. incarnatum*), and Jerusalem artichoke (*Helianthus tuberosus*).

Subfamily CURCULIONINAE

The subfamily Curculioninae as proposed by Kuschel (in press) encompasses almost half of the described species in Curculionidae. Its members are even more diverse than the Brachycerinae, and are best treated at the tribal or subtribal level. For the most part the larvae feed endophytically on living plants, and tend to be host-specific. Some, such as Cryptorhynchini and Cossonini, which feed on degrading or dead tissues, are less selective. Oviposition sites are prepared by the female using her mandibles. In the tribe Eirrhini the rounded antennae, absence of an endocarinal line, and the siting of *des3* in the frontal suture suggest that its systematic position is transitional between Brachycerinae and the tribe Curculionini.

Tribe Eirrhini

Outstanding features are as follows. Head small in relation to body, with prominent postoccipital condyles, and with a reduced number of setae, *des3* in frontal suture, and endocarinal line absent. Antennae rounded, mushroom-shaped. Labral tormae contiguous or joined at base. Spiracles either dorsal, acute, adapted to obtain oxygen by plant-piercing, or minute, with simple airtubes.

Remarks. The tribe Eirrhini (Bagoinae of authors) is a group of aquatic or semiaquatic weevils with larvae that are host-specific in water plants, horsetails, and mosses. In recent years some species have been introduced from South America to control weeds which threaten to choke inland waters in southern Africa and Australia (May &

Sands 1986). The larvae of two *Cyrtobagous* species, *Echinocnemis* sp., *Neochetina eichhorniae* Warner, and *Neohydronomus pulchellus* Hustache have been described in this context (May, in press). Another South American weevil, *Lissorhoptrus oryzophilus* Kuschel, of which a diagnosis is included here, has become a pest in rice plantations. The major endemic erirhinine genus in New Zealand, *Bryocatus* Broun, is associated with mosses and mat plants and contains over 100 species.

Genus *Bryocatus* Broun

Bryocatus Broun, 1915: 218.

Type species *Bryocatus alternans* Broun.

Body dense white due to deposits of fat. Head free, deeply emarginate behind; small relative to body size; postoccipital condyles acute, conspicuous through cuticle; sutures distinct; 2 pairs of ocelli present. Clypeal and labral setae reduced or absent. Labral tormae convergent, approximate at base. Epipharyngeal setae in modal numbers but minute. Labial palps 1- or 2-segmented. All spiracles minute with Abd airtubes caudad. Alimentary canal simple, without mycetomes or gastric caeca.

Remarks. The water weevils of New Zealand are poorly known as a group, through being largely confined to the subaquatic environment of alpine mosses and cushion plants. Of the five species which have been reared, four were feeding as larvae on mosses and one in leaf bases of a bog cushion, *Oreobolus pectinatus* (Cyperaceae). The spiracles in *Bryocatus* larvae are inconspicuous and reduced, unlike the upstanding spiracles characteristic of *Lissorhoptrus* LeConte and other water weevils living among aquatic plants.

Bryocatus amplus Broun

amplus Broun, 1915: 221.

Fig. 591–599

Maximum dimensions 5.5×1.75 mm; head width 0.5 mm. Body slender, evenly curved, tapering. Cuticle almost smooth. Setae very small, pallid; setal numbers differing from modal pattern as follows: head 3+1 *des*, 1 *fs*, 0 *cls*, 2 *lrms*; maxilla 3 *pfs*, 5 *dms*, 4 *vms*; pronotum 8 setae; Th II/III 1 *dls*, pedal area 5 setae; Abd I–VIII 4 *pds*, Abd IX 2 *ds*. Head pale yellow; mandibles and epistoma reddish. Antennae subspherical. Mandibles triangular, unidentate, with 1 seta. Labrum evenly rounded. Tormae elongate, subparallel, indistinctly joined at base. Maxilla somewhat elongate, with stipes narrow. Labial palps 2-segmented.

Premental sclerite with anterior and posterior median extensions subequal.

Material examined. NEW ZEALAND: AK—Hunua Ra., Mangatangi Vly, 7 May 1970, 21 larvae*, BMM. TK—Mt Egmont 1400 m, 3 Nov 1967, 54 larvae*, BMM. NN—Kaiteriteri, sea level, 12 Oct 1965, 18 larvae, JIT; Lake Sylvester area, 1400 m, 16 Dec 1967, 12 larvae*, BMM. All specimens from the moss *Polytrichadelphus magellanicus*.

Biology. Larvae of *Bryocatus amplus* have been found from sea level to 1400 m, at the base of moss mats, where they appeared to be feeding on rhizoids and old leaves. Young larvae were nearer the surface eating fresh material, and prepupae were found amongst the mass of roots. Pupal cells (in a rearing vial) were thinly lined with a viscous fluid. Adults emerged after about 3 weeks.

Genus *Lissorhoptrus* LeConte

Lissorhoptrus LeConte, 1876: 181, 183.

Type species *Bagous simplex* Say.

Genus *Lissorhoptrus* contains about fifteen species, among which *L. oryzophilus* Kuschel is well documented as a pest in rice paddies (Isely & Schwardt 1934, as *L. simplex*). It is included here as an example of erirhinine adaptation to the true aquatic environment. The South American genera introduced into Australia to control invasive water weeds show modifications ranging from elongate, trailing hairs and ventral hooks to a terminal dorsal plate (May, in press). The most noticeable features held in common are the upstanding, plant-piercing spiracles, similar in appearance to those of *Steriphus ascita* (Pascoe) (Rhytirhinini) but of different construction (May 1970a). A general description is given for *L. oryzophilus*, the only species for which larvae are available.

Lissorhoptrus oryzophilus Kuschel

oryzophilus Kuschel, 1951: 44.

'Rice water weevil'

Fig. 600–610

Maximum dimensions 8.0×1.5 mm; head width 0.4 mm. Body slender, tapered, slightly curved, semitransparent, with tracheal trunks visible through cuticle; 6 pairs of spiracles upstanding on dorsum. Cuticle smooth. Setae pallid, minute; setal numbers differing from modal pattern as follows: head 2 *des*, 1 *fs*, 3 *cls*; 1 *lrms*; mandible 1 seta; maxilla 5 *dms*, 3 *vms*; pronotum 5 setae; Th II/III 3 *pds*, 2

dls, 1 *ss*, pedal area 5 setae; Abd II–VII 1 *pds*; Abd VIII 4 *pds*; Abd IX 2 *ds*. Head partially retracted, deeply emarginate behind, pale yellow, with epistoma and mandibles reddish; ocelli indistinct. Antennae subspherical. Labrum concave in front, with only 1 seta visible. Tormae slender, convergent but not joined at base. Maxilla with both palpal segments short; stipital seta near inner margin. Labial palps 1-segmented, with apex bulbous. Premental sclerite V-shaped, tenuous. Spiracles of Th II minute, circular, with airtubes non-annulate, cephalad; those of Abd I and Abd VIII similar, with airtubes caudad. Spiracles of Abd II–VII in contiguous pairs on dorsum, directed forwards; scalpelum present at apex; retractile section apparently not developed. Abd VIII spiracles on depressed dorsum. Anus subterminal, 4-lobed, pubescent. Alimentary canal with proventriculus internally striate; cardiac valve surrounded by a thickened ring bearing 2 slender tubules; ventriculus smooth, slender; posterior section slightly narrower but not coiled, lacking gastric caeca; Malpighian tubules 4+2, arising at ileo-colic valve, rejoining hind gut at anal end of rectum; cryptonephridium undeveloped.

Material examined. U.S.A.: Texas, Beaumont, ex rice plants, 1968, 50 larvae, adults, CCB.

Biology (after Isely & Schwardt 1934, as *L. simplex*). The rice water weevil extends from Mexico to as far north as Canada, but it assumes importance only where the natural range of rice, which is a tropical plant, and that of *L. oryzophilus*, a temperate insect, overlap. The weevil can survive on several other aquatic grasses. In Arkansas the rice fields are invaded by swarms of adult weevils soon after flooding. The eggs are deposited in submerged roots. Newly hatched larvae feed within the roots and later live in the mud, feeding ectophytically. When larvae are abundant, nearly all roots are lost. Pupation takes place in a watertight cocoon attached to a rootlet. Development from egg to adult takes 32–77 days. The adults overwinter. The life habit of *L. oryzophilus* in the substrate is in sharp contrast to that of *Cyrtobagous* species on the floating fern *Salvinia* (May & Sands 1986). These latter larvae are free-drifting, using their long pleural setae as balancers and their hooked sternal setae for attachment when feeding and aerating.

Tribe Cryptorhynchini

Head usually carrying a full complement of setae (5 *fs*, 5 *des*, 4 *pes*, 2 *les*, 2 *ves*); *fs4* and *fs5* subequal; *des3* on epicranium; endocarinal line usually present. Labrum with lateral seta well developed. Tormae joined for part of their

length, Y-shaped. Premental sclerite usually a distinct trident. Maxillary and labial palps 2-segmented. Thoracic spiracles ovate, occasionally circular; Abd spiracles circular, much smaller; Abd VIII spiracle lateral. Anus terminal or subdorsal, 4- or 6-lobed, the dorsal lobe hemispherical.

Remarks. Cryptorhynchine larvae are always endophytic. Many of them, perhaps the majority, are primary invaders working initially in live tissue. This degrades as feeding progresses, and by the time of pupation and adult emergence the substrate is decayed. Larvae developing late are often overtaken by fungus. Some species of *Microcryptorhynchus* are leaf miners in healthy monocots (May 1987).

The characters listed above are held in common by the New Zealand element. The alimentary canal varies considerably, and is thus useful diagnostically at the generic level. A key is given (p. 20) to thirteen genera and generic groups, of which six representative species are described and figured. *Notacalles* Kuschel and *Pachyderris* Broun are treated in May (1971), and eight Australian genera in May (in press).

Subtribe Psepholacina

Body robust, dense white, terminating abruptly, with Abd VIII expanded ventrally and anus subdorsal. Abd I–VI usually with 4 dorsal folds. Setal numbers differing from modal pattern as follows: maxilla 7 *dms*, 5 *vms*; pronotum 8–11 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 7 setae; Abd VIII 4 *pds*; Abd IX 4 *ds*. Head free, entire behind, subcircular in outline, pallid, with oral margins, mandibles, and epicranial apex red-black; endocarinal line present; ocelli faint or absent. Antennae minute, narrowly conical, with a few basal papillae. Mandibles bidentate, with a raised median grinding surface, ridged longitudinally. Labrum produced forwards, pigmented, bisulcate. Tormae strong, united at base, with or without a short stem. Epipharyngeal lining pubescent, with *ams* on labral surface; *mes* pairs evenly spaced. Premental sclerite a distinct trident. Hypopharyngeal bracon pigmented. Thoracic spiracle ovate-fringed, with small airtubes; Abd spiracles circular, diminishing in size retrogressively. Alimentary canal with proventriculus narrow; cardiac mycetomes present or absent; anterior ventriculus bulky; posterior ventriculus 1+1-coiled, with gastric caeca globose, numerous; origin of Malpighian tubules swollen, floriate; cryptonephridium asymmetrical; rectal bracon a short, unpigmented loop.

Remarks. The subtribe Psepholacina, collectively known as the pit weevils, is a well defined group in which larval

morphology is distinctive and extremely homogeneous. Genus *Psepholax* Broun accounts for the greatest number of species (ten). *Mesoreda* Broun contains three species, and *Strongylopterus* Schoenherr and *Homoreda* Broun two species each; *Oreda* White and *Nothaldonus* Broun are monotypic (Lyal, in press). All the psepholacines live in trunks and branches of mature native trees, entering when the wood is either alive or recently dead but still sound. The larval mouthparts and alimentary canal show characteristic modification for xylophagy. The diagnosis above applies to all genera (except possibly *Nothaldonus*, larvae of which are still unknown).

Genus *Psepholax* White

Psepholax White, 1843: 275.

Type species *Psepholax sulcatus* White.

Genus *Psepholax* occurs in Chile and Australia as well as New Zealand.

Psepholax tibialis Broun

tibialis Broun, 1880: 482.

Fig. 611–622

Maximum dimensions 18.0×5.5 mm; head widths – 1st instar 0.8–1.0 mm, 2nd instar 1.3–1.8 mm, 3rd instar 2.4–3.0 mm. Abd I–VI with 3 dorsal folds; Abd VII and VIII with 2 folds. Cuticle coarsely spiculate on dorsal folds of Abd I–V and ventrally on Abd VIII. Setae dark, moderately long. Labral tormae joined, but lacking a basal stem. Epipharyngeal lining with distal *mes* pair immediately behind middle *ams* pair on opposing surface (therefore indistinct on a slide preparation). Maxillary mala with apical margin serrate. Similar in other respects to subtribal diagnosis.

Egg dimensions 2.0×1.3 mm.

Material examined. NEW ZEALAND: ND – Tutamoe, ex *Weinmannia sylvicola*, 12 Oct 1967, 11 larvae, adults, JSD. AK – Huia, ex *Leptospermum scoparium*, 15 Aug 1965, 12 eggs, 31 larvae in all stages*, BMM. WO – Mangatarata, ex *Myrsine australis*, 21 Oct 1973, 9 larvae, adults, JSD. BP – Te Aroha, Waiorongomai Vly, ex *Weinmannia racemosa*, 12 Dec 1965, 7 larvae, 1 pupa, adults*, BMM; Mt Te Aroha, 975 m, ex *Nothofagus menziesii*, 23 Oct 1967, 5 larvae, adults, JCW. All specimens taken from trunks of live trees.

Biology. Some of the pit-boring weevils, such as *Psepholax sulcatus*, initiate their workings in live timber which for

one reason or another has begun to degrade. Others, e.g., *P. coronatus* White, use wood that is already dead. *P. tibialis* however selects healthy trees, and its activities appear not to result in decay. A tall, slender manuka (*Leptospermum scoparium*) studied at Huia, near Auckland, contained nine entry holes within a 2.5-m length of trunk, comprising one mature, abandoned working, three abortive sites, one active colony, and four newly initiated sites in various stages of development. In the same way as other pit-borers, *P. tibialis* places its eggs at the end of a short tunnel. The female, having chewed about twelve depressions, re-enters backwards to oviposit. The tunnels of newly hatched larvae radiate from this point before proceeding separately along the grain.

The largest tunnel observed was 65 mm long and 6.0–10.0 mm wide throughout its length. The very robust larva must have developed within this relatively small space. Detritus is pushed out through the entry hole, where a characteristic dribble of frass is the sign of a viable colony. Pupation occurs *in situ*, and emerging adults exit through the original aperture, unlike those of *P. sulcatus*, which leave the trunk peppered with individual exit holes.

Two kinds of symbiotic organism are present in the alimentary canal of Psepholacina (Grinbergs 1962, on the Chilean species *Empleuodes dentipes* Boheman). The mycetomes surrounding the cardiac valve, frequent in Curculionidae, contain thread-like forms, and the expanded Malpighian tubule bases characteristic of Psepholacina and a few cossonines, e.g., *Mesites pallidipennis* Boheman, carry rod-shaped organisms. Apparently some unusual process of food assimilation may be at work.

Subtribe Cryptorhynchina

Genus *Mitrastethus* Redtenbacher

Mitrastethus Redtenbacher, 1868: 167.

Type species *Mitrastethus baridioides* Redtenbacher.

Similar in general appearance to larvae of Psepholacina, with head creamy white and anus subdorsal, but terminal segments slightly less truncate. Head widest behind middle. Labrum trilobate. Epipharyngeal lining with *ams* at margin, not on labral surface; middle *mes* pair nearer the proximal than the distal *mes* pair. Premental sclerite medially obsolete. Hypopharyngeal bracon clear. Alimentary canal with cardiac mycetomes absent; gastric caeca ovate, not numerous; bases of Malpighian tubules simple.

Remarks. Genus *Mitrastethus* is present only in the Australian Region, with one species each in New Caledonia, Norfolk Island, Australia, and New Zealand.

Mitrastethus baridioides Redtenbacher

baridioides Redtenbacher, 1868: 167.

'Long-nosed kauri weevil'

Fig. 623–632

Maximum dimensions 9.0×3.0 mm; head width 2.0 mm. Cuticle minutely spiculate on dorsum of Abd I–V and ventrally on Abd VIII and IX. Setae pale red-brown, moderate in length. Setal numbers differing from modal pattern as follows: maxilla 6 *dms*, 5 *vms*; pronotum 12 setae; Th II/III 1 *dls*, pedal area 7 setae; Abd VIII 3+3 *pds*; Abd IX 2+2 *ds*.

Material examined. NEW ZEALAND: ND – Waipoua SF, ex dead branches of *Agathis australis*, 7 Jun 1966, 5 larvae, adult, JCW, JIT. AK – Auckland, ex *Prumnopitys taxifolia*, Jan 1964, 7 larvae, 1 pupa, MK; Huia, ex damp, dead wood of *Agathis australis*, 6 Sep 1966, 40 larvae, 1 pupa*, BMM; Huia, ex untreated pine boxing, 5 Aug 1968, 12 larvae*, BMM.

Biology (after Hosking 1978). *Mitrastethus* is restricted to dead Gymnospermae, including Araucariaceae, Podocarpaceae, and introduced Pinaceae. In New Zealand it occurs in the North Island only. Unlike *Psepholax* the adults do not penetrate the wood by boring, but enter where bark has been loosened or removed and feed between bark and sapwood. Eggs are laid singly in small excavations either in the bark or in adult feeding tunnels. Moisture is essential for larval development, and in the right conditions the sapwood is honeycombed by their workings. Pupation takes place *in situ*, and emerging adults leave exit holes 2–3 mm in diameter. A generation occupies 1–3 years.

Genus *Rhynchodes* White

Rhynchodes White, 1846: 16.

Type species *Rhynchodes ursus* White.

Rhynchodes is a monotypic genus not closely allied to other New Zealand cryptorhynchines. The larva of *R. ursus* stands apart by reason of its size and its spatulate premental sclerite. A general diagnosis is given below.

Rhynchodes ursus White

ursus White, 1846: 16.

'Elephant weevil'

Fig. 633–642

Maximum dimensions 25.0×10.0 mm; head width 4.0 mm.

Body thick, sturdy, strongly curved, tapering. Cuticle finely spiculate. Setae pallid, very short except those on head and pronotum, and major *pds* of thorax and Abd V–IX. Setal numbers differing from modal pattern as follows: maxilla 9 *dms*, 5 *vms*; pronotum 8 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 5+2 setae; Abd VIII 0 *prs*, 5 *pds*; Abd IX 4 *ds*. Head partially retracted, longer than wide, red-brown with pallid paramedian and lateral stripes; frons darker; oral margins, epistoma, and mandibles reddish black; endocarinal line half as long as frons; ocelli not visible. Antennae acutely conical, with 1 rod-like papilla, partially overhung. Mandibles apically bifid, with a supplementary tooth and a blunt molar projection. Labrum trilobate, pigmented medially. Tormae strong with stem as long as arms or longer. Epipharyngeal lining modally arranged, with clusters of sensilli between distal *mes* pairs. Premental sclerite quadrate at sides, with anterior median extension narrow, and posterior extension spatulate at apex. Hypopharyngeal bracon clear. Thoracic spiracle elongate-ovate, 3X as long as Abd VIII spiracle, with airtubes minute, simple, dorsal; Abd spiracles progressively smaller and more circular. Anus terminal, 4-lobed. Alimentary canal with anterior ventriculus occupying two-thirds of body space, folded laterally and puckered into a median longitudinal sulcus; posterior section 1+1-coiled, with about 10 vermiform caeca on either side of lower coil; Malpighian tubules unusually thick; cryptonephridium symmetrical; rectal bracon membranous.

Material examined. NEW ZEALAND: BP – Mamaku, ex *Dacrydium cupressinum*, 26 Nov 1948, 3 larvae, 1 pupa, adults, NMW. TO – Erua, 16 Dec 1961, 4 larvae, 1 pupa, GK; Mt Ruapehu, 1100 m, ex dead trunk of *Nothofagus solandri* var. *cliffortioides*, 1 Dec 1965, 1 larva, 2 pupae, adults*, BMM. NN – Mt Arthur, 1350 m, ex dead trunk of *Dracophyllum traversii*, 16 Dec 1961, 9 larvae, 1 pupa, JIT, GFW.

Biology. *Rhynchodes ursus* oviposits in the trunk and branches of dead forest trees while the wood is still sound. By the time a generation has developed the sapwood is riddled with tunnels made by the large larvae, other invaders have followed, and fungus has entered.

Larvae of *R. ursus* are parasitised by the giant ichneumon wasp *Certonotus fractinervis* (Vollenhoven). The emergence holes of the wasps measure 3.0–4.0 mm in diameter, whereas those of the elephant weevil measure 6.0–9.0 mm.

Remarks. In Australia the name 'elephant weevil' refers to *Orthorhinus cylindrirostris* (Fabricius) in Molytini.

Genus *Tychanus* Pascoe

Tychanus Pascoe, 1876: 64.

Type species *Tychanus gibbus* Pascoe.

Tychanus is a monotypic genus distributed throughout the North Island. *Didymus* Kuschel is considered to be its only close ally (Kuschel 1981). On larval characters, as shown in the key (p. 20), *Clypeolus* Broun and *Pachyderris* Broun are not far removed. A general diagnosis follows.

Tychanus gibbus Pascoe

gibbus Pascoe, 1876: 64.

Fig. 643–653

Maximum dimensions 12.0×4.5 mm; head width 2.4 mm. Body robust, of even width, terminating abruptly. Cuticle coarsely spiculate on dorsum of Th and Abd I–V and ventrally on Abd VII–IX. Setae pallid, fine, short except for major dorsal setae of Abd VI–IX. Setal numbers differing from modal pattern as follows: maxilla 10 *dms*, 5 *vms*; pronotum 10 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 7 setae; Abd VIII 5 *pds*; Abd IX 4 *ds*. Head free, subcircular in outline, bright red-brown, unpatterned; oral margins, narrow epistoma, and mandibles red-black; endocarinal line one-third as long as frons; primary ocelli distinct, secondary (posterior) ocelli faint or absent. Antennae very small, overhung. Mandibles apically bifid, with a median projection and an acute molar tooth. Labrum trilobate, pigmented. Tormae strong, dark, with stem short, one-fifth as long as arms. Epipharyngeal lining modal, with clusters of sensilli between proximal *mes* pairs. Premental sclerite complete, rather broad. Postlabial setae subequal. Hypopharyngeal bracon maculate. Thoracic spiracle elongate-ovate, 4× as long as Abd VIII spiracle; airtubes dorsal, small, irregularly annulate; Abd spiracles circular, becoming retrogressively smaller. Anus terminal, 4-lobed. Alimentary canal lacking cardiac mycetomes; anterior ventriculus occupying half of body space; posterior ventriculus 1+3-coiled, with about 40 gastric caeca on either side of anterolateral coil cryptonephridium elongate, asymmetrical; rectal bracon an elongate, pigmented loop.

Material examined. NEW ZEALAND: AK – Huia, in live wood of *Olearia furfuracea*, 14 Apr 1967, 37 larvae, 1 pupa, 1 adult*; Titirangi, in dead trunk of *Fuchsia excorticata*, 18 Jul 1967, 5 larvae*, BMM; in dead wood, 25 Mar 1968, 13 larvae, JG.

Biology. Eggs of *Tychanus gibbus* are laid in shrubs and small trees where damage to the bark has left the phloem exposed. Although larvae have been taken in recently dead

wood, their activity is not necessarily instrumental in the demise of the plant. *Olearia furfuracea*, for instance, often assumes a stunted, gnarled appearance when the workings and exit holes have enlarged with age and growth has continued round them. *Coprosma arborea*, *C. australis*, and *Phebalium nudum* are also recorded as host plants.

Genus *Crisius* Pascoe

Crisius Pascoe, 1876: 66.

Type species *Crisius binotatus* Pascoe.

Body of even width, with anus terminal; Abd I–VII with 3 dorsal folds. Setation differing from modal numbers as follows: maxilla 7 *dms*, 5 *vms*; pronotum 10 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 5+2 setae; Abd I–V 2+3 *pds*; Abd VI–VIII 3+2 *pds*; Abd IX 2+2 *ds*. Head free, pigmented, more or less evenly rounded; postoccipital condyles right-angled; endocarinal line present; secondary ocelli absent. Antennae minute, partially overhung. Mandibles apically bifid, with cutting edge flanged; molar area bearing a small, acute tooth. Labrum rounded, pigmented mesally. Tormae strong, joined into a basal stem. Epipharyngeal lining with sensilli between distal *mes* pairs; proximal *mes* pairs arranged quadrately. Premental sclerite a distinct trident. Hypopharyngeal bracon clear. Thoracic spiracle ovate, with dorsal airtubes; Abd spiracles much smaller, circular. Alimentary canal with proventriculus simple; mycetomes present at cardiac valve; posterior ventriculus 2-coiled, with gastric caeca ovate or vermiform; Malpighian tubules arranged 4+2, slender, with bases simple; cryptonephridium asymmetrical near apex; rectal bracon a short loop.

Remarks. The generic diagnosis is assembled from reared larvae of *C. variegatus* Broun, *C. binotatus* Pascoe, *C. fasciculatus* Broun, and an undescribed species from the Chatham Islands. Diagnoses for *Omoecalles* Broun, *Indecentia* Broun, *Mecistostylus* Lacordaire, and *Hadracalles* Broun are similar to the foregoing. *Hadracalles* (a monotypic genus from the Poor Knights islands) is distinguished from the others by its thick Malpighian tubules and lack of gastric caeca.

Crisius variegatus Broun

variegatus Broun, 1880: 501.

Fig. 654–663

Maximum dimensions 11.3×3.5 mm; head width 2.5 mm. Cuticle coarsely spiculate. Setae red-brown, tapering, of

moderate length. Pronotum lightly pigmented. Head slightly produced behind, bright red-brown with darker paramedian streaks; frontal suture narrow, angled before acute apex; *fs*1,2,3 half as long as *fs*4,5; *des*4 half as long as *des*1,2,3,5. Clypeal setae subequal. Alimentary canal with about 40 gastric caeca in a multiple row on either side of lower ventricular coil.

Material examined. NEW ZEALAND: ND – Poor Knights Is., Aorangi, ex dead *Clematis* vine, 11 Nov 1981, 9 larvae*, JSD. AK – Whatipu Beach, subcortical in thick dead bark of *Lupinus arboreus*, 15 Jun 1968, 15 larvae, pupae, adults*, BMM; Huia, Karamatua Vly, in live vines of *Tetrapathaea tetrandra*, 3 Jan 1972, 20 larvae, pupae, adults*, BMM; Lynfield, subcortical at base of live trunk of *Sophora microphylla*, 28 Feb 1976, 4 larvae, GK.

Biology. Larvae of *Crisius* species are usually discovered working in dead tissue, either bark or phloem, with adult exit holes as an indication of their presence. *C. fasciculatus* on *Freycinetia baueriana* (Pandanaeae) provided a clue to the feeding pattern for the genus. Its eggs are laid in live stems and aerial roots, and the larvae feed initially in the green tissue. As the workings are extended the tissue degrades, so that older larvae are feeding on dead material. *C. variegatus* on the native passion vine *Tetrapathaea tetrandra* was in a partly dead section of a thick (70 mm diameter) stem, feeding beneath the bark. Pupae were in unlined pits chewed in the sapwood. The colony was in deep shade. This species was also found on yellow lupin (*Lupinus arboreus*) in an open sand dune situation, where older larvae were feeding subcortically in dry, dead stems. Many *Crisius* species inhabit subalpine plants, feeding in older leaves and pupating amongst their shredded remains.

Genus *Sympedius* Pascoe

Sympedius Pascoe, 1876: 65.

Type species *Sympedius testudo* Pascoe.

Body stout, strongly curved, of even width, with anus terminal. Setae pallid, very short or minute. Setation differing from modal numbers as follows: maxilla 7 *dms*, 5 *vms*; pronotum 7–9 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 1+6 setae; Abd I–VI 2+3 *pds*; Abd VII/VIII 2+2 *pds*; Abd IX 2+1 *ds*. Head longer than wide, narrowed and entire posteriorly, partially retracted, unpigmented except for red-brown cranial and oral margins, epistomal band, and mandibles; postoccipital condyles rounded; sutures not visible; endocarinal line present; ocelli faint or absent. Antennae exposed, broadly conical, with basal papillae.

Mandibles bidentate, apically with a small median tooth. Labrum with a 5-pointed red-brown pattern. Tormae with stem acute at apex. Epipharyngeal lining with clusters of sensilli between distal *mes* pairs. Premental sclerite a distinct trident. Hypopharyngeal bracon clear. All spiracles circular, with short, annulate airtubes. Abd spiracles all of similar size, smaller than Th spiracle. Alimentary canal with proventriculus 6-striated; cardiac mycetomes present; posterior ventriculus 1+1-coiled, without gastric caeca; Malpighian tubules with 2 forward-looping pairs twice as thick as the caudal pair; cryptonephridium asymmetrical near apex; rectal bracon a short loop.

Sympedius testudo Pascoe

testudo Pascoe, 1876: 65.

Fig. 664–673

Maximum dimensions 4.0×2.5 mm; head width 1.5 mm. Cuticle almost smooth. Setae minute except for 2 major setae on Abd VI–IX dorsum and 1 on each pedal lobe. Pronotum and head pallid; epistoma rather wide; endocarinal line one-third as long as frons; *fs1,2,3* and *des4* very short. Clypeal setae of unequal length. Epipharyngeal lining with *mes* as long as *als*. Tormae with stem as long as arms.

Material examined. NEW ZEALAND: ND – Taupo Bay, ex *Coprosma lucida*, 19 Feb 1967, 8 larvae, adult, BMM. AK – Huia, ex *Coprosma robusta*, 1 Jan 1967, 10 larvae, pupa, adult*, BMM; ex *Geniostoma ligustrifolium*, 10 Jan 1967, 6 larvae, BMM. CL – Motuoruhi I., ex *Myoporum laetum*, 9 Nov 1970, 9 larvae, 7 pupae, adults*, BMM.

Biology. *Sympedius* larvae pass their entire cycle in dead small wood which has been invaded by fungus. The eggs are inserted through the thin cortex or into the sides of adult emergence tunnels. The larval workings are tightly packed with frass, and are often lined with fungus. The pupal cell is constructed near the surface, at a right angle to the working. The adult exit hole is not prepared by the larva before pupating. The thickened Malpighian tubules may contain symbiotic organisms (Stammer 1934).

Remarks. *Tychanus vexatus* has tormae with the stem shorter than the arms, but is similar in other respects.

Tribe Eugnomini

Head free, variable in shape, usually emarginate behind; frontal suture distinct, not angulate before apex; endocarinal line short and indistinct, or absent; *fs1,2,3* usually minute; antennae exposed; postoccipital condyles inconspicuous or absent. Mandibles apically bifid, with a median tooth or a ridged grinding area; setae aligned longitudinally. Setation differing from modal numbers as follows: head 4+1 *des*, 2+3 *fs*; maxilla 6,7, or 12 *dms*, 5 *vms*; pronotum 4–8 setae; Th II/III 1 *dls*, 1 *ss*, pedal area 2+5 setae; Abd VIII 1+2 *pds*; Abd IX 1+1 *ds*; anal lateral lobe 3 setae. Labral tormae convergent, often joined in a V-shape. Epipharyngeal lining with clusters of sensilli between distal *mes* pairs. Premental sclerite a complete trident. Hypopharyngeal bracon usually clear. Labial palpi 2-segmented. Spiracles subcircular, bicameral or unicameral, those of Th and Abd VIII subequal in size, larger than the others; Abd VIII spiracles on dorsum in front of *pds*; airtubes of Th dorsad, others caudad. Abd IX much narrower than Abd VIII. Anus subterminal, 6-lobed. Alimentary canal with proventriculus narrow; cardiac mycetomes absent; posterior ventriculus with 1+1 coils; gastric caeca globular, occasionally with a few vermiform caeca, or absent; cryptonephridium asymmetrical, ending in a cup-shaped membrane; rectal bracon a loop, often pigmented.

Remarks. The Eugnomini show a Gondwanic pattern of distribution focused in New Zealand (15-plus endemic genera) and with representatives in South America, Australia, and New Caledonia (Cawthra 1966). Habitats are as varied as those of the Cryptorhynchini. Many species develop host-specifically in live plants; the remainder are attracted to degrading tissues. Two genera have mouthparts adapted for masticating wood fibres. Adults feed on pollen of various native flowers. Females have a sclerotised ovipositor, so it is unlikely that their mandibles are used to prepare sites for the eggs. The following tribal diagnosis, based on reared larvae, refers to the New Zealand element (subtribe Eugnomina) but diverges in some respects from the Australian *Myossita* Pascoe (Meriphina).

Twelve genera are keyed, six of which are treated in detail and figured. *Pactolotypus depressirostris* (Kirsch) from Campbell Island is diagnosed in May (1971).

Genus *Ancistropterus* White

Ancistropterus White, 1846: 15.

Type species *Ancistropterus quadrispinosus* White.

This monotypic genus is present in the North Island only. It is a representative of the xylophagous section of the tribe.

***Ancistropterus quadrispinosus* White**

quadrispinosus White, 1846: 15.

Fig. 674–685

Maximum dimensions 5.5×1.5 mm; head width 1.0 mm. Body slender, of even width, strongly curved and tapering abruptly. Cuticle finely asperate dorsally on Th and Abd I–V, and ventrally on Th and Abd VIII/IX, elsewhere smooth. Setae pallid; major setae moderately long. Head subquadrate, bright red, unpatterned, with oral margins and mandibles blackish; anterior ocelli distinct. Antennae narrowly conical, pubescent. Mandibles with a ridged grinding surface. Labrum somewhat elongate, sclerotised. Tormae convergent, approximate at base. Epipharyngeal lining with *als* arranged longitudinally, parallel to tormae. Hypopharyngeal bracon completely pigmented. Maxillary mala with setal bases quadrate. Th spiracle 6- or 7-annulate. Abd spiracles unicameral, 3- or 4-annulate. Alimentary canal lacking gastric caeca.

Material examined. NEW ZEALAND: AK – Huia, in old log, 15 Aug 1971, 50 larvae, 2 pupae, 6 adults*, BMM. RI – Mt Ruapehu, 830 m, in dead stump of *Nothofagus fusca*, 31 Oct 1970, 15 larvae, 1 pupa, BMM.

Biology. Larvae of *Ancistropterus* were feeding in the undecayed parts of trunk wood, where their workings were filled with soft, buttery frass. Their mouthparts, as in *Psepholacina*, are modified for chewing hard, woody fibres. Pupation occurs in situ. In October, adults were found feeding on pollen of *Leptospermum* flowers.

Remarks. *Ancistropterus* is closely resembled by *Rhopalomerus* Blanchard (*R. nobilis* (Broun) examined), larvae of which are found in soft, dead wood. Although the mandible has a median grinding surface and the hypopharyngeal bracon is partially pigmented, the modifications do not extend to the labrum. This genus likewise has unicameral Abd spiracles.

Genus *Gonoropterus* Broun

Gonoropterus Broun, 1904: 122.

Type species *Gonoropterus spinicollis* Broun.

The monotypic genus *Gonoropterus* is endemic in the North Island. It is linked by biology and larval conformation with *Curculio* Linnaeus, which is represented in Australia and has larvae which feed in fruits and nuts of various kinds.

***Gonoropterus spinicollis* Broun**

spinicollis Broun, 1904: 122.

‘Nestegis weevil’

Fig. 686–694

Maximum dimensions 7.0×3.0 mm; head width 1.0 mm, length 1.3 mm. Body sturdy, convex, widest behind middle, slightly recurved. Cuticle minutely asperate. Setae pallid, short to minute. Head ovate, longer than wide, slightly produced behind, red-brown, unpatterned, with oral margins and mandibles blackish; postoccipital condyles conspicuous; anterior ocelli distinct. Antennae narrowly conical, pubescent. Mandibles bifid, with a small median projection. Labrum evenly rounded. Tormae Y-shaped, with stem half as long as arms. Epipharyngeal lining with all setae strong. Th spiracles 7- or 8-annulate; Abd spiracles 3- or 4-annulate. Alimentary canal with proventriculus slightly expanded; anterior ventriculus transversely rugose; posterior ventriculus with 12–15 globose gastric caeca.

Material examined. NEW ZEALAND: AK – Huia, in fruits of *Nestegis lanceolata*, 16 Dec 1974, 20 larvae*, BMM. RI – Kauwhata Base, Ruahine Ra., in fruits of *Nestegis cunninghamii*, 24 Dec 1985, 12 larvae*, BMM.

Biology. *Gonoropterus spinicollis* is host-specific to *Nestegis* (Oleaceae). It probably breeds on all four species, but I have found larvae on only *N. cunninghamii* and *N. lanceolata*. Its biology was followed through irregular sampling of *N. lanceolata* fruits from Destruction Gully, Huia. Young larvae were found in early January in prematurely yellowed fruit. Up to four oviposition sites were visible on the cuticle. The workings showed that first-instar larvae had fed in the fleshy mesocarp before approaching the nut, where several had died while chewing through the tough shell (endocarp). In May, first- and second-stage larvae were still present, often two together in the same kernel. By July the ripening fruits were becoming juicy. Mature larvae, one survivor to a fruit, were occupying the eaten-out cavities. Two weeks later some prepupae had made incomplete exit holes at the stem end. The prepupal period can be prolonged, and pupation was not observed until early December. Adults emerged during summer.

The weevil *Peristoreus rufirostris* (Broun) was utilising *Nestegis cunninghamii* fruits at the same time (December) as *Gonoropterus*. The larvae fed only in the mesocarp, and left the fruit to pupate in the soil.

Remarks. *Gonoropterus* is distinguished from *Curculionini* by its globose gastric caeca and united labral tormae.

Genus *Hoplocneme* White

Hoplocneme White, 1846: 14.

Type species *Hoplocneme hookeri* White.

Hoplocneme is distributed throughout New Zealand, occupying along with *Pactola* Pascoe and *Pactolotypus* Broun dead or degrading twigs and small branches.

Hoplocneme inaequale Broun

inaequale Broun, 1893: 1229.

Fig. 695–704

Maximum dimensions 6.0×1.3 mm; head width 0.9 mm. Body slender, of even width, gently curved. Cuticle mostly smooth, but minutely asperate on dorsum. Setae pallid; major setae moderately long, others minute. Head subquadrate, strongly depressed, emarginate behind, yellow-brown, unpatterned, with oral margins and mandibles blackish; ocelli indistinct. Antennae narrowly conical, pubescent. Mandibles apically bifid, with 2 median incisor teeth. Labrum slightly lobed, unpigmented. Tormae slender, almost contiguous at base. Epipharyngeal sensilli in clusters of 2. Maxilla with 7 *dms*. Th spiracles 10- or 11-annulate; Abd spiracles 6- or 7-annulate. Alimentary canal with 2 sets of gastric caeca, 4 vermiform followed by 12–14 globular on lower coil.

Material examined. NEW ZEALAND: NC – Arthurs Pass, 1700 m, in dead tips of *Coprosma serrulata*, 11 Nov 1967, 14 larvae, 1 pupa, 2 adults*, BMM.

Biology. Larvae of *H. inaequale* were found in withered shoots of *Coprosma serrulata*, a low-growing shrub in the fell-fields of Arthurs Pass. Eggs are inserted beneath the leaf bracts, and the larvae tunnel in the pith, working towards the tips. They pupate in the workings.

Remarks. Genus *Pactola* is similar to *Hoplocneme* in most respects, including the pattern of gastric caeca.

Genus *Nyxetes* Pascoe

Nyxetes Pascoe, 1870: 456.

Type species *Curculio bidens* Fabricius.

Nyxetes is a monotypic genus from the North Island and the Nelson region. It develops in live tissue on a limited range of host plants. Two autapomorphies distinguish the larva from all other eugnomines: (1) the labrum is subquadrate, with parallel sides; (2) the maxillary mala bears 11–13 *dms*, by comparison with 6 or 7 *dms* in other genera.

Nyxetes bidens (Fabricius)

bidens Fabricius, 1792: 420 (*Curculio*).

Fig. 705–714

Maximum dimensions 8.0×2.5 mm; head width 1.25 mm. Body very robust, widest behind middle, recurved. Cuticle coarsely spiculate on dorsum of Th II to Abd VII. Setae red-brown; major setae strong. Head small relative to body size, subquadrate, depressed, emarginate behind, bright red-brown, unpatterned, with oral margins and mandibles red-black; postoccipital condyles acute, dark at apex; both primary and secondary ocelli with corneae. Antennae broadly conical, pubescent. Mandibles bifid, with small median projections. Labrum completely sclerotised, narrow, half as wide as clypeus, with sides straight, parallel; front margin evenly rounded. Tormae approximate at base. Epipharyngeal lining with distal *mes* pair on margin between *ams* pairs; sensilli in clusters of 2. Maxillary mala with 11–13 *dms*, 6 *vms*. Th spiracles 11- or 12-annulate; Abd I–VII spiracles 6–8-annulate. Alimentary canal with 8 or 9 globular gastric caeca; rectal bracon a pigmented loop; cryptonephridium undeveloped; Malpighian tubules rejoining at rectum.

Material examined. NEW ZEALAND: AK – Huia, from galls in live vines of *Clematis paniculata*, 6 Jul 1968, 10 larvae*, BMM; Whatipu, from gall in live trunk of *Hoheria populnea*, 12 Aug 1968, 3 larvae, 1 pupa, BMM; Swanson, from galls in live branches of *Nestegis lanceolata*, 29 Feb 1972, 12 larvae*, BMM. TO – Taumarunui, in *Clematis paniculata*, 12 Nov 1968, 23 larvae, 1 pupa, 2 adults*, BMM.

Biology. Developing larvae of *Nyxetes* live in an apparently symbiotic relationship with mealybugs: *Paracoccus deboerae* on *Clematis* and *Crisicoccus comatus* on *Nestegis*. Young larvae feed on green tissue such as new callus growth around cicada wounds. As the workings enlarge they become lined with a black fungoid substance, and mealybugs are present. A small hole is made for the extrusion of frass. Final-stage larvae inhabit a subspherical cavity, usually visible on the surface as a gall. It is still lined with black fungus and shared with mealybugs, which are often pressed behind the recurved end of the larva so that their flocculence becomes abraded. Comparatively little plant tissue is removed, and the larvae appear to feed by scraping the inner surface of the cavity, which in turn makes fresh cells available for the mealybugs. In the alimentary canal an unusual type of excretory process is indicated by the caudally arranged Malpighian tubules, which rejoin the hind gut at the rectal bracon (Fig. 714).

instead of anastomosing to form a cryptonephridium. On *Nestegis*, when a sliver of gall was removed, the larva repaired the damage within 20 minutes with masticated, semiliquid material. Pupation takes place within the gall.

Genus *Oreocalus* Marshall

Oreocalus Marshall, 1943: 118.

Type species *Oreocharis nigriceps* Broun.

Genus *Oreocalus* occurs throughout New Zealand. Its many species are confined to live plants of the genus *Hebe*. The majority are stem miners, characterised by a small globose head and elongate body shape. *O. hebe*, which constructs terminal galls of rolled leaves, is short and convex.

Oreocalus albosparsus (Broun)

albosparsus Broun, 1912: 126 (*Oreocharis*).

Fig. 715–724

Maximum dimensions 11.0×2.0 mm; head width 0.75 mm. Body very elongate, of even width, slightly curved; pigmented oenocyte clusters conspicuous laterally. Cuticle smooth; Th with circular pedal lobe lightly sclerotised; Abd IX *ds* and *ps* on pigmented tubercles. Setae short, pallid; minor setae minute. Head small, subspherical, only slightly emarginate behind, dark smoky brown with a paler lateral stripe; oral margins and mandibles black; endocarinal line present; postoccipital condyles absent; both pairs of ocelli distinct. Antennae narrowly conical, rather elongate. Mandibles short; incisor section a curved blade below apical teeth. Labrum truncate, with setae short, subequal. Tormae approximate at base. Epipharyngeal lining with 4 *mes* pairs, the distal pair close together immediately below inner *ams* pair. Th spiracles 10- or 11-annulate; Abd spiracles not much smaller, 7- or 8-annulate. Alimentary canal with 10–12 globular gastric caeca in a single row on either side of lower coil.

Material examined. NEW ZEALAND: AK – Huia, in live stems of *Hebe macrocarpa*, 10 Jul 1966, 15 larvae, 2 pupae, 1 adult*, BMM; 10 May 1968, 10 larvae, BMM.

Biology. The life history given below is representative of the various *Oreocalus* which develop as stem miners in all *Hebe* species, from sea level to the subalpine zone. Eight species have been reared, five of them undescribed (May 1987). The eggs are placed in terminal or lateral leaf buds. Newly hatched larvae work spirally downwards beneath the cortex to occupy eventually the entire lumen of the

stem, by which time the shoot above the working has wilted and drooped. Pupation takes place in a cell blocked off at either end by shredded fibres. A partial exit hole is prepared, leaving the cortex entire.

Pupae are parasitised by a proctotrupid. *O. hebe* makes a terminal bud-gall; an account of its biology is given by Gourlay (1964).

Genus *Scolopterus* White

Scolopterus White, 1846: 14.

Type species *Scolopterus tetracanthus* White.

Genus *Scolopterus* requires degrading plant material for larval development, and the two species I have reared appear to be specific in their preference for *Pseudopanax* bark (*S. penicillatus* White) and for the tree fern *Cyathea* (*S. aequus* Broun). *Scolopterus* and *Stephanorhynchus* White are so alike as larvae that I can find only two stable characters, excepting pigmentation and size, to separate them. (1) In *Scolopterus* the *pds* pattern on Th II/III is short, long, short, long, whereas in *Stephanorhynchus* it is short, short, long, long. (2) On the head capsule *fs* 1,2,3 of *Scolopterus* are minute, whereas in *Stephanorhynchus* they are well developed. Both genera occur together in dead bark of *Pseudopanax arboreus*.

Scolopterus aequus Broun

aequus Broun, 1880: 473.

Fig. 725–734

Maximum dimensions 9.0×3.0 mm; head width 1.3 mm. Body fairly robust, of even width, with strong musculature. Cuticle minutely asperate. Setae pallid; major setae moderately long. Head subquadrate, slightly emarginate behind, pale red-brown, with oral margins and mandibles darker; only primary ocelli visible. Antennae broadly conical. Mandibles apically bifid, with a median projection. Labrum trilobate. Tormae with base narrowly joined, bifurcate. Epipharyngeal lining with inner *als* pair away from margin. Th and Abd VIII spiracles 12–14-annulate; Abd I–VII spiracles half as large, 5–7-annulate, dorsocaudal. Alimentary canal with gastric caeca numerous, globular, about 40 in a double row on either side of lateral and lower parts of posterior coil.

Material examined. NEW ZEALAND: AK – Waitakere Ra., in dead rachides of *Cyathea dealbata*, 11 Nov 1964, 9 larvae*, BMM. NN – Nelson, Whangamoia Hill, in dead rachis of *Cyathea dealbata*, 13 Apr 1966, 9 larvae, pupal cocoon, JIT, JCW.

Biology. *Scolopterus aequus* has been reared in the dead, dry rhachides (midribs) of the tree fern *Cyathodes dealbata*. Larvae work in the central cavity, leaving the pith between the outer fibres to the smaller inhabitants, mainly Cossoninae. Development is rather slow. A partly grown larva found in mid July did not pupate until late October. A cocoon is made from shredded fibres and cemented inside. The pupal period occupies 2 weeks. A 4.0 mm exit hole is chewed by the emerging adult.

Remarks. *Scolopterus penicillatus* White develops in recently dead bark of *Pseudopanax* (= *Nothopanax*) (Araliaceae). The larva figured in Cawthra (1965), however, is that of a *Stephanorhynchus*, probably *S. curvipes* White, which utilises this same habitat. Here is an instance where larval association with adults or pupae is not reliable for identification. The larval description given in the text fits both genera.

Tribe Gymnetrini

The tribe Gymnetrini, of which *Gymnetron* Schoenherr is the largest genus, is predominantly European, but several species associated with weeds have become widespread. *Gymnetron pascuorum* (Gyllenhal) was discovered in New Zealand in 1971. Larvae of seven *Gymnetron* species are included in Emden's (1938) "Key to the subfamilies and tribes of weevil larvae with two tergal folds". Scherf (1964) gives biological information for fifteen species, and describes six of them. Anderson (1973) provides a key to the three genera (including *G. pascuorum*) present in North America. Although the biology of Gymnetrini, all of which develop in the live tissue of herbaceous plants, resembles that of many Curculionini, the larvae themselves are strongly divergent. They are distinguished by the following characters: (1) abdominal segments with 2 dorsal folds; (2) labial palpi 1-segmented; (3) Abd spiracles often unicameral; and (4) pedal lobes grossly expanded. Gymnetrini, although separated radically from Apioninae by an incomplete frontal suture, nevertheless show an affinity with that group by reason of the first three features mentioned above. Their mode of life is also similar.

Genus *Gymnetron* Schoenherr

Gymnetron Schoenherr, 1825: 587.

Type species *Curculio beccabungae* Linnaeus.

Body small, less than 6.0 mm long, tapering; Abd segments with 2 dorsal folds, and thorax with expanded, sclerotised pedal lobes. Head free, subcircular in outline, variously

pigmented; frontal suture incomplete in front, not reaching mandibular membrane; endocarinal line present; *fs4* and *fs5* subequal; antennae exposed, narrowly conical. Mandibles short, broad, apically bifid, with 2 setae aligned longitudinally. Labrum more or less evenly rounded, often fused with clypeus. Labial palps 1-segmented. Abd spiracles unicameral, caudad; Abd VIII spiracle sometimes obsolete. Anus terminal, X-shaped.

Remarks. The generic diagnosis takes into account the work of Emden (1938, p. 21), Scherf (1964), and D.M. Anderson (1973).

Gymnetron pascuorum (Gyllenhal)

pascuorum Gyllenhal, 1813: 124 (*Rhynchaenus*).

Fig. 735–744

Maximum dimensions 2.3×0.9 mm; head width 0.5 mm. Cuticle invested with coarse skin-points, giving a granular appearance; dorsopleural lobes of Th II/III and Abd I–VII expanded into a soft tubercle above the setae. Setae pallid, fine, mostly minute but longer on head and thorax, apparently in modal numbers. Head pale yellow, with margins and mandibles reddish; frontal suture not visible; *des1,2,3,5* and *fs1,4,5* subequal. Labrum fused with clypeus, unpigmented; setae mesad, near front margin. Epipharyngeal lining with setae clustered frontomesad. Tormae obsolete. Maxillary palps short; basal segment incompletely pigmented in front. Premental sclerite V-shaped. Postlabium smooth, with middle pair of setae 4× as long as the others. Thoracic spiracle and 8 pairs of Abd spiracles all unicameral, 3–5-annulate. Alimentary canal with proventriculus narrow; 2 large cardiac mycetomes present; anterior ventriculus smooth; posterior ventriculus 1-coiled, lacking gastric caeca; Malpighian tubules 4+2; cryptonephridium short, symmetrical.

Material examined. New Zealand: AK – Henderson, in seed capsules of *Plantago lanceolata*, 15 Dec 1971, 45 larvae, 12 pupae, 18 associated adults, BMM.

Biology. Adults of *G. pascuorum* were discovered in June 1971 during a routine inspection of kiwifruit (*Actinidia deliciosa*) packaged for export. They were subsequently found on a Henderson, Auckland property, overwintering on both kiwifruit and grape vines. In early November adults were abundant on the heads of *Plantago lanceolata* (long-leaved or ribwort plantain), and young larvae were in the fruits. By mid December, when the seeds were in all stages of maturity, larvae, pupae, and emergent adults were

present. A larva consumes the entire content of one capsule before pupating *in situ*. There was no evidence from empty capsules with exit hole to suggest that larvae migrate. The adult emerges by lifting the top of the capsule. *Plantago* heads had mostly shed their seeds by mid January, and adults had moved back to vines and hedgerow shrubs.

The few larvae that remained were parasitised by a hymenopteran, *Mesopolobus incultus* (Walker). This pteromalid is recorded from plantain seed in Europe, but is also known to be a secondary parasite of *Apion* on *Trifolium repens* (E.W. Valentine, pers. comm.).

Tribe Curculionini

The following characters are held in common: (1) cuticle microasperate in transverse series, or occasionally spiculate; (2) postoccipital condyles acute; (3) *fs1*, 2,3 minute or absent, and *fs4* longer than *fs5*; (4) antennae fully exposed; (5) endocarinal line present; (6) mandibular setae aligned longitudinally; (7) labral tormae subparallel or slightly convergent; (8) postlabium with proximal pairs of setae equidistant; (9) Th II/III with *pds* arranged short, short, long, long; (10) Abd VIII with 3 *pds*; (11) all spiracles bicameral; (12) Abd spiracles with airtubes caudad; (13) Abd VIII spiracle on dorsum.

Remarks. Members of the tribe Curculionini, known as 'flower weevils', occupy niches in all parts of living plants. Many utilise the inflorescence for oviposition, their larvae feeding in unopened buds or in the flowers, penetrating to the ovary with its developing seeds. Some species enter when the fruits are nearing maturity, and although most of them are small, less than 5.0 mm long, some of the seed (nut)-feeding larvae in genus *Curculio* Latreille reach 15.0 × 5.0 mm or more. Other species are stem borers and leaf miners. All are host-specific at the plant genus level.

There are approximately 100 endemic species, spread through the literature in various subfamilies and brought together in Curculionini(-ae) in Kuschel (1981). The systematics of the New Zealand element is overdue for revision, and therefore, with the exception of *Peristoreus* Kirsch, generic diagnoses have not been attempted. The six genera studied here are representative of different habitats. *Peristoreus innocens* Kirsch and *Notinus aucklandicus* Kuschel are diagnosed and figured in May (1971).

Genus *Peristoreus* Kirsch

Peristoreus Kirsch, 1877: 270.

Type species *Peristoreus innocens* Kirsch.

Body moderately robust, tapering, less than 10.0 mm long,

usually about 5.0 mm; Abd VIII/IX with dorsum depressed. Cuticle minutely asperate in transverse series. Setae pallid, inconspicuous. Setation differing from modal numbers as follows: maxilla 6–8 *dms*, 5 *vms*; pronotum 4+5 setae; Th II/III 1 *dls*, 2 *ss*; pedal area variable; Abd VIII 1+2 *pds*; Abd IX 1+1 *ds*. Head free or slightly retracted, sub-circular in outline; postoccipital condyles acute. Labrum slightly lobate, with anterior setae as long as discal setae. Epipharyngeal lining arranged modally, with clusters of sensilli in front of median *mes* pair. Hypopharyngeal bracon clear.

Remarks. This diagnosis is based on slide-mounted specimens of seven species from a variety of habitats.

Peristoreus grossus (Broun)

grossus Broun, 1893: 1224 (*Dorytomus*).

Fig. 745–754

Maximum dimensions 9.0×3.0 mm; head width 1.35 mm. Body widest at middle. Fat-body dense white. Head pale red, with a darker paramedian stripe; oral margins and mandibles red-black; frontal suture narrow, distinct; endocarinal line two-thirds as long as frons; ocelli faint; antennae broadly conical, with 5 basal papillae. Mandibles slender, apically bifid. Pronotum lightly pigmented, darker in front. Labrum distinctly trilobate, pigmented in proximal half; lateral setae half as long as anterior setae. Labral tormae slender, arcuate. Epipharyngeal lining with all setae well developed. Premental sclerite a complete trident. Th spiracles with airtubes 12-annulate, obliquely dorsad; Abd spiracles 8- or 9-annulate, caudad. Anus terminal, 6-lobed. Alimentary canal with proventriculus narrow; cardiac mycetomes absent; anterior ventriculus smooth; posterior ventriculus almost as wide, with 1+1 coils; gastric caeca vermiform, translucent, 30–40 in a single row on either side; Malpighian tubules 4+2; cryptonephridium symmetrical, elongate; rectal bracon a membranous ring.

Material examined. NEW ZEALAND: NN – Mt Arthur, 1050 m, in spent rhachides of *Dracophyllum traversii*, 14 Dec 1961, 11 larvae, JIT, GFW; 16 Nov 1969, 9 larvae*, BMM; 3 Feb 1982, 11 larvae*, JSD.

Biology. The species of *Peristoreus* are mainly associated with the reproductive parts of plants – buds, flowers, and fruits – but a few inhabit the thick, durable axis (rhachis) of certain plants. *P. trilobus* (Pascoe), for instance, has been reared from the succulent stems of *Collospermum hastatum* and *Astelia fragrans* (Liliaceae).

P. grossus is the largest representative of this endemic genus; its host plant *Dracophyllum traversii* (Epacridaceae) is the largest of the grass trees, with an inflorescence up to 30 cm long and a rachis 4 cm in diameter at the base. The eggs of *P. grossus* are inserted at the basal leaf axils. After tunnelling in the cortex the larvae feed in the degrading rhachis. Panicles gathered on Mt Arthur in February 1982 had finished flowering, and were harbouring larvae in all stages from first instar to prepupa. Seven months later these heads still contained final-instar larvae. Pupation takes place *in situ*. Adults emerge throughout the summer.

Three smaller species of *Peristoreus*, as yet unnamed, occupying a similar habitat have been reared from *Dracophyllum traversii* at Arthur's Pass, NC-WD; *D. latifolium* on the Urewera Range, BP and Mt Pirongia, WO; and *D. matthewsii* on Mt Moehau, CL.

Genus *Aneuma* Pascoe

Aneuma Pascoe, 1876: 56.

Type species *Aneuma fulvipes* Pascoe.

Genus *Aneuma*, as applied at present, contains species whose larvae have been reared from unopened buds (*A. fulvipes*), flowers (*A. rubricale* (Broun)), developing seeds (*A. compta* Broun), and leaf-mines (*A. spinifer* Broun).

Aneuma compta Broun

compta Broun, 1885: 387.

Fig. 755–765

Maximum dimensions 5.0×1.5 mm; head width 0.7 mm. Body slender, evenly curved, tapering. Fat-body dense. Cuticle coarsely spiculate on dorsum, less so ventrally. Setae red-brown; major setae moderately long, minor setae minute. Setation in modal numbers except as follows: head 1+3*fs*, 3+2*des*; maxilla 6*dms*, 5*vms*; pronotum 4+3 setae; Th II/III 1*dls*, 1*ss*, pedal area 2+5 setae; Abd VIII 1+2*pds*; Abd IX 1+2*ds*. Head subglobose, emarginate behind, pale red-brown, unpatterned but with margins and mandibles darker; frontal suture distinct; endocarinal line half as long as frons; primary ocelli large, with raised corneae; antennae broadly conical, with 3 basal papillae. Mandibles slender, apically bifid. Pronotum lightly pigmented. Labrum indistinctly trilobate, pigmented in basal half; anterior setae longer than discal setae. Labral tormae short, thick, convergent. Epipharyngeal lining with middle *mes* pair wider apart than the other 2 pairs; setae otherwise modally arranged. Premental sclerite a complete trident. Hypopharyngeal bracon clear. Spiracles of Th and Abd VIII larger than those of Abd I–VII. Anus terminal. Alimentary

canal lacking cardiac mycetomes; anterior ventriculus smooth, posterior ventriculus loosely 2-coiled, with 6–8 gastric caeca, longer than diameter of tube, on either side; Malpighian tubules 4+2, slender. Cryptonephridium weak; rectal bracon a membranous ring.

Material examined. NEW ZEALAND: AK—Mt Albert, in green fruits of *Hoheria populnea*, 30 Mar 1972, 40 larvae, 3 pupae*, BMM; Parau, 4 Apr 1972, 14 larvae, BMM; Laingholm, 1 Mar 1978, 20 larvae, BMM.

Biology. Flowers of *Hoheria* (lacebark) appear in late summer and the fruits in March. Females of *Aneuma compta* wait until the petals have dropped and wings have formed on the developing fruits before ovipositing. Then a single egg is inserted at the base of a wing. The growing larva, having consumed the contents of the first carpel, chews its way through to an adjoining one. During April fully fed larvae drop to the ground to pupate. Once the cell is constructed the prepupal stage is somewhat prolonged, and in Auckland adults were emerging from late July.

Genus *Phorostichus* Broun

Phorostichus Broun, 1882a: 409.

Type species *Pachyodon linearis* Broun.

This leaf-mining genus occurs throughout New Zealand on many species of *Astelia* and on *Collospermum hastatum* (Liliaceae).

Phorostichus linearis (Broun)

linearis Broun, 1881: 705 (*Pachyodon*).

Fig. 766–776

Maximum dimensions 6.0×1.0 mm; head width 0.5 mm. Body slender, elongate, of even width. Cuticle minutely spiculate on dorsal folds, coarsely spiculate on Abd VIII/IX, smooth ventrally. Setae pallid; major setae moderately long, minor setae minute; *pds* reduced in number. Setation differing from modal numbers as follows: head 1+3*fs*, 3+2*des*; maxilla 6*dms*, 5*vms*; pronotum 4+5 setae; Th II/III 2+1*pds*, 1*dls*, 1*ss*, pedal area 2+4 setae; Abd I–VII 2+2*pds*; Abd VIII 1+2*pds*; Abd IX 1+2*ds*. Head subcircular in outline, depressed, emarginate behind, orange-brown with a pallid paramedian stripe; margins and mandibles darker; frontal suture distinct; endocarinal line half as long as frons; primary ocelli large, with a raised cornea; antennae narrowly conical, with 4 slender papillae at base. Mandibles apically bifid. Pronotum lightly pigmented. Labrum more or less truncate, with all setae of similar

length. Tormae short, subparallel. Epipharyngeal lining with *als* curving inwards from margin, otherwise modally arranged. Premental sclerite a complete trident. Postlabium lightly sclerotised. Hypopharyngeal bracon clear. Spiracles of Th and Abd VIII larger than those of Abd I–VII. Anus subterminal, 4-lobed. Alimentary canal similar to that of *Aneuma compta* except 12 gastric caeca in a cluster on either side of posterior ventriculus.

Material examined. NEW ZEALAND: AK – Huia, in leaves of *Astelia trinervia*, 14 Nov 1971, 63 larvae, 6 pupae, 4 adults*; Mt Auckland, Glorit, in *Collosporum hastatum*, 17 Nov 1973, 11 larvae, 1 pupa*; Huia, in *Astelia solandri*, 12 larvae, BMM. NN – Nelson, Brook Reservoir, 300 m, in *Astelia fragrans*, 14 Sep 1971, 8 larvae*, JSD. BR – Greymouth, Mawhera State Forest, in *Astelia fragrans*, 6 Nov 1971, 14 larvae, 2 pupae*, JSD.

Biology. The larvae of *Phorostichus linearis* are leaf-miners which live communally in the strap-like leaves of *Astelia* and *Collosporum*. In *Astelia* the initial working utilises the tissue between two parallel costae (veins). Up to twelve larvae have been counted, apparently of similar age, and as they grow the feeding area is extended sideways to take in three or four costae, as well as lengthways up to 50 cm. This linear mine shows up as a brown streak in the green leaf blade. Pupation takes place in situ, in cells blocked off with scraped fibres. Adults emerge from November through to April. They feed elsewhere and are rarely found on the plant. In the softer leaves of *Collosporum hastatum* the working becomes more open, resembling the communal blotch-mines of *Peristoreus discoideus* (Broun) seen on *Griselinia* species. In *Astelia* the distance between the leaf surfaces (about 1.0 mm) is such that the larval head capsule is easily accommodated and it has not acquired the modifications apparent in other leaf-miners. In the later stages the larvae are highly mobile inside the mines, and the coarsely spiculate cuticle would provide the friction necessary for vigorous movement.

Genus *Hypotagea* Pascoe

Hypotagea Pascoe, 1876: 61.

Type species *Hypotagea rubida* Pascoe.

Hypotagea concolor (Broun) new combination

Fig. 777–787

concolor Broun, 1881: 710 (*Erirrhinus*) [n. comb. fide G. Kuschel].

Maximum dimensions 4.0×1.0 mm; head width 0.5 mm. Body slender, tapering, slightly curved. Cuticle minutely asperate in transverse linear series; mediosternal and pedal areas of Th I pigmented. Setae dark; major setae moderately long, minor setae minute. Setation differing from modal numbers as follows; head 0 *fs*, 1 *des*, 1 *les*; maxilla 6 *dms*, 5 *vms*; pronotum 5+2 setae; Th II/III 1 *dls*, 1 *ss*, pedal area 2+3 setae; Abd VIII 1+2 *pds*; Abd IX 1+2 *ds*. Head dusky brown, partially retracted, depressed, deeply emarginate behind; postoccipital condyles conspicuous; frontal suture distinct; coronal suture half as long as frons; endocarinal line strong, dark; ocelli obsolete; antennae broadly conical, with 4 basal papillae. Mandibles apically bifid. Pronotum dusky brown. Labrum trilobate, with anterior setae 3× as long as the other 2 pairs. Tormae short, dark, subparallel. Epipharyngeal lining with distal *mes* pair close together. Premental sclerite distinct at sides, and with elongate median extensions. Postlabium sclerotised. Hypopharyngeal bracon indistinct. Spiracles of Th and Abd VIII 6–9-annulate; Abd I–VII spiracles smaller, 4- or 5-annulate, caudad. Alimentary canal bearing 4 gastric caeca on either side of posterior ventriculus, otherwise similar to that of *Aneuma compta*.

Material examined. NEW ZEALAND: AK – Little Barrier I., Summit Track, in leaves of *Nothofagus truncata*, 5 Oct 1975, 5 larvae*, BMM; Hunua Ra., Mangatangi Vly, 3 Nov 1981, 42 larvae, 2 pupae*, BMM.

Biology. *Hypotagea concolor* is a leaf-miner in *Nothofagus truncata* (hard beech). A single egg is cemented into the rolled tip of a young leaf (Fig. 787), the female having first broken the margin by chewing. The site is marked by a pink colour reaction. The larva feeds for about 3 weeks, making a blotch-shaped mine. Prepupae exit from the leaf to pupate amongst surface litter. The cycle from egg to adult took between 8 and 9 weeks during early summer.

Another leaf-miner, *Neomyctapulicaris* Pascoe, may be present at the same time. It is distinguished by larvae which are pale-headed, with a circlet of setae on the Abd VIII dorsum (Fig. 798) and by the insertion of its egg in the middle of a leaf blade beside the main vein. Both these weevils probably feed on all four endemic species of *Nothofagus*.

Genus *Neomycta* Pascoe

Neomycta Pascoe, 1877: 145.

Type species *Neomycta pulicaris* Pascoe.

Neomycta rubida Broun

rubida Broun, 1880: 457.

Fig. 788–797

Maximum dimensions 4.0×1.5 mm; head width 0.5 mm. Body widest in anterior half, tapering; pleural lobes prominent, and Abd VIII dorsum produced caudad. Cuticle minutely asperate in transverse linear series. Setae pallid; major dorsal and pleural setae moderately long, others minute. Setation differing from modal numbers as follows: head 0 *fs*, 2 *des*, 1 *les*; maxilla 6 *dms*, 5 *vms*; labrum 2 *lrms*; pronotum 4 setae; Th II/III 1 *dls*, 1 *ss*, pedal area 2+5 setae; Abd VII 0 *pds*; Abd VIII 3 *pds*; Abd IX 3 *ds*. Head dusky yellow, deeply retracted; posterior emargination reaching frontal suture; postoccipital condyles prominent; frontal suture distinct; coronal suture absent; endocarinal line dark, as long as frons; ocelli obsolete; antennae broadly conical, with 3 basal papillae. Mandibles bidentate, with a median projection. Pronotum pallid. Labrum truncate, with short setae. Tormae slender, dark, subparallel. Epipharyngeal lining with distal *mes* pair as wide apart as the other 2 pairs and of similar size. Premental sclerite broken before middle; posterior extension elongate. Postlabium with basal *plbs* as long as middle pair and equidistant. Hypopharyngeal bracon distinct. Spiracles of Abd I–VII similar in size to Th spiracle, ventrocaudad, level with dorsopleural lobes. Paired spiracles of Abd VIII larger, 7–9-annulate, close together at apex of dorsal lobe. Alimentary canal without cardiac mycetomes or gastric caeca.

Material examined. NEW ZEALAND: AK – Huia, ex young leaves of *Metrosideros fulgens*, 8 Dec 1972, 25 larvae*, BMM; Mt Albert, ex young leaves of *M. kermadecensis*, 5 Aug 1974, 12 larvae, 1 pupa, 4 adults*, JSD. SD – Queen Charlotte Sound, Ship Cove, ex young leaves of *M. fulgens*, 30 Nov 1972, 6 larvae, JSD.

Biology. *Neomycta rubida* is a leaf-miner associated with the medium- to large-leaved species of *Metrosideros* such as *M. robusta* (northern rata), *M. excelsa* (pohutukawa), *M. umbellata* (southern rata), *M. kermadecensis* (Kermadec rata), and the scarlet climbing rata *M. fulgens*. Oviposition follows immediately on the growth of new foliage. A single egg is inserted into the blade of young leaves, where larval feeding results in a blotch-shaped mine. The larvae are able to transfer from one leaf to another if food runs short. Development occupies about 3 weeks, and pupation takes place on the ground; adults emerge during summer.

Remarks. In *Neomycta pulicaris*, which is sympatric with *Hypotagea concolor* in hard beech, the Abd VIII spiracles are set in a depressed disc (Fig. 798), and on the

head capsule the posterior emargination does not obliterate the coronal suture.

Genus *Geochus* Broun

Geochus Broun, 1882b: 128.

Type species *Geophilus inaequalis* Broun.

Geochus comprises about twenty-five species of very small weevils living on the forest floor. Because the adults are considerably modified, the systematic position of the genus has always been uncertain – it has been placed by various authors in groups such as *Cylindrorhinidae*, *Eri-rhinidae*, *Hylobiinae*, and *Diabathrarinae*. The problem has at last been resolved with the discovery by J.S. Dugdale in 1990 that the larva of *G. tibialis* Broun is a miner of dead leaves on the ground. Larval morphology is closely akin to that of *Rhamphus oxyacanthus* Marshall and *Rhynchaenus pallicornis* (Say), both of which I have examined, and to the *Rhynchaenini* figured by Emden (1938) and Scherf (1964). Moreover, as described on p. 13, *Geochus* represents the climax of a morphological regression among the New Zealand element of *Curculionini* (May 1992).

Geochus tibialis Broun

tibialis Broun, 1893: 1465.

Fig. 799–808

Maximum dimensions 2.0×1.0 mm; head width 0.4 mm. Body depressed, tapering, widest behind thorax; dorsopleural lobes prominent; dorsal folds obsolete. Cuticle minutely spiculate in linear series on dorsum of Th III and Abd I–VII, and ventrally on Abd VIII/IX. Setae pallid, very short to minute. Setation differing from modal numbers as follows: head 0 *fs*, 1 *des*, 1 *les*, 0 *ves*; mandibles 1 seta; labrum 2 *lrms*; maxilla 6 *dms*, 5 *vms*; pronotum 1+4 setae; Th II/III 1 *dls*, 0 *ss*, pedal area 2+2 setae; Abd I–VII 4 *pds*; Abd VIII 3 *pds*; Abd IX 3 *ds*. Head red-brown, unpatterned, retracted, strongly depressed; posterior emargination reaching frontal suture; postoccipital condyles conspicuous at epicranial apices; frontal suture distinct; endocarinal line strong, dark, as long as frons; 2 pairs of ocelli distinct; antennae narrowly conical with a stem, pubescent. Mandibles apically bifid. Pronotum lightly pigmented. Labrum transverse, trilobate, with 2 pairs of short setae. Tormae very short, oval. Epipharyngeal lining with *als* and *ams* in a straight line on margin; *mes* obsolete. Premental sclerite medially obsolete. Labium enlarged. Hypopharyngeal bracon obsolete. All spiracles of similar size, 6–8-annulate, caudad. Abd VIII spiracle lateral. Anus terminal. Alimentary canal not examined.

Material examined. NEW ZEALAND: WN – Akatarawa Saddle, ex dead leaves of *Weinmannia racemosa* on ground, 17 Sep 1990, 13 larvae, 3 pupae, 1 teneral adult*, JSD; same locality, 21 Nov 1990 (G. W. Gibbs), 12 larvae, 2 pupae, 5 teneral adults, extracted BMM.

Biology. *Geochus* adults are commonly extracted from leaf litter on the forest floor, where they are locally very abundant. They inhabit the middle layer of humus which is damp but not decomposed. They feed by scraping the surface of dead leaves to obtain the underlying tissues. So far larvae have been found only in leaves of *Weinmannia racemosa*, where the mines show up as raised meanders.

The progress of one such working was followed in December 1990. A first-instar larva, taken from a small blister at the leaf edge for identification, was replaced. It continued to feed until the working occupied most of the leaf area. After 28 days the larva, now fully fed, scraped out a circular, convex chamber 3.0 mm in diameter. This was provided with three or four minute ventilation holes on either surface, and was strengthened around the perimeter by a wall of compacted frass. The prepupa evidently resented the small slit made for viewing because, by the following day, it had prepared another cell 10 mm away, where it eventually pupated. The adult (*G. politus*) emerged in January 1991, about 2 months after hatching.

Remarks. *Geochus politus* Broun was reared from dead *Weinmannia* leaves collected on Mt Ngongotaha (Rotorua, BP, 22 Oct 1990, JSD). Two larvae extracted from leaves in the Mamaku Forest (BP, 9 Mar 1991, BMM) may belong to the same species. They are similar in appearance to larvae of *G. tibialis*.

Tribe Cleonini

Cleonini occur predominantly in the Northern Hemisphere, and include such genera as *Lixus* Fabricius and *Cleonis* Dejean, both gall-makers on roots. The only representative in New Zealand is *Rhinocyllus conicus* (Frölich), a European species imported in 1972 as a biocontrol agent for nodding thistle, *Carduus nutans*. Outstanding larval characteristics are: (1) thorax, abdomen (*pds*) and often epipharyngeal lining (*als*) with more than the modal number of setae; (2) spiracles of Abd VIII lateral; (3) alimentary canal with cardiac mycetomes arranged in grape-like clusters; and (4) anterior ventriculus puckered into longitudinal furrows.

Genus *Rhinocyllus* Germar

Rhinocyllus Germar, 1817: 341.

Type species *Rhinocyllus conicus* Frölich.

Rhinocyllus conicus Frölich

conicus Frölich, 1792: 132.

'Nodding thistle receptacle weevil'

Fig. 809–819

Maximum dimensions 7.0×2.5 mm; head width 1.25 mm. Body stout, with dense fat-body, strongly curved, tapering abruptly. Cuticle minutely asperate. Setae pallid, fine, very short. Setal numbers differing from the modal pattern as follows. Maxilla 6 *dms*, 5 *vms*; pronotum 11 setae; Th II/III 5 *pds*, 1 *dls*, 3 *ss*, pedal area 7 or 8 setae; Abd I–VII 6 *pds*; Abd VIII 5 *pds*; Abd IX 4 *ds*. Pronotum lightly pigmented, with dusky anterior fascia. Head subcircular, dusky brown, with pallid parietal and paramedian areas; oral margins and mandibles blackish; postoccipital condyles rounded, coloured as head; sutures distinct; endocarinal line dark, three-quarters as long as frons; anterior ocelli large, with cornea. Antennae minutely conical. Mandibles bidentate, short, broad. Labrum transverse pigmented. Tormae short, thick, subparallel. Premental sclerite a complete trident. Epipharyngeal lining with *als* and *mes* stronger than labral setae, and sensilli between proximal *mes* pairs. Hypopharyngeal bracon clear. Th spiracles 7–9-annulate, dorsal; Abd spiracles smaller, dorsocaudal. Alimentary canal with proventriculus internally 6-ridged; 4 large mycetomes in bunches at cardiac valve; anterior ventriculus rugose, puckered into 4 longitudinal furrows; posterior ventriculus in 1+1 coils, with about 20 squamiform gastric caeca randomly distributed; Malpighian tubules rather thick, arranged 3+3; cryptonephridium well developed; rectal bracon a membranous ring.

Material examined. NEW ZEALAND: BP – Whakatane, in capitula of *Carduus nutans*, 25 Mar 1976, 40 larvae, 4 pupae, reared CTJ.

Biology (after Jessep 1981, 1989). The biology of *R. conicus* and its effects on the nodding thistle had been closely studied in both Canada and California before the species was imported into New Zealand for testing. The progeny of the 1972 importation was released in Nelson (NN) and central Canterbury (MC), with subsequent releases near Whakatane (BP). They became established in all these districts and, helped by some redistribution of adults, the weevil is now present in most areas where nodding thistle is troublesome. Overwintering is in the adult stage.

Throughout spring and summer *Rhinocyllus* oviposits on thistle buds, where larvae feed in the capitula and pupate *in situ*. The primary inflorescences – i.e., terminal and first two lateral heads – receive most of the eggs, and production of seeds in these is strongly inhibited. Seeds in secondary heads which receive less attention are likely to mature. Although *Carduus nutans* is the preferred host, larvae have completed development on Californian thistle (*Cirsium arvense*), marsh thistle (*Cirsium palustre*), plumeless thistle (*Carduus acanthoides*), winged thistle (*Carduus tenuiflorus*), and slender winged thistle (*Carduus pycnocephalus*). The two last-named are early-flowering, and oviposition on them ceases once *C. nutans* comes into bud.

Tribe Molytini

The tribe Molytini (Hylobiinae of authors) is based on the Nearctic genus *Hylobius* Germar and its allies. The New Zealand genera *Lyperobius* Pascoe, *Hadramphus* Broun, and *Karocolens* Kuschel differ from the typical form only in the alignment of spiracles. As presently composed, Molytini in New Zealand comprise two distinct elements – the live tissue feeders with modal mouthparts, and the inhabitants of dead wood (previously Phrynixinae) with mouthparts adapted to xylophagy. The fern-dwelling genus *Rystheus* Broun and the dead wood-feeders *Phronira* Broun and *Exeiratus* Broun, transferred from Cossoninae, fall between these two groups. *Megacolabus* Broun (formerly in Phrynixinae), with *des3* in the frontal suture, would fit into Aterpini. Although the ‘flower weevil’ tribe Curculionini is composed of mostly very small species, it is linked by morphology and especially biology to Molytini, as demonstrated by the Australian genera *Storeus* Schoenherr and *Melanterius* Erichson (May, in press).

The following characters are common to both tribes: (1) cuticle microasperate in transverse linear series; (2) *fs1*, *2*, *3* usually minute or absent; (3) antennae conical, exposed; (4) mandibular setae aligned longitudinally; (5) labral tormae subparallel or bowed; (6) Abd VIII with 3 *pds*; (7) Abd VIII spiracle on dorsum.

Genus *Arecophaga* Broun

Arecophaga Broun, 1880: 533.

Type species *Arecophaga varia* Broun.

Arecophaga is a monotypic genus host-specific to the nikau palm, *Rhopalostylis sapida*, which is present throughout New Zealand.

Arecophaga varia Broun

varia Broun, 1880: 534.

Fig. 820–829

Maximum dimensions 5.0×1.5 mm; head width 0.7 mm. Body moderately robust, evenly curved, with dorsum of Abd VIII/IX slightly depressed. Cuticle spiculate. Setae red-brown, with major setae of Abd VIII/IX about 10x as long as minor setae. Setation differing from modal numbers as follows: head 2 *fs* (*fs4* shorter than *fs5*), 4 *des*; maxilla 7 *dms*, 5 *vms*; pronotum 9 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 2+4 setae; Abd VIII 2+2 *pds*; Abd IX 1+1 *ds*. Head evenly rounded, depressed, bright red-brown, with a pallid paramedian stripe enclosing *des1* and *des3*; frontal suture curved before apex; endocarinal line dark, two-thirds as long as frons; ocelli not visible. Antennae minute, rounded, partially overhung. Mandibles bidentate apically, with incisor section flanged, serrate, and with a supplementary tooth at base. Labrum trilobate, transverse; proximal half pigmented. Tormae dark, elongate, subparallel. Epipharyngeal lining modal, with paired clusters each of 2 sensilli behind middle *mes* pair. Premental sclerite broad, with median extensions tapering. Hypopharyngeal bracon maculate on hind margin. Abd spiracles with airtubes caudad. Anus terminal, 4-lobed. Alimentary canal of modal form except cardiac mycetomes absent, gastric caeca in 2 groups of 3 and 5 each, cryptonephridium extended into a ventral pad, and rectal bracon membranous.

Material examined. NEW ZEALAND: AK – Huia, in green leaf base of *Rhopalostylis sapida*, 28 Feb 1974, 33 larvae, 3 pupae, 7 adults*, BMM. CL – Little Barrier I., Pohutukawa Flat, in damaged leaf base of *R. sapida*, 6 Dec 1978, 5 larvae, 1 pupa, 3 adults*, BMM.

Biology. A nikau palm with a shorter trunk than usual provided an opportunity to examine fronds sheathing the crownshaft. The outer frond, when removed, had a few *Arecophaga* adults sheltering behind it and there was one larva near the edge. Removal of the second frond revealed an abundance of adults, well adapted by their smooth, flattened shape to crawl in such a narrow space. The inner (abaxial) side of the frond was brown-scarred where the larvae were working in the spongy intervascular tissue. The relatively large eggs (1.0×0.5 mm) are deposited singly in holes chewed through the cuticle. The workings proceed in a series of right angles, cutting through the vascular fibres and then longitudinally between them. Pupation takes place in a cell blocked off from the feeding tunnel by shredded fibres. Dispersal is probably triggered when the outer frond falls and the ‘nursery’ begins to dry

out. *R. sapida* loses up to three fronds a year (Esler 1969). Thus the selection of an inner frond for mass oviposition would ensure a moist food supply for at least one generation. The adults are fully winged.

Genus *Lyperobius* Pascoe

Lyperobius Pascoe, 1876: 54.

Type species *Lyperobius huttoni* Pascoe.

Body very robust, strongly curved, widest behind middle, with all lobes prominent; dorsum of Abd VIII/IX depressed. Cuticle smooth or finely asperate, with V-shaped pockets mediosternally. Setae dark brown; major setae strong, minor setae very short. Th II/II *pds* arranged short, short, long, long. Setation differing from modal numbers as follows: head 2 *fs* (*fs*5 shorter than *fs*4); maxilla 7 *dms*, 4 or 5 *vms*; pronotum 9 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 2+5 setae; Abd VIII 1+2 *pds*; Abd IX 1+1 *ds*. Head evenly rounded, strongly pigmented, with pallid paramedian stripes; postoccipital condyles large, obtuse; ecdysial valve well defined; frontal suture narrow, not angled before apex; endocarinal line present but sometimes indistinct; 1 pair of ocelli present. Antennae narrowly conical, partially overhung. Mandibles bidentate (teeth eroded in older specimens). Labrum trilobate, pigmented, with lateral setae well developed. Tormae strong, dark, bowed (divergent at base). Epipharyngeal lining modal, with middle *mes* pair wider apart than proximal pair; sensilli behind middle *mes* pair. Hypopharynx armoured. Premental sclerite broad, with median extensions well defined. Hypopharyngeal bracon clear. Spiracles subcircular, with conspicuous pigmented airtubes open on outer side, those of Th dorsad, those of Abd caudad. Abd VIII spiracles on dorsum. Anus subterminal, 4-lobed. Alimentary canal with proventriculus short, simple; anterior ventriculus smooth, bulky; posterior ventriculus 2-coiled, with numerous short gastric caeca on lower coil. Malpighian tubules 4+2, arising in 2 opposing clusters, each with a thickened base. Cryptonephridium symmetrical; rectal bracon a membranous ring.

Remarks. *Lyperobius* is a genus of medium-sized to large weevils associated with *Aciphylla* (speargrass, wild spaniard) and *Anisotome* (Apiaceae). As with their host plants, there are a large number of species with limited distribution in the high country and subalpine zones. The genus is closely related to *Hadramphus* Broun (larva: see May 1981) and *Karocolens* Kuschel (larva: see May 1987), known only from coastal lowlands and some offshore islands and virtually indistinguishable as larvae from *Lyperobius*. Larvae of the xylophagous Nearctic weevils in

Hylobius Germar and *Pachylobius* LeConte differ mainly in the shape (elongate-ovate) and alignment (dorsad) of the spiracles. The generic diagnosis is based on three species.

Lyperobius sp. indet.

Fig. 830–839

Maximum dimensions 32.0×10.0 mm; head width 5.0 mm. Cuticle smooth. Head dark red-brown, mandibles black; endocarinal line pallid, one-third as long as frons; ocelli not visible. Antennae very small, with 2 basal papillae. Spiracles pear-shaped, all of similar size; airtubes with 14–18 close-set annuli. Otherwise similar to generic diagnosis.

Material examined. NEW ZEALAND: NN—Mt Arthur, 1700 m, in crowns of *Aciphylla ferox*, 16 Nov 1969, 3 larvae, 1 pupa, 1 adult, BMM.

Biology. In the spring of 1969, on Mt Arthur, a yellowed, unhealthy-looking plant of *Aciphylla ferox* was found to be hosting several large, submature larvae which were feeding ectophytically on the crown at soil level. Adults were chewing the leaves at the margins. In captivity the larvae were fed on carrot, and one pupated on 10 December but died before ecdysis.

Genus *Paedaretus* Pascoe

Paedaretus Pascoe, 1876: 55.

Type species *Paedaretus hispidus* Pascoe.

The monotypic genus *Paedaretus* has previously been placed in Pissodinae and Cossoninae. It is associated with soft, decaying wood. The only morphological indication of xylophagy is some rugosity on the mandible and inwardly curving *als* on the epipharyngeal lining. Its cossonine affinity is indicated by complete cephalic setae and the lateral position of the Abd VIII spiracle.

Paedaretus hispidus Pascoe

hispidus Pascoe, 1876: 55.

Fig. 840–849

Maximum dimensions 5.0×1.5 mm; head width 0.75 mm. Body strongly, evenly curved, not tapered. Cuticle minutely asperate, spiculate ventrally on Abd VIII/IX. Setae pallid, short, except for major *pds* on Abd VI–IX. Setation differing from modal numbers as follows: maxilla 7 *dms*, 4 *vms*; pronotum 8 setae; Th II/III 1 *dls*, 3 *ss*, pedal area 6 setae; Abd VIII 1+2 *pds*; Abd IX 1+1 *ds*. Head subglobose,

slightly produced behind, pallid, with narrow oral margin and mandibles dark; sutures not visible; endocarinal line and ocelli absent. Antennae broadly conical, with 4 basal papillae. Mandibles bidentate, rugose on inner surface; setae subequal, rather long. Labrum transverse, trilobate, pigmented, with lateral setae as long as anterior setae. Tormae elongate, dark, subparallel. Epipharyngeal lining modal except for inward-curving row of *als*. Hypopharyngeal bracon maculate. Spiracle of Th larger than the others, 6–8-annulate, dorsad; Abd spiracles 3–5-annulate, caudad; Abd VIII spiracle lateral. Anus terminal, 4-lobed. Alimentary canal with proventriculus slender; cardiac mycetomes absent; proventriculus smooth; postventriculus with 1+3 coils; gastric caeca vermiform, 20 on either side of anterior coil; Malpighian tubules 4+2; hind gut together with 2 Malpighian tubules passing posteriad through 3 coils; cryptonephridium symmetrical; rectal bracon a membranous ring.

Material examined. NEW ZEALAND: ND – Whangarei, Mt Manaia, in dry decaying log, 28 Apr 1970, 18 larvae, 4 pupae, 10 adults*, BMM.

Genus *Phrynixus* Pascoe

Phrynixus Pascoe, 1875: 221.

Type species *Phrynixus terreus* Pascoe.

Body cuticle thin, minutely asperate in transverse linear series. Abd setae very short except for 1 major seta on all postdorsal and pleural stations. Th II/III *pds* arranged short, short, long, short. Setation differing from modal numbers as follows: head 2 or 3 *fs*, 4+1 *des*; maxilla 10 *dms*, 4 *vms*, 3 *pfs*; pronotum 8 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 6 setae; Abd VIII 1+2 *pds*; Abd IX 1+1 *ds*. Head subglobose, depressed in front, pallid or yellowish, with dark brown oral margins and mandibles; sutures not visible; endocarinal line present; ocelli faint. Antennae exposed, narrow, elongate, pubescent. Mandibles bifid, with molar area raised and corrugated. Labrum longer than wide, completely pigmented except on recurved anterior margin; proximal extension short. Tormae strong, elongate, bowed. Epipharyngeal lining pubescent, with *als* arranged longitudinally, 2 *mes* pairs proximally with clusters of sensilli between them, 1 *ams* pair on anterolateral margin, and inner *ams* pair and distal *mes* pair on anterior labral surface. Premental sclerite subtriangular. Hypopharyngeal bracon completely pigmented. Spiracle of Th 6–8-annulate, dorsad; spiracles of Abd I–VII smaller, dorsad, those of Abd VIII 6–8-annulate, caudad. Anus terminal, 6-lobed. Alimentary canal with proventriculus grossly expanded; 8 globular cardiac mycetomes present; anterior ventriculus

short; posterior ventriculus 2-coiled, with 1 or 2 long, slender gastric caeca halfway along either side; Malpighian tubules 4+2; cryptonephridium extended into a ventral pad; rectal bracon membranous.

Remarks. Genus *Phrynixus* is typical of the group of genera formerly in Phrynixinae of which the larvae, for the most part, have mouthparts adapted for feeding on the hard, resistant parts of dead wood. Representatives of *Astyplus* Broun, *Cuneopterus* Sharp, *Dolioceuthus* Broun, *Lithocia* Broun, and five species of *Phrynixus* have been reared, and are remarkably homogeneous except for variation in size. They diverge sharply from the *Hylobius* / *Lyperobius* section of Molytini. The third (innermost) seta on the palpifer is the usually minute basal malar seta enlarged and displaced. *Cuneopterus* lacks cardiac mycetomes and has 10–12 long gastric caeca.

Phrynixus astutus Pascoe

astutus Pascoe, 1875: 221.

Fig. 850–860

Maximum dimensions 5.0×2.0 mm; head width 1.0 mm. Body moderately slender, evenly curved, slightly tapering. Head pallid, with *fs*5 longer than *fs*4, other *fs* minute, *des*1,2,3,5 long, and *des*4 short. Endocarinal line faint. Pronotum pallid, with 4+4 setae. Otherwise as in generic diagnosis.

Material examined. NEW ZEALAND. AK – Huia, in *Metrosideros robustus*, dead branch on ground, 9 Jul 1967, 35 larvae, 5 pupae, 3 adults*, BMM. SI – Stewart I., Port William, 7 Feb 1969, 10 larvae, 6 pupae, 1 adult*, BMM.

Biology. Larvae are found in damp, dead wood, on or near the ground, feeding in the harder parts such as knot wood which is resistant to decay. Pupation occurs *in situ*.

Genus *Rystheus* Broun

Rystheus Broun, 1893: 1218.

Type species *Rystheus ocularis* Broun.

The monotypic genus *Rystheus* is a fern-inhabiting weevil, formerly placed in Phrynixinae. As a soft tissue feeder it lacks the distinctive mouthparts of *Phrynixus* and its associates. *Rystheus* is linked to the *Lyperobius*-complex by short antennae and caudally directed spiracles, and to the phrynixine group by ten dorsal malar setae (instead of seven), by the short, short, long, short pattern of thoracic *pds*, and by the enlarged proventriculus.

Rystheus notabilis Broun

notabilis Broun, 1917: 441.

Fig. 861–870

Maximum dimensions 8.0×2.25 mm; head width 1.25 mm. Body elongate, moderately slender, with 3 or 4 Abd folds; terminal segments depressed. Cuticle finely spiculate. Setae red-brown, rather short except for long dorsal and pleural setae on Abd VIII/IX. Setation differing from modal numbers as follows: head 2 *fs*, 4+1 *des*; maxilla 10 *dms*, 4 *vms*; pronotum 8 setae; ThII/III 1 *dls*, 1 *ss*, pedal area 2+5 setae; Abd VIII 1+1 *pds*; Abd IX 2 *ds*. Head evenly rounded, depressed, partially retracted, yellow-brown, with a paramedian pallid stripe; frons pallid; oral margins and mandibles red-brown; sutures distinct; endocarinal line faint; ocelli large, with comeae. Antennae broadly conical, pubescent. Mandibles bidentate, with a small, raised grinding area. Labrum transverse, trilobate, pigmented. Tormae strong, bowed. Epipharyngeal lining modally arranged. Premental sclerite a distinct trident. Hypopharyngeal bracon maculate. Spiracles of Th and Abd VIII larger than those of Abd I–VII; all Abd spiracles caudad. Anus ventral, 4-lobed, with ventral lobe small. Alimentary canal with proventriculus enlarged; cardiac mycetomes forming a continuous ring; anterior ventriculus twice as long as proventriculus; posterior ventriculus 2-coiled, with 8–10 gastric caeca on either side of lower coil; Malpighian tubles 4+2, with caudal ends evenly distributed around cryptonephridium.

Material examined. NEW ZEALAND: TK – Mt Egmont [Mt Taranaki], 1000 m, Dawson Falls, in rhachides of *Blechnum* sp. (kiokio), 5 Mar 1968, 15 larvae, 1 pupa, 5 adults*, BMM. WN – Tararua Ra., Mt Holdsworth, 350 m, in dead rhachides of *Blechnum* sp. (kiokio), 19 Nov 1968, 6 larvae, pupal exuviae, 2 adults, BMM.

Biology. Larval workings of *Rystheus notabilis* are initiated in the rhachides of mature fronds of ferns, usually in the upper half. The larvae work downwards, cutting off the sap supply so that the frond is brown by the time they have finished feeding. Pupation occurs *in situ*. Adults emerge through a circular chewed hole. Larvae have been taken in *Blechnum* species, *Polystichum vestitum*, and *Leptopteris hymenophylloides*. At Dawson Falls in March the lower, thicker portion of some rhachides of *Blechnum* sp. (kiokio) was occupied by *Megaocolabus decipiens* Marshall. The niches appear to remain separate, and thus competition is avoided (May 1973).

The New Zealand fern known as *Blechnum capense* is at present awaiting revision since the name '*capense*' is

preoccupied by a South African species (Brownsey & Smith-Dodsworth 1989).

Tribe Ceutorhynchini

Members of the tribe Ceutorhynchini are of predominantly Holarctic distribution. Many genera are common to both North America and Europe. Most species are small, up to 5.0 mm long, with larvae inhabiting seeds, petioles, and stems of herbaceous plants, especially those preferring low-lying damp areas. Their habits and small size show a resemblance to Curculionini, but in some important aspects their morphology diverges, and a separate derivation for the group is indicated.

Two ceutorhynchines are present in New Zealand. *Rhinoncus australis* Oke, living in the stems of pasture weeds, is adventive and *Trichosirocalus horridus* (Panzer) has been introduced for the biological control of nodding thistle, *Carduus nutans*. The following tribal characters have emerged from the study of these and from *Mecysmoderes stylicornis* Marshall in Gardner (1934) and ten *Ceutorhynchus* species in Scherf (1964): (1) head with *des3* on epicranial half; (2) antennae hemispherical, fully exposed; (3) endocarinal line absent; (4) frons with only *fs4* developed, *fs5* absent; (5) tormae separate, subparallel; (6) postlabium with proximal pairs of *plbs* as far apart as the median pair; (7) Abd spiracles with airtubes caudad; (8) Abd VIII spiracle lateral; (9) Abd segments with ventral lobes developed as ambulatory ampullae.

Characters (2), (3), and (8) suggest an affinity with Brachycerinae, but in that group *des3* is in the frontal suture or on the frons. Once again we have a transitional situation, and a systematic placing early in the subfamily Curculioninae, say between Erihynchini and Cryptorhynchini, could be justified.

Genus *Rhinoncus* Schoenherr

Rhinoncus Schoenherr, 1825: 586.

Type species *Curculio quadrituberculatus* Fabricius.

Genus *Rhinoncus* is indigenous to both North America and Europe. The adults are very small, rotund weevils found among weeds in pasture and waste places. Larvae of eight species are diagnosed but not figured in Scherf (1964), all from either *Polygonum* or *Rumex*. *Rhinoncus australis* was described from Australia in 1931, and was discovered in Auckland in 1960.

Rhinoncus australis Oke

australis Oke, 1931: 198.

Fig. 871–879

Maximum dimensions 3.25×1.0 mm; head width 0.5 mm. Body opaque, evenly curved, tapering, with a dense fat-body. Cuticle very finely asperate. Setae pallid, fine, short to minute. Head with 1 *fs*, 4 *des*, 2 *les*; maxilla 6 *dms*, 4 *vms*; pronotum 3+4 setae; only 1 major seta in postdorsal, dorsopleural, and pedal stations; ventral setae obsolete. Head subglobose, pale yellow, unpatterned, with margins and mandibles pale red; sutures indistinct; ecdysial valve longer than coronal suture; endocarinal line and ocelli absent; antennae on a convex base with 3 papillae. Mandibles apically bidentate, without accessory teeth. Labrum transverse, subtruncate, with 1 long seta and 2 minute setae in line across. Tormae slender, elongate, slightly convergent. Premental sclerite weak, triangulate. Epipharyngeal lining with *als* curved away from margin, otherwise modal. Hypopharyngeal bracon clear. Spiracles circular, bicameral, those of Th and Abd VIII 6–9-annulate, others 3–5-annulate, caudad. Anus terminal, 4-lobed. Alimentary canal with 3 slender gastric caeca on either side.

Material examined. NEW ZEALAND: AK – Auckland, Mt Albert, in stems of *Polygonum persicaria*, 23 Mar 1970, 5 larvae, 1 pupa, 3 adults*, BMM.

Biology. Larvae were found in willow weed in late summer, feeding in the lower part of the stems. The workings led back to a node or leaf axil. In some stems the workings were up to 42 cm long. In other plants tunnelling continued downwards into the fleshy part of the root. Pupation occurred *in situ*, in a mucus-lined cell among the dark frass.

Genus *Trichosirocalus* Colonnelli

Trichosirocalus Colonnelli, 1979: 213.

Type species *Curculio troglodytes* Fabricius.

Trichosirocalus horridus (Panzer)

horridus Panzer, 1801: 84 (*Ceutorrhynchidius*).
'Nodding thistle crown weevil'

Fig. 880–888

Maximum dimensions 4.5×1.8 mm; head width 0.65 mm. Divergent from *Rhinoncus* as follows: head more quadrate and slightly depressed; 2 pairs of ocelli distinct; *des2* and *des4* minute; epipharyngeal lining with distal *mes* pairs on margin between *ams*; pedal lobe with all setae minute; all

spiracles of similar size, with airtubes 6–8-annulate, caudad. Alimentary canal not examined.

Material examined. NEW ZEALAND: MC – Lincoln, ex potted plants of *Carduus nutans*, 16 May 1989, 19 larvae, CTJ.

Biology (after Jessep 1989). *T. horridus*, of European origin, has been introduced as a biological control agent on nodding thistle, *Carduus nutans*. It is active in winter, and attacks a different part of the plant from the summer-active, seed-inhibiting *Rhinocyllus conicus*. *T. horridus* aestivates during the summer months. After emerging, the adults oviposit on new thistle rosettes throughout winter and spring. Larval feeding damages and often destroys the central growth of the crown. Because of the long oviposition period, any regrowth is also subject to oviposition. *Carduus tenuiflorus* (winged thistle), *C. pycnocephalus* (slender-winged thistle), *Cirsium vulgare* (Scotch thistle), and *C. palustre* (marsh thistle) are alternative hosts, and should ensure a continuing food resource. The progeny of 200 adults released into a field cage at Winchmore (MC) in 1984 has become established locally.

Tribe Baridini

Although Australia has many endemic Baridini, the only species to reach New Zealand is *Linogeraeus urbanus* (Boheman), a grass-dwelling weevil from South America. It was discovered in Auckland in 1975, but has been known in Australia since 1927 as *Lepidobaris metasternalis* Lea (E.C. Zimmerman, pers. comm.). The characters of Baridini in America and India have been summarised by Böving (1927) and Gardner (1934a) respectively. The head capsule provides distinguishing features in having a dark epicranial ridge (as in the cossonine tribe Pentarthrini) and a pallid, V-shaped pattern. In addition, the Abd VIII spiracles are lateral and the anus is terminal and four-lobed.

Genus *Linogeraeus* Casey

Linogeraeus Casey, 1920: 309.

Type species *Centrinus lineellus* Casey.

Linogeraeus urbanus (Boheman)

urbanus Boheman, 1859: 138 (*Brachygeraeus*).

Fig. 889–897

Maximum dimensions 7.0×2.0 mm; head width 2.0 mm. Body of even width, slender, weakly curved. Cuticle

minutely asperate. Setae fine, pallid; major setae moderately long, in modal numbers except as follows: maxilla 6 *dms*, 4 *vms*; pronotum 10 setae; Th II/III 1 *dls*, 2 *ss*, 2 *vpls*; pedal lobes 5 setae; Abd VIII 3 *pds*; Abd IX 2 *ds*. Head slightly retracted, subspherical, pale red-brown, with paramedian pallid stripes extending on to frons; epicranial ridge visible as a dark line extending below *des*2; *des*1,3,5 and *fs*4,5 subequal; other setae minute; frontal suture distinct; endocarinal line three-quarters as long as frons; 2 pairs of ocelli present. Antennae very small, broadly conical. Mandibles with 2 apical teeth and 2 smaller ones. Pronotum lightly pigmented. Labrum transverse, trilobate, with lateral setae well developed. Tormae subparallel, slender, reaching epistoma. Epipharyngeal lining modally arranged, with sensilli between proximal pairs of *mes*. Hypopharyngeal bracon clear. Premental sclerite with anterior median extension short or obsolete. Spiracles circular, bicameral; airtubes of Abd spiracles caudad. Alimentary canal of modal form, with small globular mycetomes around cardiac valve and 4 or 5 gastric caeca on either side of lower coil.

Material examined. NEW ZEALAND: AK—Auckland, Mt Albert, from stolons of *Paspalum paspaloides*, Feb–Nov 1977, 414 larvae*, BMM.

Biology. In New Zealand *L. urbanus* has been found only in Mercer grass (*Paspalum paspaloides*), a primary invader of bare ground with robust, node-rooting stolons and capable of rapid growth in frost-free areas. Adults of *L. urbanus* are rarely seen because, although able to fly, they live and feed at ground level. Their eggs are inserted into the stolons near the nodes, where oviposition sites are difficult to distinguish from feeding punctures. The larvae tunnel along the stolon for a considerable distance (up to 60 cm), increasing in size until the fifth instar. When fully fed they remain quiescent within the plant during the colder months. In spring they pupate in the soil, and adults emerge during summer. There is one generation a year. A diagram showing the life cycle of *L. urbanus* is given in May (1984).

Tribe Magdalinini

Magdalinini, as represented by larvae of the Northern Hemisphere genus *Magdalis* Germar and the Australian *Neosaccolaemus* Hustache, are more closely allied to Cossoninae and Scolytinae than to any other weevil groups. They appear to be transitional between these two subfamilies, similar to Cossoninae in biology but morphologically closer to Scolytinae. Lekander (1967) pointed to the conformity between *Magdalis* and *Scolytus* Geoffrey. Like-

wise, *Neosaccolaemus narinus* (Pascoe) converges towards *S. multistriatus* Marsham. *Scolytus* is itself divergent in some respects from other genera in the subfamily.

Salient characters used in these comparisons are as follows: (1) typical Abd segments with 3 dorsal folds; (2) frons with *fs*1 present; (3) labrum with lateral setae as long as anterior setae; (4) epipharyngeal lining with 1 pair of sensilli clusters, in front of proximal *mes* pair; (5) prothorax enlarged; (6) pedal lobes expanded; (7) spiracles without airtubes; (8) Abd VIII spiracle lateral.

Genus *Neosaccolaemus* Hustache

Neosaccolaemus Hustache, 1937: 201.

Type species *Laemosaccus subsignatus* Boheman.

Neosaccolaemus is known from southern Australia, Tasmania, and New Zealand.

Neosaccolaemus narinus (Pascoe)

narinus Pascoe, 1872: 141 (*Laemosaccus*).

Fig. 898–907

Maximum dimensions 6.0×2.3 mm; head width 1.3 mm. Body stout, widest at thorax; terminal segments recurved. Cuticle delicate, coarsely spiculate on all dorsal folds. Setae pallid, very short, longer on head, thoracic mesosternum, and pedal lobes. Setation differing from modal numbers as follows: 1 mandibular seta; maxilla 7 *dms*, 5 *vms*; Th I pronotum 9 setae, *vpls* + pedal area 14 setae, 7 or 8 *msts*; Th II/III 1 *dls*, 1 *ss*, pedal area 4–7 setae, 3–5 *msts*; Abd VIII 3 *pds*; Abd IX 3 *ds*. Pronotum lightly pigmented, areolate, expanded posteriorly into a rugose, transverse ridge, reducing Th II dorsal area. Head partially retracted, longer than wide, straight-sided, rounded behind, not emarginate, pallid except for dusky brown epistoma, genae, and mandibles; sutures not visible; endocarinal line and ocelli absent. Antennae exposed, conical, with 3 basal papillae. Mandibles unidentate, chisel-shaped when eroded; a single seta near base. Labrum transverse, evenly rounded, basally pigmented. Tormae strong, convergent, reaching epistoma. Clypeus unpigmented; setae subequal. Epipharyngeal lining with *ams* and distal *mes* pair together on margin; rosettes of 3 sensilli between proximal *mes* pairs only. Labium slightly concave. Premental sclerite narrow, with median extensions obsolete. Hypopharyngeal bracon clear. Spiracles ovate, without airtubes, those of Th twice as large as Abd spiracles. Anus terminal. Alimentary canal of modal form; cardiac mycetomes and gastric caeca absent; hind gut elongate, looped forwards dorsally to meet anterior ventriculus.

Material examined. NEW ZEALAND: NN – Nelson, in dying branchlets of *Racosperma (Acacia) decurrens*, 1 Jul 1973, 50 larvae, 9 pupae, 3 adults*, GK.

Biology. *N. narinus* is indigenous in New South Wales, South Australia, and Tasmania, and has been known in New Zealand since 1939 (as *Laemosaccus*). Associated with wattle trees, *Racosperma (Acacia)* and *Albizia*, it has become widespread in the North Island and in the Nelson region. Eggs are inserted into dead and dying branchlets through the thin bark. The female weevil covers the puncture with viscous excreta, which dry to form an inconspicuous brown scab. Unlike the scolytine bark beetles she does not enter the wood. Newly hatched larvae work under the bark for a short distance before entering the phloem. Workings of the numerous larvae in the same branch run parallel to each other, and are tightly packed with frass. Pupation takes place just below the bark, and circular exit holes 1.5 mm in diameter are chewed by the emerging adults.

Subfamily COSSONINAE

The Cossoninae comprise a somewhat diverse group of small weevils living in dead woody tissues. They are not to be confused with the 'bark beetles' Scolytinae, for although they may be found in similar situations, an evolutionary divergence has ensured that, in general, the adults are distinct, each group shaped according to its life habit. In the larvae too there are good morphological distinctions. Typically, cossonine adults are slender, depressed, suited for moving in narrow spaces, and with a rostrum long enough to excavate an oviposition cavity from an external position. Workings are made only by the larvae, which are slender, of even width, and not strongly curved. Scolytine adults are convex and cylindrical, with the rostrum obsolete and the head capsule blunt, modified for tunnelling. They bore through the bark to construct a nursery gallery, and only secondary workings are made by the larvae. A phylogenetic link is indicated by the cossonine tribe Araucariini, the members of which, as adults (Kuschel 1966) and as larvae (May 1967), show apomorphies of both Cossoninae and Scolytinae. Their biological strategy is close to that of the bark beetles.

The following larval characters were used for a comparison of Cossoninae and Araucariini with Scolytinae.

Held in common:

- (1) labral lateral setae as long as anterior setae;
- (2) epipharyngeal lining with 2 groups of sensilli;
- (3) tormae strong, separate (a few exceptions);
- (4) Abd VIII spiracle lateral.

Held by Cossoninae, Araucariini, and up to 50% of Scolytinae:

- (5) mandibular setae (two) aligned longitudinally;
- (6) spiracles bicameral;
- (7) rectal bracon a pigmented loop.

Held by Cossoninae only (excluding Araucariini):

- (8) head with 4 fs (*fs1* absent);
- (9) Abd II–VI with 4 dorsal folds (except Cotasterini).

Held by Cossoninae only (including Araucariini):

- (10) Abd IX with 2 dorsal setae.

In most cossonine larvae (and some Cryptorhynchini), when alive or freshly killed, the oenocyte clusters are visible as grey patches beneath the dorsopleural lobes (Wigglesworth 1950). In preserved specimens the clusters become creamy-white like the fat-body. The work of Gardner (1934a, 1938), Anderson (1952), and Viedma (1963) has been of assistance in compiling the subfamily and tribal characters. I have followed the systematic arrangement for New Zealand Cossoninae of Kuschel (unpublished).

Tribe Cossonini

Cossonini are represented in New Zealand only by the sparsely distributed *Exomesites* Broun, larvae of which are still unknown, and by the littoral adventive species *Mesites pallidipennis* Boheman from southern Europe. Anderson (1952) considered the larvae of *Cossonus* Clairville (seven species) to be almost identical to those of *Mesites* (two species). The tribe differs from Pentarthrini by: (1) Th II/III with 4 *pds*; (2) Abd I–VII with 5 *pds* (modal numbers); (3) posterior pair of *plbs* closer together than the middle pair; (4) thoracic spiracle much larger than Abd spiracles; and (5) anus subdorsal.

Genus *Mesites* Schoenherr

Mesites Schoenherr, 1838: 1043.

Type species *Mesites pallidipennis* Boheman.

Mesites pallidipennis Boheman

pallidipennis Boheman in Schoenherr, 1838: 1045.

Fig. 908–917

Maximum dimensions 7.0×2.0 mm; head width 1.5 mm. Body slender, evenly curved, caudally truncate, with Abd VIII expanded ventrally and Abd IX small. Cuticle finely asperate, coarser ventrally on terminal segments. Setae pallid, inconspicuous, in modal numbers except as follows: maxilla 7 *dms*, 5 *vms*; pronotum 11 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 6 setae; Abd VIII 3 *pds*; Abd IX 2 *ds*. Pronotal

shield pallid. Head free, subglobose, slightly emarginate behind, pallid, with narrow oral margin and mandibles dark brown; sutures indistinct; endocarinal line dark, half as long as frons; ocelli absent; all setae developed. Antennae exposed, narrowly conical. Mouthparts adapted for xylophagy as follows: mandibles with raised, corrugated grinding surface; labrum elongate, diamond-shaped, heavily pigmented; epipharyngeal lining with *als* and anterior *mes* pair aligned longitudinally, outer *ams* pair strong; hypopharyngeal bracon entirely pigmented. Premental sclerite broken before middle. Postlabium unusually narrow. Thoracic spiracles ovate, 4× longer than Abd spiracles; airtubes contained within peritreme. Alimentary canal lacking cardiac mycetomes; posterior ventriculus with 1+2 coils; gastric caeca in 2 clusters of 4–6; Malpighian tubules with individually swollen bases; cryptonephridium elongate, asymmetrical; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: WO – Te Akau beach, in driftwood, 4 Feb 1968, 40 larvae; Waikato North Head, in driftwood, 4 Jul 1976, 72 larvae*, BMM.

Biology. *M. pallidipennis* is a Mediterranean littoral species found on New Zealand west coast beaches above high water mark in pine driftwood. Large populations of larvae with live adults inhabit sizeable logs which have long since lost their bark. The workings are in cambium about 40 mm below the surface, and all immature stages are present. Pupation occurs *in situ*. Anderson (1952) took *Mesites* sp. in 1944 “in log, lodged in sand on beach” at Mayo, Maryland.

Tribe Cotasterini

The only New Zealand genera to be placed in Cotasterini are *Eiratus* Pascoe and *Allaorus* Broun. The larva of *Cotaster uncipes* Boheman, diagnosed by Viedma (1963), shows (1) frons with 5 *fs*; (2) anterior ocelli present; (3) endocarinal line present; and (4) tormae separate.

Genus *Eiratus* Pascoe

Eiratus Pascoe, 1877: 142.

Type species *Eiratus parvulus* Pascoe.

Eiratus species are small weevils found throughout New Zealand in dead bark of *Pseudopanax*. The larvae are divergent from those of *Cotaster* in having four frontal setae, and tormae which meet but are not joined at the base. *Eiratus*, in company with tribe Araucariini, has three Abd dorsal folds (instead of four).

Eiratus suavis Broun

suavis Broun, 1885: 387.

Fig. 918–927

Maximum dimensions 3.5×0.8 mm; head width 0.7 mm. Body strongly curved, of even width, tapering abruptly. Abd I–VII with 3 dorsal folds. Cuticle sparsely asperate. Setae pallid; major setae moderately long, in modal numbers except as follows: head 4 *fs*, mandibles 1 seta; maxilla 7 *dms*, 5 *vms*; pronotum 9 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 3+3 setae; Abd VIII 4 *pds*; Abd IX 3 *ds*. Pronotum pallid. Head free, subcircular, depressed, emarginate behind, pale yellow, with oral margins and mandibles reddish-brown; sutures indistinct; endocarinal line half as long as frons; *fsl* absent. Antennae exposed, broadly conical, pubescent, with 3 or 4 basal papillae. Mandibles bidentate, with a small median projection and with only 1 seta. Labrum transverse, trilobate. Tormae thickened at base, meeting each other. Clypeal setae unequal in length. Epipharyngeal lining modally arranged. Labial palps with a large apical process. Premental sclerite with medial extension elongate posteriorly, obsolete in front. Postmentum with posterior *plbs* pair closer together than middle pair. Hypopharyngeal bracon clear. Spiracles small, circular, with annulated airtubes. Alimentary canal of modal form, with 5 or 6 vermiform, well spaced gastric caeca on either side; cryptonephridium short, asymmetrical; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: AK – Waitakere Range, in dead *Pseudopanax arboreus*, 20 Jun 1965, 28 larvae, 4 pupae, 2 adults*, BMM. TO – Mt Ruapehu, 1200 m, in dead *Pseudopanax simplex*, 3 Dec 1964, 48 larvae, 8 pupae*, BMM.

Biology. *E. suavis* is found subcortically in *Pseudopanax*. Larvae feed in the cambium or amongst the frass of larger weevil species such as *Stephanorhynchus curvipes* White, *Scolopterus penicillatus* White, and *Mecistostylus douei* Lacordaire. Pupation occurs *in situ*.

Tribe Pentarthrini

The Pentarthrini constitute about half of the cossonine fauna of New Zealand. They are characterised by: (1) reduced numbers of *pds* (Th II/III with 3 *pds*; Abd I–VII with 4 *pds*); (2) a dark epicranial ridge (not evident in *Pentarthrum*); (3) the posterior pair of *plbs* wider apart than the middle pair; (4) in many species, folds 2 and 4 of Abd I–VI dorsally puckered (plicate); and (5) anus terminal, 4-lobed.

Genus *Pentarthrum* Wollaston

Pentarthrum Wollaston, 1854: 129.

Type species *Pentarthrum huttoni* Wollaston.

Pentarthrum is represented in southern Australia and Tasmania, and fifteen species are recognised in New Zealand. These are not known to damage commercial timber, but the European *P. huttoni* Wollaston has reportedly caused damage in plywood and panelling made from birch, alder, and oak (Hammad 1955).

Pentarthrum zealandicum Wollaston

zealandicum Wollaston, 1873: 598.

Fig. 928–938

Maximum dimensions 3.5×1.5 mm; head width 0.75 mm. Body stout, C-shaped, somewhat humped, with thorax expanded; dorsal folds of Abd indistinct. Cuticle finely asperate, sclerotised on Th I sternum. Setae pallid, short, in modal numbers except: head 4 *fs*; maxilla 5 *dms*, 5 *vms*; pronotum 9 or 10 setae; Th II/III 3 *pds*, 1 *dls*, 3 *ss*; pedal area 6 setae (3 in distinct pedal lobe); Abd I–VII 4 *pds*; Abd VIII 3 *pds*; Abd IX 2 *ds*. Pronotum pallid. Head partially retracted, longer than wide, straight-sided, entire behind, pale yellow-brown with pallid paramedian stripes; oral margins and mandibles red-brown; sutures indistinct; endocarinal line and ocelli absent. Antennae exposed, narrowly conical, differentiated into stem and club, pubescent. Mandibles indistinctly bidentate, usually eroded. Labrum more or less evenly rounded, lightly pigmented. Tormae slender, convergent, reaching epistoma. Clypeus unpigmented; setae subequal. Epipharyngeal lining with inner *als* submarginal. Labial and maxillary palps each with a large apical process. Premental sclerite medially obsolete. Hypopharyngeal bracon entirely pigmented. Spiracles of Th and Abd VIII similar in size, with airtubes dorsad; other spiracles slightly smaller, with airtubes caudad. Alimentary canal of modal form, with 8–10 vermiform gastric caeca on either side; cryptonephridium asymmetrical; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: AK – Waitakere Range, in dead wood of *Melicytus* sp., 21 Jun 1965, 25 larvae, 4 adults*, BMM; Te Henga, in dead *Corynocarpus laevigatus*, 23 Nov 1967, 42 larvae, 5 pupae, 6 adults*, BMM.

Biology. *P. zealandicum* is attracted to sound dead wood, and is not host-specific. Larvae have been found in *Hedycarya arborea* (pigeonwood) and *Macropiper ex-*

celsum (kawakawa) as well as in *Melicytus* and karaka, mentioned above. The larval workings were in soft but undecayed phloem, running parallel to each other and tightly packed with frass. Pupation takes place *in situ*. Some adults were present in tunnels which had been cleared of frass. In the laboratory, in August 1965, a flight of adults occurred when the temperature had risen after a long cold spell.

Genus *Arecocryptus* Hutton

Arecocryptus Broun in Hutton, 1904: 217.

Type species *Canthorhynchus bellus* Broun.

Arecocryptus is a monotypic genus specific to *Rhopalostylis sapida*, nikau, the only palm endemic to the mainland flora. The larvae are typical Pentarthrini.

Arecocryptus bellus (Broun)

bellus Broun, 1880: 526 (*Canthorhynchus*).

Fig. 939–948

Maximum dimensions 4.5×1.0 mm; head width 0.75 mm. Body slender, tapering, scarcely curved; Abd I–VI with dorsal folds 2 and 4 plicate, pleural lobes inconspicuous. Cuticle finely asperate. Setae pallid; major setae very long, filamentous. Setation differing from modal numbers as follows: head 4 *fs*; maxilla 6 *dms*, 5 *vms*; pronotum 9 setae; Th II/III 3 *pds*, 1 *dls*, 2 *ss*, pedal area 6 setae; Abd I–VII 4 *pds*; Abd VIII 3 *pds*; Abd IX 2 *ds*. Pronotum pallid. Head free, subcircular, depressed, emarginate behind, pale red-brown with darker epicranial ridge, frons, oral margins, and mandibles; frontal suture distinct anteriorly; endocarinal line and ocelli absent; *des3* in suture; *fs1* absent, *fs2,3* short, *fs4,5* long. Antennae exposed. Mandibles quadridentate, slender. Labrum transverse, evenly rounded. Tormae subparallel. Clypeus membranous. Epipharyngeal lining with medial *mes* pair wider apart than proximal pair; single sensilli scattered between *mes* pairs. Labial and maxillary palps with distal segment straight-sided, cylindrical, each with a large apical process. Premental sclerite an elongate trident. Hypopharyngeal bracon clear. Spiracles 6–8-annulate; airtubes on Th dorsad, on Abd segments caudad. Alimentary canal of modal form, with 12–18 short gastric caeca in a single row on either side; cryptonephridium asymmetrical, extended into a ventral pad; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: AK – Titirangi, in dead sheath of *Rhopalostylis sapida*, 16 Jun 1964, 52 larvae, 17 pupae, 8 adults*, BMM.

Biology. *A. bellus* inhabits the large, sheath-like bases of fallen nikau leaves when they have been on the ground long enough to turn brown. Larvae feed on pithy tissue between the fibres, and pupate in situ. The habitat is shared by the cossonines *Stenotrupis wollastonianus* (Sharp) and the smaller *S. debilis* Sharp, which have larvae very similar to those of *A. bellus*, and with the anthribid *Arecopais spectabilis* Broun, which has strongly curved and distinctively pubescent larvae.

Tribe Rhyncolini

Rhyncolini are characterised by: (1) prementum with posterior *plbs* pair wider apart than middle pair; (2) pronotum with 11 setae; (3) hypopharyngeal bracon entirely pigmented; (4) Abd II–V with dorsal folds 2 and 4 plicate; (5) Th and Abd spiracles similar in size. The diagnoses of *Rhyncolus* Germar by Anderson (1952) and Viedma (1963) are somewhat at variance with each other. *Phloeophagosoma thoracicum* Broun is described and figured by May (in press).

Genus *Pachyops* Wollaston

Pachyops Wollaston, 1873: 493, 579.

Type species *Pachyops cylindrica* Wollaston.

Larvae of *Pachyops* differ from those of *Phloeophagosoma* only in small details.

Pachyops dubius (Wollaston)

dubius Wollaston, 1873: 638 (*Eutornus*).

Fig. 949–958

Maximum dimensions 3.5×1.0 mm; head width 1.0 mm. Body slender, slightly curved, of even width. Cuticle finely asperate. Setae pallid; major setae long, slender; *pds1* as long as *pds3* and *pds5* on Abd I–VII. Setation differing from modal numbers as follows: head 4 *fs*; maxilla 6 *dms*, 5 *vms*; pronotum 11 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 6 setae, mediosternal fold 2 *msts*; Abd VIII 4 *pds*; Abd IX 2 *ds*. Pronotum pallid. Head free, widest behind middle, emarginate behind, pale red-brown with pallid paramedian stripes; oral margins and mandibles darker; epicranial ridge faint; frontal suture visible in anterior half; endocranial line absent; anterior ocelli present. Antennae broadly conical, pubescent, partially overhung. Mandibles bidentate; base of incisor section raised and longitudinally ridged. Labrum transverse, pigmented. Tormae strong,

parallel. Clypeus pigmented at base; setae unequal. Epipharyngeal lining with *als* curved away from margin; proximal 2 pairs of *mes* bifid, anvil-shaped. Premental sclerite triangular, distinct at sides only. Spiracles with airtubes simple. Alimentary canal of modal form, with 2 well spaced vermiform gastric caeca on either side; cryptonephridium asymmetrical, produced into a caudal pad; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: ND – Ahipara, in dead *Muehlenbeckia australis*, 8 Oct 1974, 15 larvae, 1 pupa*, JSD. AK – Waitakere Range, in dead *Rhipogonum scandens*, 10 Jul 1966, 27 larvae, 1 pupa*, BMM. CL – Cuvier I., in dead *Parsonsia heterophylla*, 19 Jan 1972, 16 larvae, BMM. WO – Waikaretu Valley, in dead *Clematis* sp., 2 Jan 1967, 40 larvae, 3 pupae, 8 adults*, BMM.

Biology. *P. dubius* appears to show a preference for the dead vines of woody climbing plants, where the larvae tunnel between the vascular bundles. Pupation occurs *in situ*. A few adults were found within the workings.

Tribe Araucariini

The tribe Araucariini is restricted to the Southern Hemisphere. Six genera are distributed between South America, South Africa, Queensland, New Caledonia, and New Zealand. All are host-specific on the ancient plant group Gymnospermae (Kuschel 1966). In New Zealand, *Xenocnema spinipes* Wollaston is found in dead bark of kauri and *Inosomus rufopiceus* Broun in both kauri and kahikatea. As discussed earlier, Araucariini are considered to be transitional between Cossoninae and Scolytinae.

Genus *Inosomus* Broun

Inosomus Broun, 1882b: 128.

Type species *Stenopus rufopiceus* Broun.

Inosomus and *Xenocnema* differ from the bulk of endemic cossonines in having three dorsal Abd folds, five *fs*, and the postmentum with the posterior *plbs* pair closer together than the middle pair. *X. spinipes* larvae are larger (5.5 mm) and have a pigmented head (May 1967).

Inosomus rufopiceus (Broun)

rufopiceus Broun, 1881: 739 (*Stenopus*).

Fig. 959–968

Maximum dimensions 4.0×1.5 mm; head width 1.0 mm.

Body robust, C-shaped, of even width. Cuticle coarsely spiculate on Th and Abd VIII/IX, more finely elsewhere. Setae pallid, short to moderate, longer on head; setation differing from modal numbers as follows: maxilla 7 *dms*, 5 *vms*, 1 *dls*, 2 *ss*; pedal area 7 setae; Abd VIII 4 *pds*; Abd IX 2 *ds*. Pronotum pallid. Head free, subspherical, pallid, with oral margins and mandibles red-brown; sutures and ocelli not visible; endocarinal line short, reaching *fs1*. Antennae broadly conical, partially overhung. Mandibles bidentate, rugose on inner grinding surface. Labrum unpigmented. Tormae strong, convergent. Clypeus pigmented at base; setae unequal. Epipharyngeal lining with inner *als* curved away from margin; proximal *mes* pairs close together. Maxilla and postmentum coarsely spiculate laterally. Premental sclerite triangular, distinct only at sides. Hypopharyngeal bracon maculate on posterior margin. Th spiracles circular, bicameral, irregularly 5–7-annulate, dorsad. Abd spiracles smaller, 4–6-annulate, caudad. Alimentary canal lacking cardiac mycetomes; anterior ventriculus bulky, medially constricted; posterior ventriculus with about 20 vermiform gastric caeca in a single row on either side; cryptonephridium asymmetrical; rectal bracon a pigmented loop. (*Xenocnema* usually has cardiac mycetomes, and the rectal bracon is shorter, almost annular.)

Material examined. NEW ZEALAND: ND – Omahuta Forest, in *Dacrycarpus dacrydioides*, 26 Nov 1958, 15 larvae, 6 adults, JMC. AK – Waitakere Range, in dead *Agathis australis*, 11 Aug 1966, 7 larvae, 3 adults, BMM.

Biology. In October 1966, in a kauri tree at Huia (AK) which had died as a result of mechanical injury 6 years previously, first- and second-instar larvae of *I. rufopiceus* were present in small numbers. The parent tunnels, up to 40 mm into the phloem, had eggs inserted at intervals along the sides. Workings of young larvae were branching away from the nursery tunnel. The workings were intermixed with those of the cossonine *Torostoma apicale* Broun and the anthribid *Cacephatus inornatus* (Sharp).

Subfamily SCOLYTINAE

The Scolytinae comprise two tribes, Scolytini and Hylesinini, collectively known as bark beetles. Wood (1982) classified the group as a family, separate from the main body of weevils: Curculionidae. He stated (p. 36) "Largely because larval characters were not found to distinguish these two families from Curculionidae, Crow-

son (1967) reduced the time-honoured families Platypodiidae and Scolytidae to subfamilies of Curculionidae. In view of the unique gular character (in adults) and the limited and apparently superficial search for larval characters, his action is considered untenable."

My larval studies refute that statement by showing the bark beetles to be an evolutionary extension of Curculionidae through Cossoninae, from which there are transitional features linking *Scolytus* and *Phloeosinus* with *Pentarthrum*, *Xenocnema*, and *Inosomus*, and also with *Magdalis* (see Lekander 1967) and *Neosaccolaemus* in Magdalinini.

Nearly sixty years ago, having studied seventeen genera at Dehra Dun, Gardner (1934b), wrote: "I have not succeeded in finding characters to separate scolytid larvae as a whole from Curculionidae. So far as larvae are concerned, the two families should be treated together, the Scolytidae perhaps being divided into at least two groups each more closely allied to separate curculionid groups than to one another".

The following character states, constant in Scolytinae (Thomas 1957, Lekander 1968), occur also in Cossoninae and other weevil groups: 3 Abd dorsal folds, absence of ocelli, and Abd VIII spiracle lateral. Distinctions are to be found mainly in body contours, dictated by a style of living where adults bore into the wood to prepare a well organised nursery, and larvae work in tissue which is still succulent though degrading.

Wood (1986) keyed out Scolytidae and Platypodidae to a position between the orthocerous families Oxycorynidae and Attelabidae. For such a placement to have credence, the larval head capsules would need frontal sutures reaching the mandibular membrane without interruption and antennae isolated from the frontal sutures. But this is not the case. As in Curculionidae (Fig. 387, 645), the frontal suture is delimited anteriorly by an epicranial bridge and meets the antennal cushion. These features are mentioned in couplet 1 of Wood's key (p. 26), but their systematic implications are ignored.

The accidentally introduced bark beetles which have become pests of forestry are well documented by workers at the Forest Research Institute, Rotorua. The native species are less well known. Four introduced species are diagnosed and figured here, three of which are indubitably established. These include *Scolytus multistriatus* Marsham, a recently recorded vector of Dutch elm disease, present in spite of vigorous control measures. Two native bark beetles are also diagnosed. Four additional species diagnosed and figured in May (in press) are included in the key (p. 23); three are established and one, *Ips grandicollis* Eichhoff, present in Australia, is occasionally intercepted.

Tribe Hylesinini

Hylesinini are characterised by the posterior pair of *plbs* being closer together than the middle pair, the three *plbs* pairs on either side forming a triangle, and the thoracic pedal areas bearing 6 or 7 setae. All the bark beetle species in New Zealand that I have studied, with the exception of *Scolytus multistriatus*, belong in this tribe.

Genus *Chaetoptelius* Fuchs

Chaetoptelius Fuchs, 1913: 40, 43.

Type species *Homarus mundulus* Broun.

In genus *Chaetoptelius* the only other species mentioned in Reitter (1913) is *C. vestitus* Rey, with a distribution from the Mediterranean eastwards to Russian Armenia.

Chaetoptelius mundulus (Broun)

mundulus Broun, 1881: 740 (*Homarus*).

'Pittosporum bark beetle'

Fig. 969–978

Maximum dimensions 3.5×1.0 mm; head width 0.5 mm. Body robust, C-shaped, widest at thorax. Cuticle finely asperate on dorsum and pleural lobes. Setae minute, in modal numbers except: head 4 *fs*, 2 *des*, 1 *les*; mandibles 1 miniset; maxilla 6 *dms*, 5 *vms*; epipharyngeal lining 2 *mes* pairs; pronotum 9 setae; Th II/III 1 *dls*; pedal area 7 setae, 4 sensilli; 2 *msts*; Abd VIII 5 *pds*; Abd IX 4 *ds*. Pronotal shield pallid. Head free, subglobose, pallid, with narrow oral margins and mandibles pale red-brown; sutures indistinct; endocarinal line very short, pallid. Antennae exposed, narrowly conical, with 4 basal papillae. Mandibles apically bifid, with a small median projection and with only 1 seta. Labrum membranous, hemispherical; setae subulate, short, subequal. Tormae strong, subparallel. Clypeal setae subulate, short, subequal. Epipharyngeal lining with *mes* minute, proximal pair longitudinal. Premental sclerite triangular, distinct at sides. Spiracles circular, without airtubes. Anus subdorsal. Alimentary canal with 8 globular gastric caeca on either side of posterior ventriculus.

Material examined. NEW ZEALAND: AK – Auckland, in live *Pittosporum crassifolium*, 30 Aug 1965, 108 larvae, 27 pupae, 6 adults*, BMM.

Biology (after Miller 1971, as *Pteleobius*). *C. mundulus* is host-specific to the larger kinds of *Pittosporum*. It is recorded from tarata (*P. eugenioides*), kohuhu (*P. tenuifolium*), and karo (*P. crassifolium*), but probably attacks any

species with bark thick enough to provide cover. The adult beetles overwinter under bark and emerge in early spring, when they are attracted probably by the strong resinous aroma of trees under stress or dying. The beetles bore through the bark to construct a nursery gallery engraved on the surface of the phloem. The female excavates the gallery, chews individual oviposition sites on both sides of the tunnel, and places an egg in each; the male removes the debris and covers each egg with frass. Larval workings radiate from the main gallery, and larvae pupate at the end of their feeding tunnels. There are two generations a year, with emergence in summer and autumn. At Mt Albert the karo I investigated in 1965 is still sparsely inhabited by *C. mundulus* 25 years later, healthy new branches having grown from below the original infestation.

Genus *Dendrotrupes* Broun

Dendrotrupes Broun, 1881: 740.

Type species *Dendrotrupes vestitus* Broun.

Dendrotrupes, with three species (one undescribed), is endemic to New Zealand and is present throughout.

Dendrotrupes costiceps Broun

costiceps Broun, 1881: 741.

Fig. 979–988

Maximum dimensions 2.6×0.6 mm; head width 0.5 mm. Body strongly curved. Cuticle coarsely spiculate. Setae pallid, finely tapering; major *pds* 10× as long as minor setae. Setae in modal numbers except as follows: mandibles 1 seta; maxilla 7 *dms*, 5 *vms*; pronotum 10 setae; Th II/III 1 *dls*, pedal area 7 setae; Abd VIII 3 *pds*; Abd IX 3 *ds*. Pronotal shield pallid. Head free, subglobose, pale yellow with oral margins and mandibles red-brown; sutures distinct, narrow; endocarinal line half as long as frons. Antennae exposed, differentiated into cap and stem, with 2 basal papillae. Mandibles bidentate, with each tooth pronged at base, and with only 1 seta. Labrum unpigmented, hemispherical. Tormae joined widely at base. Clypeal setae unequal. Epipharyngeal lining modally arranged. Premental sclerite triangular, pigmented at sides only. Spiracles bicameral; Th spiracle with airtubes 4–6-annulate, dorsal; Abd spiracles 3- or 4-annulate, caudad. Anus terminal. Alimentary canal modal, with 3 or 4 flask-shaped gastric caeca on either side of posterior ventriculus; cryptonephridium symmetrical; rectal bracon a membranous ring.

Material examined. NEW ZEALAND: AK – Huia, Marama Valley, in dead *Pseudopanax crassifolius*, 28

May 1977, 16 larvae, 9 adults*, BMM. TK – Mt Egmont, Pouakai Ra., 1300 m, subcortical in dying *Pseudopanax simplex*, 12 Jan 1978, 15 larvae, 4 adults, JCW.

Biology. *Dendrotrupes* species are host-specific on *Pseudopanax* (Araliaceae), and are associated with freshly dead or dying trees. The species often coexist on the same branch, separated only by the relative thickness of different areas of the tree (branchlets, branches, trunk) (Kuschel 1990). The pattern of working as shown by *D. costiceps* in *P. arboreus* (five-finger) is similar to that of *Chaetoptelius mundulus*. *Dendrotrupes* is also recorded from *P. lessonii*.

Genus *Hylastes* Erichson

Hylastes Erichson, 1836: 47.

Type species *Hylesinus ater* Fabricius.

Body moderately robust, widest at thorax, with pedal area prominent. Head free, pigmented, subglobose, entire behind; cephalic setae well developed; epistoma usually bearing a medial tubercle; endocarinal line short. Antennae exposed, undifferentiated, with 4 or 5 basal papillae. Mandibles tridentate on incisor lobe, with a small tooth on molar section; setae arranged longitudinally, well spaced. Labrum with 2 *ams* pairs on reflexed margin. Tormae strong, curved inwards at base, often joined. Clypeal setae unequal. Epipharyngeal lining with *als* curved away from margin; sensilli in clusters of 3 in front of proximal *mes* and in pairs behind. Hypopharyngeal bracon clear. Premental sclerite with medial extensions conspicuous. Anus terminal, 4-lobed. Alimentary canal with gastric caeca vermiform.

Remarks. The diagnosis is based on the work of Lekander (1968, three species) and Beaver (1970) on *H. ater*.

Hylastes ater (Paykull)

ater Paykull, 1800: 153 (*Bostrichus*).

'Black pine bark beetle'

Fig. 989–998

Maximum dimensions 6.5×1.5 mm; head width 1.2 mm. Cuticle with coarse, dense, pigmented spinules. Setae pale brown, moderate, slender, in modal numbers except as follows: maxilla 7 *dms*, 5 *vms*; pronotum 11 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 7 setae (4 within pedal lobe); Abd VIII 5 *pds*; Abd IX 4 *ds*. Pronotal shield pale red-brown. Head red-brown, unpatterned, with oral margins and mandibles darker; frontal suture distinct in front only; epistoma with a tubercle situated medially near posterior margin. Man-

dibles with a nodule basally, above dorsal articulation, similar to that figured for *Dendroctonus ponderosae* Hopkins in Thomas (1965). Labrum transverse, trilobate. Thoracic spiracles broadly ovate, with airtubes irregularly annulate, barely extending beyond peritreme, dorsad. Abd spiracles smaller, circular, with airtubes dorsad. Alimentary canal modal; gastric caeca numerous, anteriorly arranged in a single row on either side, becoming shorter and more densely packed on lower part of ventricular coil; cryptonephridium elongate, asymmetrical; rectal bracon a tenuous loop.

Material examined. NEW ZEALAND: WD – Mahinapua State Forest, subcortical in *Pinus radiata*, 24 Apr 1974, 16 larvae, 1 pupa, eggs, 4 adults, JMCB.

Biology (after Milligan 1978). *Hylastes ater* is a Holarctic species, widely distributed in Scandinavia and Europe, and since the early 1900s in exotic forests on both main islands of New Zealand. It is also present in Australia. Its workings are almost always confined to the inner bark at the base and roots of dead conifers, especially *Pinus radiata*, and in logs left in contact with the ground. In the latter situation fungi which cause sapstaining may be introduced. Adult feeding can damage the collar area of several kinds of seedling conifers. Brood workings consist of a short nuptial chamber leading to a nursery gallery, parallel with the grain of the wood, in which the female places up to 100 eggs in prepared wall niches. The male does not necessarily remain in the working. Larval tunnels lead off at right angles, but later proceed randomly. The duration of larval development depends on temperature, and varies from 60 days during summer to almost a year if the larvae are forced to overwinter in diapause. Copulation may occur before newly emerged adults leave the bark. Swarming flights have been observed in spring and autumn.

Hylurgus ligniperda (Fabricius), a later European immigrant species, can easily be confused with *H. ater*. The habits and workings of the two species scarcely differ, and they are often found together in pine plantations. The frass ejected from the bark tunnels, being reddish, distinguishes the colonies from those of *Pachycotes* Sharp, which is white from their workings in sapwood.

Genus *Pachycotes* Sharp

Pachycotes Sharp, 1877: 10.

Type species *Pachycotes ventralis* Sharp (= *peregrinus* (Chapuis)).

Body strongly curved, of even width, with thoracic pedal areas prominent, truncate posteriorly. Head free, pig-

mented, subglobose, entire behind; cephalic setae well developed; endocarinal line present. Antennae exposed, narrowly conical. Mandibles bidentate, with a small subapical tooth; inner surface of incisor lobe finely ridged; setae arranged longitudinally, well spaced. Mouthparts adapted for xylophagy. Ligula densely hirsute. Thoracic spiracle bicameral (*peregrinus*) or without airtubes (*australis*). Anus subdorsal.

Remarks. The diagnosis is based on the Australian species *P. australis* Schedl and the native *P. peregrinus*.

***Pachycotes peregrinus* (Chapuis)**

peregrinus Chapuis, 1869: 21 (*Hylastes*).

Fig. 999–1007

Maximum dimensions 5.0×1.5 mm; head width 1.2 mm. Cuticle coarsely but sparsely spiculate on dorsal folds of Abd I–V, ventrally on Abd VIII/IX. Setae moderate, and minor setae minute, in modal numbers except as follows: maxilla 13 *dms*, 5 *vms*; pronotum 10 setae; Th II/III 1 *dls*, 2 *ss*, pedal area 6 setae; Abd VIII 5 *pds*; Abd IX 3 *ds*. Pronotal shield pallid. Head pale yellow, unpatterned, with oral margins and mandibles red-brown; sutures indistinct; endocarinal line half as long as frons. Mandibles with a raised, ridged grinding area. Labrum diamond-shaped, elongate, entirely pigmented. Tormae strong, subparallel. Clypeus quadrate, pigmented in proximal half; setae unequal. Epipharyngeal lining with *als* arranged longitudinally. Maxilla with mala truncate, expanded, bearing 13 *dms*; palpus displaced laterally; stipes pigmented only on inner margin; cardo unusually large. Labium with ligula hirsute, upstanding. Premental sclerite broken before middle. Spiracles circular, bicameral; Th spiracle twice as large as Abd spiracles. Alimentary canal of modal form, lacking both cardiac mycetomes and gastric caeca; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: TK – Mt Egmont, 700 m, in dead rimu (*Dacrydium cupressinum*), 2 Nov 1967, 10 larvae, 4 adults, BMM.

Biology (after Bain 1977b). *Pachycotes peregrinus* bores into the phloem of native gymnosperms which are under stress or recently dead, with the sapwood still moist. Its nuisance value is increased in exotic forests and timber yards, where freshly sawn boards, posts, and poles may be attacked when stored under damp conditions. Adults enter the wood at right angles and construct brood galleries parallel with the grain. The first evidence of their presence is white frass ejected from these tunnels. Eggs are laid in

lateral notches, and larval workings follow a confused pattern similar to that of *Hylastes* but do not enter the bark layer. The tunnels are lined with clay-like excreta. Pupation occurs anywhere in the working, and adults emerge during summer. Development may take up to 2 years.

Genus *Phloeosinus* Chapuis

Phloeosinus Chapuis, 1873: 245.

Type species *Hylurgus dentatus* Say.

Body strongly curved, widest at thorax, with prominent pedal lobes. Head retracted into thorax, longer than wide, with setae on anterior third; endocarinal line short or absent. Antennal cushion bearing a seta longer than the cone. Mandibles tridentate, with setae arranged transversely, close together, near base. Labrum transverse, bearing 1 *ams* pair on reflexed margin. Tormae subparallel, reaching epistoma. Epipharyngeal lining with 2 distal *mes* pairs in a compact group with medial *ams* pair, near margin. Maxilla with stipes mainly unpigmented. Premental sclerite broken before middle. Spiracles circular, without airtubes; thoracic spiracle larger than the others.

Remarks. The Holarctic genus *Phloeosinus*, present in both New Zealand and Australia, does not entirely agree with either Hylesinini or Ipini, and some systematists have placed it in a tribe of its own. While its biology is undoubtedly scolytine, it shares with the genus *Scolytus* several features which provide links with Cossoninae (e.g., *Pentarthrum*) and/or Magdaliniini: (1) head longer than wide, retracted into thorax; (2) mandibular setae arranged transversely, very close together; (3) Abd I–VII with 3 dorsal folds; (4) Th II/III with 3 *pds*, Abd I–VII with 4 *pds*; (5) spiracles without airtubes. The diagnosis is based on the introduced species *P. cupressi* Hopkins and on the work of Gardner (1934b), Thomas (1957), and Lekander (1969).

***Phloeosinus cupressi* Hopkins**

cupressi Hopkins, 1903: 35.

'Cypress bark beetle'

Fig. 1008–1017

Maximum dimensions 5.0×2.0 mm; head width 0.8 mm. Cuticle densely covered with coarse, pigmented spicules. Setae pallid, slender, very short, in modal numbers except as follows: maxilla 7 *dms*, 5 *vms*; pronotum 10 setae; Th II/III 3 *pds*, 1 *dls*, 2 *ss*, pedal area 5 setae (3 in sclerotised lobe); Abd I–VIII 4 *pds*, 1 *vpls*; Abd IX 3 *ds*. Pronotal shield pallid, tilted forwards. Head pale yellow, with anterior of frons and oral margins red-brown, and mandibles dark

brown; sutures obsolete. Labrum transverse, lightly pigmented; margin crenate. Hypopharyngeal bracon faintly maculate. Alimentary canal modal; gastric caeca vermiform, anteriorly with 10–12 on either side as long as diameter of posterior ventriculus, followed by 10 caeca twice that length; cryptonephridium elongate, asymmetrical; rectal bracon a pigmented loop.

Material examined. NEW ZEALAND: HB – Waipukurau, subcortical in *Cupressus macrocarpa*, 15 Oct 1973, 17 larvae, 9 pupae, 5 adults*, DH.

Biology (after Zondag 1976). The North American cypress bark beetle breeds under the bark of dead and dying trees, especially when felled. It does not breed in healthy trees, but newly emerged adults will bore into the centre of small twigs, causing them to break off. The ‘feather-pattern’ of the workings engraved into the phloem is typical of many scolytines. Larval feeding tunnels 50–60 mm long radiate from the brood gallery, increasing in diameter to end in a pupal chamber from where emergent adults make individual exit holes. There are two overlapping generations a year. Many species of cypress and cedar are recorded as host plants.

A hymenopterous parasite, *Rhaphitelus maculatus* Walker (Pteromalidae), has been recorded from Hawkes Bay.

Genus *Scolytus* Geoffroy

Scolytus Geoffroy, 1762: 309.

Type species *Bostrichus scolytus* Fabricius.

Members of genus *Scolytus* attack both hardwood and softwood trees which are in some way under stress. While most species are not of economic importance, some of them are disease carriers, particularly *S. multistriatus* Marsham, which is the principal vector of the fungus *Ceratocystis ulmi*, causing Dutch elm disease. As for *Phloeosinus*, several features link *Scolytus* with *Pentarthrum*: (1) head longer than wide, retracted into thorax, (2) Th II/III with 3 *pds*, Abd I–VII with 4 *pds*, (3) spiracles without airtubes; and with Magdalinini: (1) mandibles unidentate, chisel-shaped, (2) epipharyngeal lining with only 1 group of sensilli, (3) spiracles without airtubes.

Scolytus multistriatus (Marsham)

multistriatus Marsham, 1802: 54 (*Ips*).

‘Dutch elm disease beetle’

Fig. 1018–1026

Maximum dimensions 4.0×1.0 mm; head width 0.7 mm.

Body stout, strongly curved, widest at thorax, with pedal areas prominent, tapering weakly to rounded extremity. Cuticle finely asperate in linear series. Setae minute, in modal numbers except as follows: head 2 or 3 *des*, 6 *fs*, 1 *les*; maxilla 7 *dms*, 5 *vms*; pronotum 4 setae; Th II/III 3 *pds*, 1 *dls*, 2 *ss*, pedal area 4 setae (2 in sclerotised lobe); Abd I–VIII 4 *pds*; Abd IX 3 *ds*. Pronotal shield densely but minutely spiculate posteriorly. Head retracted, ovate, longer than wide, pallid, with narrow oral margins and mandibles red-brown; sutures and endocarinal line obsolete. Antennae exposed, minute, with 4 basal papillae. Mandibles unidentate, with a chisel-shaped cutting edge. Labrum hemispherical, lightly pigmented, with well developed setae. Tormae strong, slightly convergent. Epipharyngeal lining with distal *mes* pair on margin with *ams*; a few scattered sensilli between proximal *mes* pairs. Hypopharyngeal bracon clear. Maxilla partially pigmented. Premental sclerite with posterior extension spatulate. Spiracles circular, without airtubes; Th spiracle twice as large as those on Abd I–VIII. Anus terminal. Alimentary canal with anterior ventriculus expanded behind cardiac valve; posterior ventriculus with 5–12 vermiform gastric caeca arranged irregularly; cryptonephridium symmetrical; rectal bracon a ligamentous ring.

Material examined. NEW ZEALAND: AK – Auckland City, Myers Park, under bark of *Ulmus* (elm), 5 Jan 1990, 47 larvae, numerous adults, RCC, JSD.

Biology (after Chamberlin 1939, Wood 1982). *S. multistriatus* is a European beetle host-specific to *Ulmus* spp. and known to be present in the U.S.A. since 1909. It was discovered in New Zealand in elm trees in an Auckland City park in January 1990. Its biology follows the general pattern of many other bark beetles. Adults appear in spring from overwintering larvae. They feed on healthy new growth, at which time the spores of *Ceratocystis ulmi*, the fungus causing Dutch elm disease, are introduced. After a few days they are attracted to a weakened tree or branch, where the female constructs a brood gallery, engraving both bark and wood. Eggs are laid in lateral niches, from where larval mines radiate at right angles until they turn to follow the grain. These tunnels are longer than the brood gallery, and may reach 20 cm. Pupation cells are usually in the bark, whence the beetles emerge individually. In the southern U.S.A. there may be three generations a year.

Subfamily PLATYPODINAE

Body cylindrical, straight, with prothorax and often Abd IV–VI expanded; Abd II–VI with pleural lobes subdiv-

ided; terminal segment obliquely truncate, with or without basal armature; Abd X (anus) ventral, anterior to ventral fold of Abd IX. Legs absent. Cuticle more or less densely asperate, the asperities becoming hairlike on prosternum. Setation reduced from modal numbers. Setae of mouthparts often multifid. Head free, subglobose, hypognathous; endocarinal line and ocelli absent. Antennae sharply conical, on a convex cushion bearing papillae. Mandibles triangulate, with a chisel-shaped cutting edge; molar area bearing finely dentate ridges; 2 setae arranged transversely. Clypeus vestigial. Labrum broadly triangular, with 1 or 2 pairs of setae. Epipharyngeal lining with *als* and *ams* often multifid, on margin, in conspicuous sockets, proximally with a curved, protuberant ridged area which comes in contact with mandible; *mes* represented by irregular sensilli. Tormae elongate, subparallel, widening at base. Maxillary palps 1-segmented (*Periommatius* Chapuis 2-segmented); mala small, with setae, often multifid, crowded at apex. Labial palps usually 1-segmented (*Periommatius* 2-segmented). Premental sclerite a complete trident. Hypopharyngeal bracon absent. Pronotum with a characteristic raised, sclerotised pattern of rings and lines studded with single setae. Spiracles circular, simple or with a single non-annulate airtube. Anus transverse, bilobate. Alimentary canal with 6 Malpighian tubules joined terminally 3+3 and lying free in haemocoel (Stammer 1934).

Remarks. Platypodinae (pinhole borers) are a group of timber-boring weevils proliferating in tropical regions. Some have migrated to cooler areas north and south. Three species of *Platypus* Herbst are endemic to New Zealand.

All platypodines are ambrosia beetles, cultivating within their galleries the fungi on which they feed. Sapstaining caused by secondary fungal infection and the physical damage of their tunnelling activities combine to give these weevils considerable importance as timber pests, and as such they are well documented. The larvae are extremely homogeneous, but distinctive as a group. A subfamily diagnosis of the final (fifth) instar has been compiled with reference to Gardner (1932b), Browne (1961, 1972), Roberts (1962), Santoro (1965), and Schedl (1972). A key to the genera is given by Browne (1972).

Earlier instars (after Browne 1972, Milligan 1979). The external morphology of the first three instars is largely related to locomotion – their need to move along the galleries which their small size does not fill. In the first instar the body is more or less ovoid and medially humped, and the head is short and broad. Only the thoracic and Abd VIII spiracles are present. The mandibles are finely toothed, and the labral margin is entire. The lateral lobes of

body segments are enlarged, adapted to function as pseudopods, each with a single seta. Abd VI and VII may be provided with dorsal and ventral setose tubercles. By maintaining contact with the tunnel walls, the larvae move rapidly with a looping motion. The second and third instars have the full complement of nine spiracles, and the labrum is trilobate.

The fourth instar is stout enough to fill the width of the tunnel, and it has lost the lateral pseudopods. In the fifth instar various types of holdfast appear. These enable the larvae to maintain position while making tunnel extensions, and include the distinctive pronotal sclerotisations which also serve for muscle attachment. Pigmented skin points, verrucae, and probably the terminal armature also serve as holdfasts. R.H. Milligan (pers. comm.) observed mature larvae using the rake-like labrum for (presumably) spreading fungi on newly excavated galleries.

Genus *Platypus* Herbst

Platypus Herbst, 1793: 128.

Type species *Bostrichus cylindrus* Fabricius.

Platypus is by far the largest genus of the subfamily. *Platypus*-related genera are distinguished from *Crossotarsus* Chapuis and *Diapus* Chapuis, both present in Australia, by the presence of an airtube ('accessory chamber' of authors) on the spiracles. The labrum has only one pair of discal setae; the incisions between the anterior lobes are usually deep and narrow but may be wider, shallower notches as in *P. gracilis* Broun. The declivity of Abd IX is without paired lateromedian spines; basal armature may or may not be present.

Platypus apicalis White

apicalis White, 1846: 18.

Fig. 1027–1042

Maximum dimensions 8.0x2.0 mm; head width 1.5 mm. Body of typical shape. Cuticle of Abd I–IV dorsally and of Abd IV/V ventrally spiculate; other segments more or less smooth; Abd pleural lobes slightly rugose. Abd IX declivity finely shagreened, with a spiculate tubercle (verruca) anterior to pleural setae and a median, pigmented, hooked tubercle at base. Setae fine, pallid, moderate to minute. Major setae of Th II/III *pds* and Abd I *pds* mounted on rugose tubercles. Setation in modal numbers except as follows: maxilla 6 malar setae (1 bifid), 3 *pfs*; pronotum 8–10 setae; pedal area 5+2 setae; Abd I–IV 2 *pds*; Abd V–VII 1 *pds*; Abd VIII 2 *pds*; Abd IX 6+1 *ds*. Head pale yellow, with margins and mandibles red–brown. Epi-

pharyngeal lining with *ams* bifid. Premental sclerite with anterior extension linear, posterior extension spatulate. Postlabium with proximal pair of *plbs* closer together than median pair. Pronotal pattern of 3 incomplete circles joined behind by a tenuous line not extending mesad. Alimentary canal: proventriculus expanded symmetrically, with a constriction before cardiac valve.

Larval instars. Length of 1st instar 1.5 mm (Fig. 1037). Broadly conical in lateral outline. Pleural lobes acute, each bearing 2 setae. Abd V dorsum with a pair of upstanding tubercles each with an elongate seta, these persisting in successive instars but becoming smaller at each moult (Fig. 1039–1041). Abd VI and VII each with a pair of small, setose tubercles. In 4th instar, caudal horn evident.

Material examined. NEW ZEALAND: ND – Brynderwyn, in sound wood felled 1 year of *Agathis australis*, 3 Aug 1966, 2× 1st, 2× 2nd, 2× 3rd, 1× 4th, 5× 5th-instar larvae, 1 adult. AK – Waitakere Range, in recently dead trunk of *Olearia rani*, 5 Jul 1966, 50 larvae, 8 adults*, BMM; Titirangi, in 2-year-old log of *Dysoxylum spectabile*, 4 Jun 1970, 6 larvae, 3 pupae*, BMM. NN – Nelson, Maitai Vly, in *Nothofagus* sp, 1 May 1946, 80 larvae, JMK.

***Platypus caviceps* Broun**

caviceps Broun, 1880: 542.

Fig. 1043–1049

Maximum dimensions 9.0×2.5 mm; head width 1.5 mm. Divergent from *P. apicalis* as follows. Cuticle finely spiculate except around groups of setae; prodorsal folds of Abd I–V pigmented yellow-brown; Abd IX declivity coarsely shagreened and pigmented, with a median, longitudinal, rugose ridge at base, but lateral verruca absent. Cuticle of head nodulate. Pronotal pattern with 2 incomplete circles, joined behind by a distinct line extending mesad. Alimentary canal with proventriculus expanded asymmetrically in a goose-neck shape.

First- and 2nd-instar larvae (Fig. 1043) with 2 pairs of short, rounded tubercles dorsally on Abd VI/VII.

Material examined. NEW ZEALAND: TO – Kai-manawa Ra., State Forest 90, Clements Clearing, in *Nothofagus fusca* felled 8 months, 2 Feb 1966, 8 larvae, 3 adults, RHM. NN – Nelson, Mt Domett, 1400 m, Nov 1971, 16 larvae, JMcB. NC – Ashley State Forest, in *Nothofagus solandri*, 23 Aug 1971, 21 larvae, 10 pupae, 8 adults, RHM. SL – Rowallan State Forest, Alton Valley, in *Nothofagus menziesii*, 4 Aug 1966, 15 eggs, 2× 1st, 1× 2nd, 2× 3rd, 3× 4th, 3× 5th-instar larvae, 5 adults, RHM.

***Platypus gracilis* Broun**

gracilis Broun, 1893: 1254.

Fig. 1050–1061

Maximum dimensions 5.0×1.3 mm; head width 1.0 mm. Smaller than the two previous species, and diverging from them as follows. Cuticle more coarsely spiculate, especially on Abd IV/V where skin-points become pigmented nodules, functioning as part of an abdominal holdfast; Abd IX declivity densely shagreened but not pigmented, and without basal armature or a lateral verruca. Labrum with incisions between anterior lobes wider, shallower. Maxillary mala pubescent on dorsal surface. Pronotal pattern with 3 incomplete circles not joined posteriorly. Spiracles of Abd VI/VII without airtubes. Alimentary canal with proventriculus expanded asymmetrically, and with a globe swelling before cardiac valve.

First- and 2nd-instar larvae not available. No indication of dorsal tubercles in 3rd instar.

Material examined. NEW ZEALAND: TO – Kai-manawa Ra., State Forest 90, Clements Clearing, in *Nothofagus fusca* felled 3 years, 18 Dec 1966, 16 eggs, 4× 3rd, 7× 4th, 75× 5th-instar larvae, 37 pupae, 2 adults, RHM.

Biology (after Milligan 1970, 1979). The habits of Platypodinae have much in common with scolytine ambrosia beetles in that both adults and larvae feed on fungi which they cultivate in their galleries. Nest building is initiated by the male, which is attracted to the odour of stressed or freshly felled trees. Only *P. gracilis* will establish nests in timber which is long dead and which has previously been invaded. Extension of the primary tunnel is eventually taken over by a female, the male then ejecting the waste and excess fungal growth. This tunnel is taken through the bark and sapwood to follow the boundary between sapwood and heartwood. Ambrosia is carried by the beetles in pits (mycetangia) on the pronotum, and a shining film appears on the walls of recent excavations.

Up to seven eggs are laid near the end of the primary tunnel, and a second batch at the end of a branch tunnel. Both parents tend the brood, and if either dies during the early stages the nest will not survive. Eight to 10 months after initiation, frass is no longer ejected and the males become busy with nest clearing. Further gallery extensions and short (8.0 mm) pupation chambers are constructed by fifth-instar larvae. These produce a more granular frass, and have been observed to use their rake-like mouthparts to spread ambrosia (presumably) around new tunnels. Young larvae feed on the fungus, digesting only the hyphae; the spores pass through to germinate in the faeces.

From nests in a relatively stable substrate, adults of *P. apicalis* and *P. caviceps* emerge after 2 years, with greater numbers in the third season and dwindling numbers in the fourth. Adults of *P. gracilis*, however, were still emerging from nests in red beech (*Nothofagus fusca*) after 6 years.

Subfamily RHYNCHOPHORINAE

Many of the Rhynchophorinae (Calandrinae or Calendrinae of authors) are important to horticulture – especially in tropical crops such as banana and coconut – and to commerce, where the depredations of the grain weevils (*Sitophilus* species) and their control are extremely costly. Thus, as with other weevils which command economic attention, the group is well documented, e.g., Cotton (1924), Gardner (1934a, 1938), Anderson (1948a), Zimmerman (1968). With only a few exceptions, rhynchophorine larvae inhabit live herbaceous plants, mainly grasses and grass-related plants such as bamboo, sugar cane, and palms. Some species develop in seeds, and a few in rotten wood. Only three genera are known to have reached New Zealand. *Sitophilus* has been present since the early days of colonisation by Europeans. *Sphenophorus brunnipennis* (Germar) has been known as an occasional adventive since 1925, and is now established in Northland. *Dryophthorus* was found in 1975. Diagnoses of these larvae are included here, and a key to eleven genera in Australia and the South Pacific islands is presented in May (in press).

Recognition features for the Rhynchophorinae are as follows. (1) Typical body shape (e.g., of *S. brunnipennis* but not of *Sitophilus* or *Dryophthorus*) expanded between Abd IV and Abd VI, narrowing abruptly to Abd VIII/IX, which together form a depressed dorsal disc. (2) Pleural areas subdivided into 2, 3, or 4 superimposed lobes. (3) Anus subterminal or ventral. (4) Abd I–VII with *pds* reduced in number. (5) Head usually free, longer than wide, entire behind, with postoccipital condyles obsolete. (6) Tormae usually joined at base, U-shaped. (7) Maxillary mala with *dms* branched (except in *Sitophilus*). (8) Thoracic spiracles narrowly ovate, often partially surrounded by a pigmented skin-fold. (9) Spiracles of Abd VIII dorsal, aligned longitudinally with airtubes caudad.

Tribe Sphenophorini

Genus *Sphenophorus* Schoenherr

Sphenophorus Schoenherr, 1826: 327.

Type species *Curculio abbreviatus* Fabricius.

Sphenophorus (= *Calendra* in Cotton 1924 and Anderson 1948a) comprises a large number of species endemic to

South America. They are commonly known as 'billbugs'. Apart from features general to the subfamily, *Sphenophorus* is characterised by the following: (1) head free, with posterior margin entire; (2) frons with 5 setae (*fs1* and *fs2* small but distinct); (3) endocarinal line present; (4) maxillary mala with setae branched and bearing tufts of pubescence at base of *dms*; (5) postlabium with posterior pair of *plbs* closer together than middle pair; (6) Th II/III with 4 *pds* and *dpls* subequal in length; (7) Abd I–VII with 4 *pds*; (8) Abd II–VI with 3 dorsal folds; (9) Abd IX with posterior margin rounded; (10) all spiracles well developed (functional), the orifice closed by interlocking rows of teeth.

Sphenophorus brunnipennis (Germar)

brunnipennis Germar, 1824: 297 (*Calendra*).

Fig. 1062–1073

Maximum dimensions 9.0×5.0 mm; head width 2.0 mm. Body contours typical of subfamily. Cuticle sclerotised around groups of setae, coarsely spiculate elsewhere. Setae red-brown, mostly short, but longer and coarser on terminal segments, in modal numbers except as follows: maxilla 8 *dms*, 5 *vms*; pronotum 8 setae; Th II/III 2 *dls*, 2 *ss*, pedal area 7 setae; Abd I–VII 4 *pds*; Abd VIII 3 *pds*; Abd IX 2 *ds*. Pronotal shield lightly pigmented, with a darker anterior fascia. Head bright red-brown, with pallid paramedian stripes and setal bases; frontal suture distinct, narrow, angled before apex; endocarinal line one-third as long as frons. Labrum with a stellate pattern of pigmentation. Tormae not completely joined at base. Epipharyngeal lining pubescent. Maxilla with 6 *dms* branched, 2 *dms* simple. Premental sclerite a complete trident. Thoracic spiracle narrow, elongate, with airtubes wider than peritreme, 9–11-annulate; spiracles of Abd I–VII half as long, those of Abd VIII two-thirds as long, each surrounded anterodorsally by a pigmented skin-fold. Alimentary canal of modal form, with 15–20 short, vermiform gastric caeca on either side of lower coil; cryptonephridium symmetrical; rectal bracon a ligamentous ring.

Material examined. NEW ZEALAND: ND – Tangiteroria, in kikuyu (*Pennisetum clandestinum*) pasture, 7 Feb 1979, 3 larvae, 4 pupae* RHB, BMM. AUSTRALIA: W.A., near Perth, under kikuyu grass on racecourse, 10 Dec 1983, 4 larvae, ANS.

Biology. *S. brunnipennis* shows a preference for areas that are swampy for at least part of the year. The Tangiteroria site was on a slope above some patches of *Juncus* which would have been saturated in winter. In Perth the kikuyu

grass on horseracing courses was watered heavily to promote growth. This caused waterlogged conditions in poorly drained areas, to which the billbugs were attracted. Larvae severed the roots, leaving large dead patches (A.N. Sproul, pers. comm.). The larvae on both occasions were mature when found, and were free in the soil, but since most rhynchophorines are endophytic, the young larvae probably feed in the thick stolons of kikuyu grass. Pupation takes place in a prepared cell in the soil during summer, the adults emerging in February–March. Mating was observed shortly after emergence. The adults feed by clinging to the grass stems and moving backwards with rostrum inserted, leaving a longitudinal slit.

Tribe Dryophthorini Genus *Dryophthorus* Germar

Dryophthorus Germar, 1824: 302.

Type species *Curculio corticalis* Paykull.

Head width 0.5–1.2 mm (5 species). Body only slightly expanded on middle segments. Setation differing from modal numbers as follows: head 4 *des* (3 long), 4 *fs* (2 long); maxilla 7 *dms* (multi-branched), 5 *vms*; pronotum 10 setae (1 long); Th II/III 2 *pds*, 1 *dls*, 1 *ss*, pedal area 4 setae (1 long); Abd II–VI 3 *pds*. Head free; frons usually bearing paramedian low tubercles and a transverse ridge; endocarinal line absent. Mandible with a granular area on inner surface; dorsal articulatory condyle with a distinct rim. Labrum hemispherical. Epipharyngeal lining with clusters of sensilli behind proximal *mes* pair. Labial palpi 1-segmented. Premental sclerite triangular, with anterior extension short. Postlabium with posterior *plbs* pair as widely separated as middle pair. Spiracles of Abd I–VII nonfunctional. Th and Abd VIII spiracles subtriangular, with orifice smooth-margined. Abd VIII bearing a short, fleshy process on either side. Abd IX posteriorly emarginate, with paired finger-like projections.

Remarks. *Dryophthorus* is represented in New Zealand by a single adventive species, recorded by Kuschel (1990) but as yet undescribed. The larva is unknown. Larvae of four species from Hawaii and one from Maryland, U.S.A. are diagnosed by Anderson (1948a). All were found in rotten wood. Anderson noted that the mandible of *Dryophthorus* is comparable with that of *Cossonus*, which has a similar granular area on the inner surface. Being in both instances an adaptation for chewing wood, this feature does not indicate a phyletic relationship. The diagnosis is after Anderson (1948a).

Biology. The New Zealand adult specimens were found in Auckland in a partly decayed *Pinus radiata* board deposited above a stream bank by flood waters in bush, and in a *Cupressus macrocarpa* stump (Kuschel 1990).

Tribe Sitophilini Genus *Sitophilus* Schoenherr

Sitophilus Schoenherr, 1838: 967.

Type species *Curculio oryzae* Linnaeus.

Body small, up to 3.5 mm long, subspherical; Abd with 2 or 3 dorsal folds. Setae pallid, slender, short to minute, in modal numbers except as follows: maxilla 3–5 *dms*, 3+2 *vms*; epipharyngeal lining 2 *als*; pronotum 8 setae; Th II/III 3 *pds*, 1 *dls*, 3 *ss*, pedal area 5 subequal setae; Abd I–VII 2 or 3 *pds*, 0 or 1 *vpls*; Abd VIII 2 *pds*; Abd IX 2 *ds*. Head partially retracted into prothorax; frontal suture distinct in front; endocarinal line present; anterior ocelli distinct. Mandibles short, bifid, with only 1 seta. Labrum evenly rounded, with setae subequal. Tormae strong, convergent, weakly joined at base or free. Buccal setae simple. Epipharyngeal lining with distal *mes* pair on margin between the 2 *ams* pairs. Premental sclerite complete, with posterior extension spatulate. Postlabium with posterior *plbs* pair closer together than middle pair. Spiracles bicameral; Th spiracle twice as long as Abd VIII spiracle, 4× as long as Abd I–VII spiracles. Abd IX margin rounded, without fleshy processes. Anus subterminal.

Remarks. Although some *Sitophilus* species are familiar as stored products pests – the rice, maize, and granary weevils – there are others which feed and develop in various kinds of seeds, e.g., *S. linearis* (Herbst) in the pods of tamarind, *S. rugicollis* (Casey) in *Shorea robusta*, and *S. glandinum* Marshall in acorns of *Quercus* species in India. The diagnosis is based on reared specimens of *S. oryzae*, *S. zeamais* Motschulsky, and *S. granarius* (Linnaeus) as well as on the publications of Cotton (1920, 1924), Gardner (1934a), Anderson (1948a), and Mathur (1954).

Sitophilus oryzae (Linnaeus)

oryzae Linnaeus, 1763: 395 (*Curculio*).

'Rice weevil'

Fig. 1074–1079

Maximum dimensions 3.0×1.5 mm; head width 0.5 mm. Cuticle minutely asperate. Pronotal shield pallid. Head pale red-brown, with pallid paramedian stripes; frons darker in front; oral margins and mandibles red-brown; endocarinal line two-thirds as long as frons. Hypopharynx-

geal bracon clear. Abd segments lacking a ventropleural seta.

Material examined. NEW ZEALAND: ND – Kerikeri, from Australian rice, 26 Mar 1968, 45 larvae, 15 pupae*, BMM. AK – Auckland, from macaroni, 26 Mar 1966, 50 larvae, 12 pupae*, BMM.

***Sitophilus granarius* (Linnaeus)**

granarius Linnaeus, 1758: 378 (*Curculio*).

'Granary weevil'

Fig. 1080–1084

Maximum dimensions 3.5×2.0 mm; head width 0.6 mm. Slightly larger than *S. oryzae*, and differing as follows: (1) hypopharyngeal bracon with paramedian, rounded maculae on posterior margin; (2) Abd segments with the single *vpls* moderately distinct.

Material examined. NEW ZEALAND: AK – Auckland, from culture on oats, 22 Jan 1976, 7 larvae, 5 pupae*, JC. MC – Ashburton, from barley, 16 Jan 1950, 10 larvae, 4 pupae*, ADL.

***Sitophilus zeamais* Motschulsky**

zeamais Motschulsky, 1855: 77.

'Maize weevil'

Fig. 1085, 1086

Maximum dimensions 3.25×2.0 mm; head width 0.7 mm. Similar in size to *S. granarius*, but differing as follows: (1) labrum more trilobate; (2) tormae almost joined at base; (3) Abd segments lacking *vpls*.

Material examined. AUSTRALIA: A.C.T., Canberra, from culture on wheat, Feb 1988, 30 larvae, 12 pupae (ANIC).

Biology. Despite the common names by which they are known, the grain weevils are indiscriminate in their attack on stored cereals. They are also recorded on acorns and nuts. Larvae feed and pupate within the same seed. Larger grains such as maize may be occupied by two or more larvae. The rate of development and the expansion of populations largely depend on temperature and relative humidity. The three species have spread worldwide through the agency of commerce, and there is an extensive literature on their ecology and control.

Remarks. *S. zeamais* is established in New Zealand.

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APPENDIX 1

Hyperparasites and predators of curculionoid larvae described in this publication.

Larvae of

ANTHRIBIDAE: *Phymatus hetaera*

Sharpius browni

APIONINAE: *Neocyba metrosideros*

ATERPINI: *Rhadinomus acuminatus*

GONIPTERINI: *Gonipterus scutellatus*

CRYPTORHYNCHINI: *Rhynchodes ursus*

EUGNOMINI: *Oreocalus albosparsus*

GYMNETRINI: *Gymnetron pascuorum*

SCOLYTINAE: *Phloeosinus cupressi*

APIONINAE: *Neocyba metrosideros*

GONIPTERINI: *Gonipterus scutellatus*

Hyperparasites

Proctotrupidae

Proctotrupes sp. (Proctotrupidae)

Pteromalidae

Xanthocryptus novozealandicus (Ichneumonidae)

Pteromalidae

Patasson nitens (Mymaridae)

Certonotus fractinervis (Ichneumonidae)

Proctotrupidae

Mesopolobus incultus (Pteromalidae)

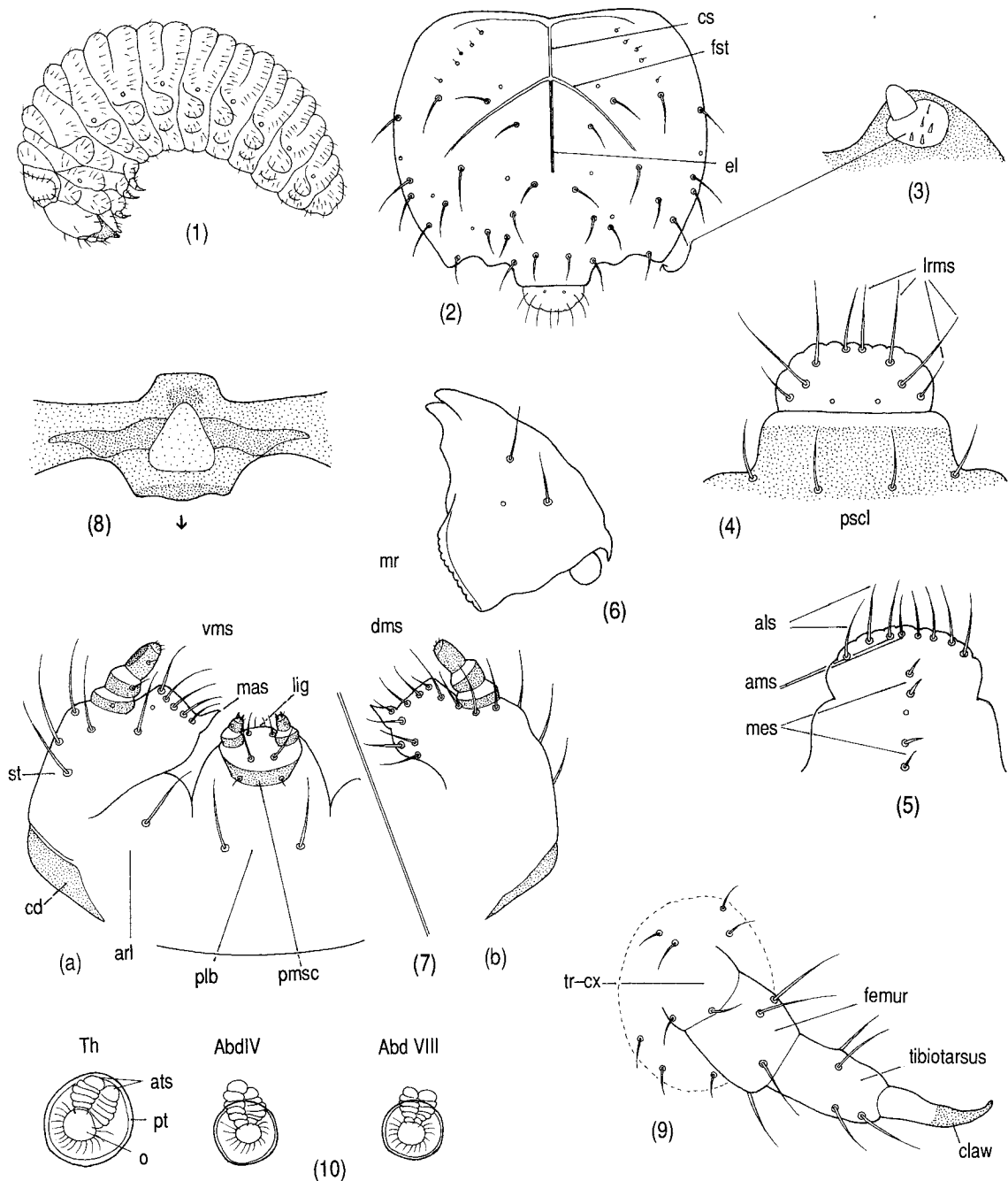
Rhaphitelus maculatus (Pteromalidae)

Predators

Melyridae (Coleoptera)

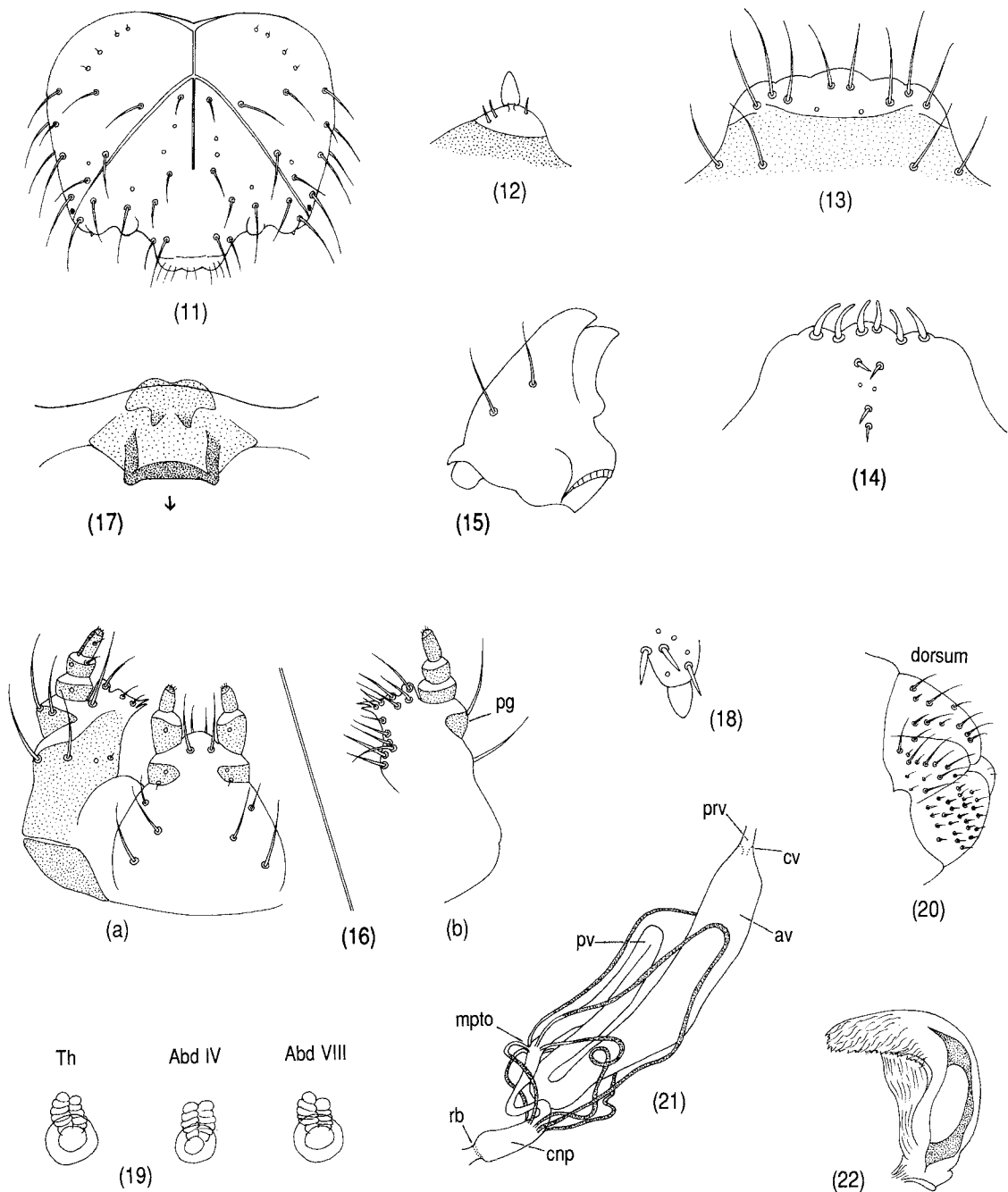
Cermatulus nasalis (Heteroptera: Pentatomidae)

ILLUSTRATIONS



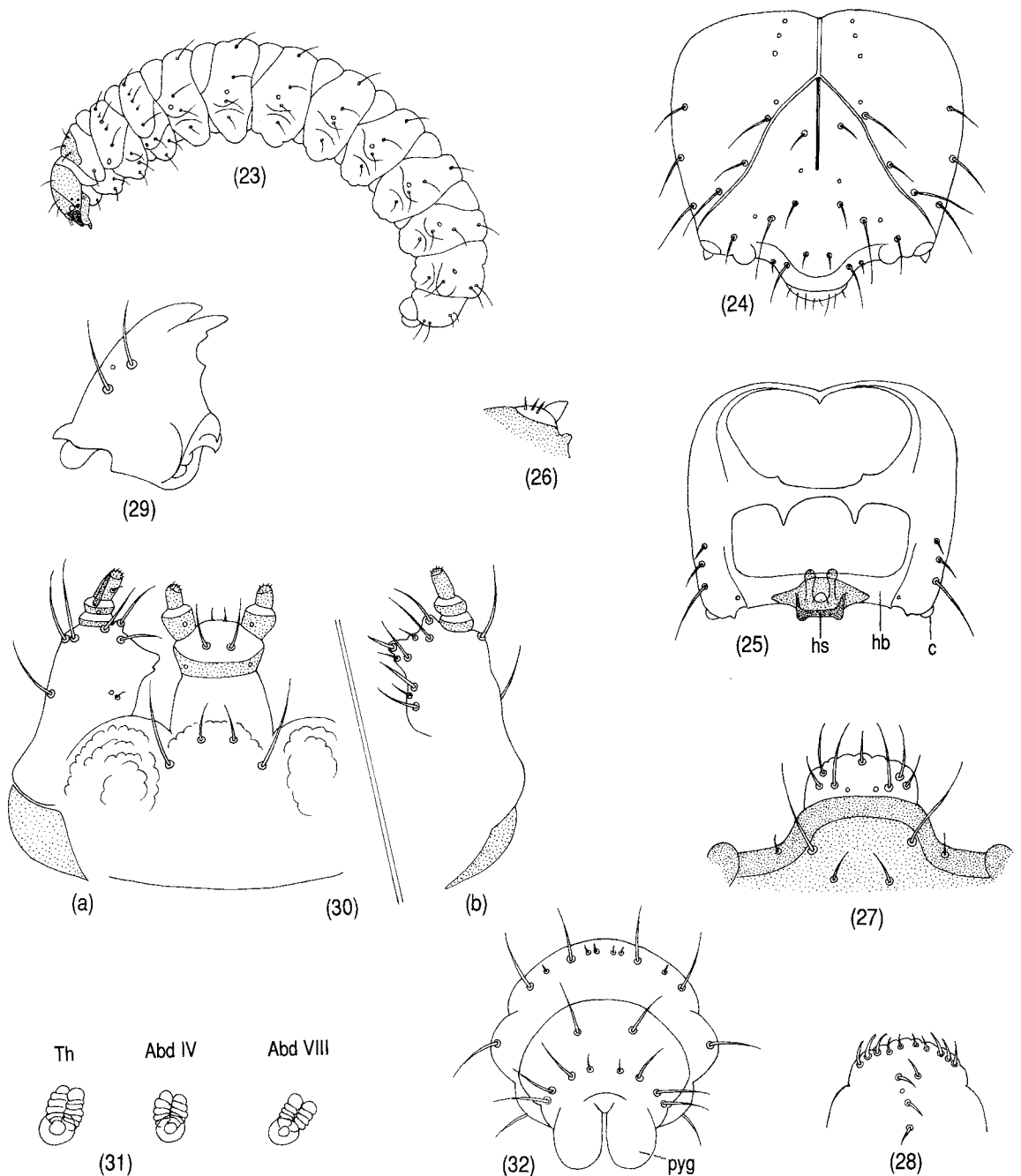
Nemonychidae: Nemonychinae

Fig. 1–10 *Nemonyx lepturoides*: (1) habitus, lateral, x15; (2) head, dorsal, x45; (3) antenna, ventral, x265; (4) labrum and pseudoclypeus, x130; (5) epipharyngeal lining, x130; (6) mandible, x110; (7) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (8) hypopharyngeal bracon, x130; (9) leg, x130; (10) spiracles, x165.



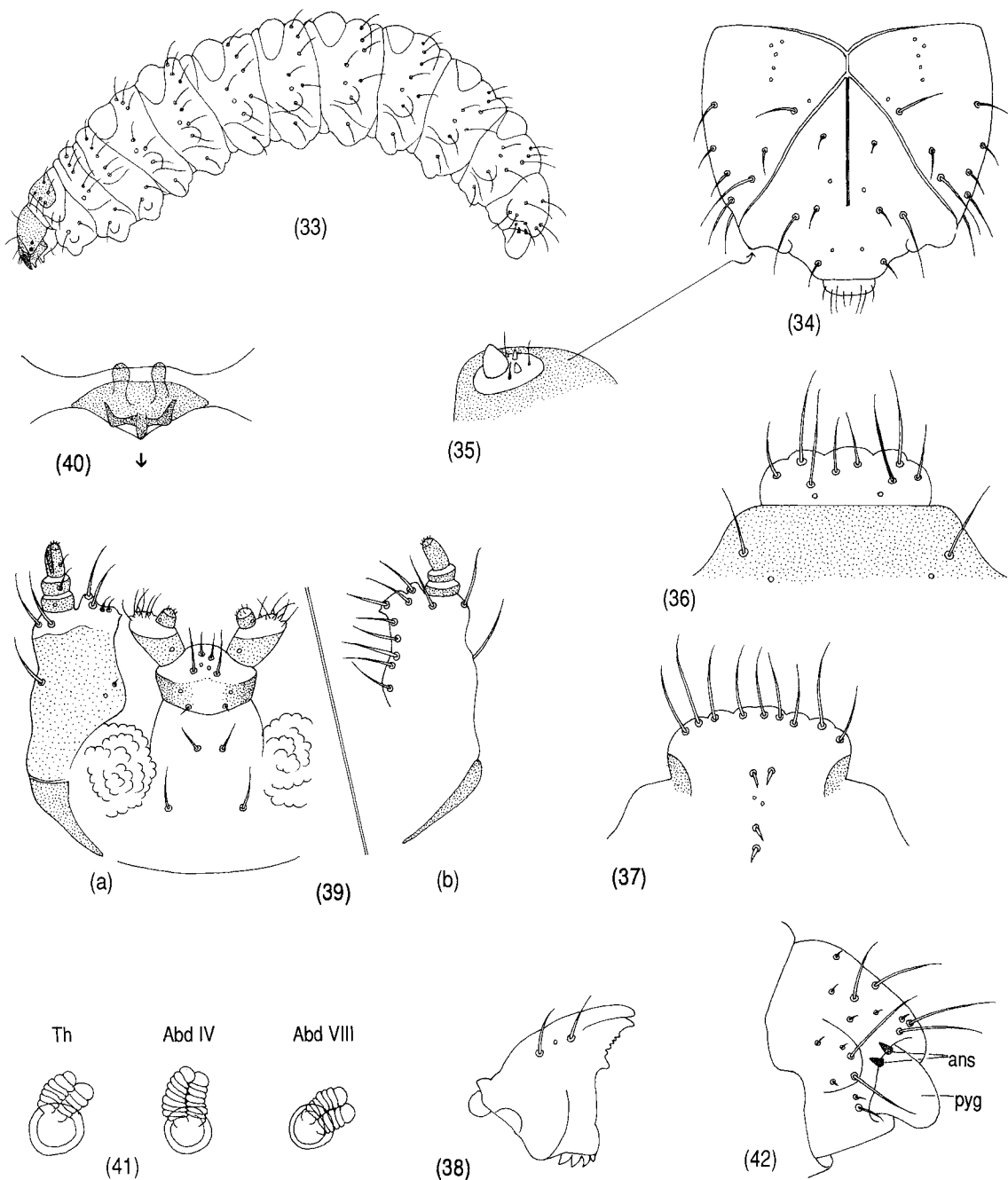
Nemonychidae: Doydirhynchinae

Fig. 11–20 *Cimberis comptus*: (11) head, dorsal, x65; (12) antenna, x265; (13) labrum and pseudoclypeus, x220; (14) epipharyngeal lining, x220; (15) mandible, x110; (16) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (17) hypopharyngeal bracon, x110; (18) pedal papilla, x265; (19) spiracles, x265; (20) Abd IX and X, lateral, x25. **Fig. 21, 22 *C. pilosus*:** (21) alimentary canal, x30; (22) egg inserted into sporophyll of *Pinus banksiana*, x15.



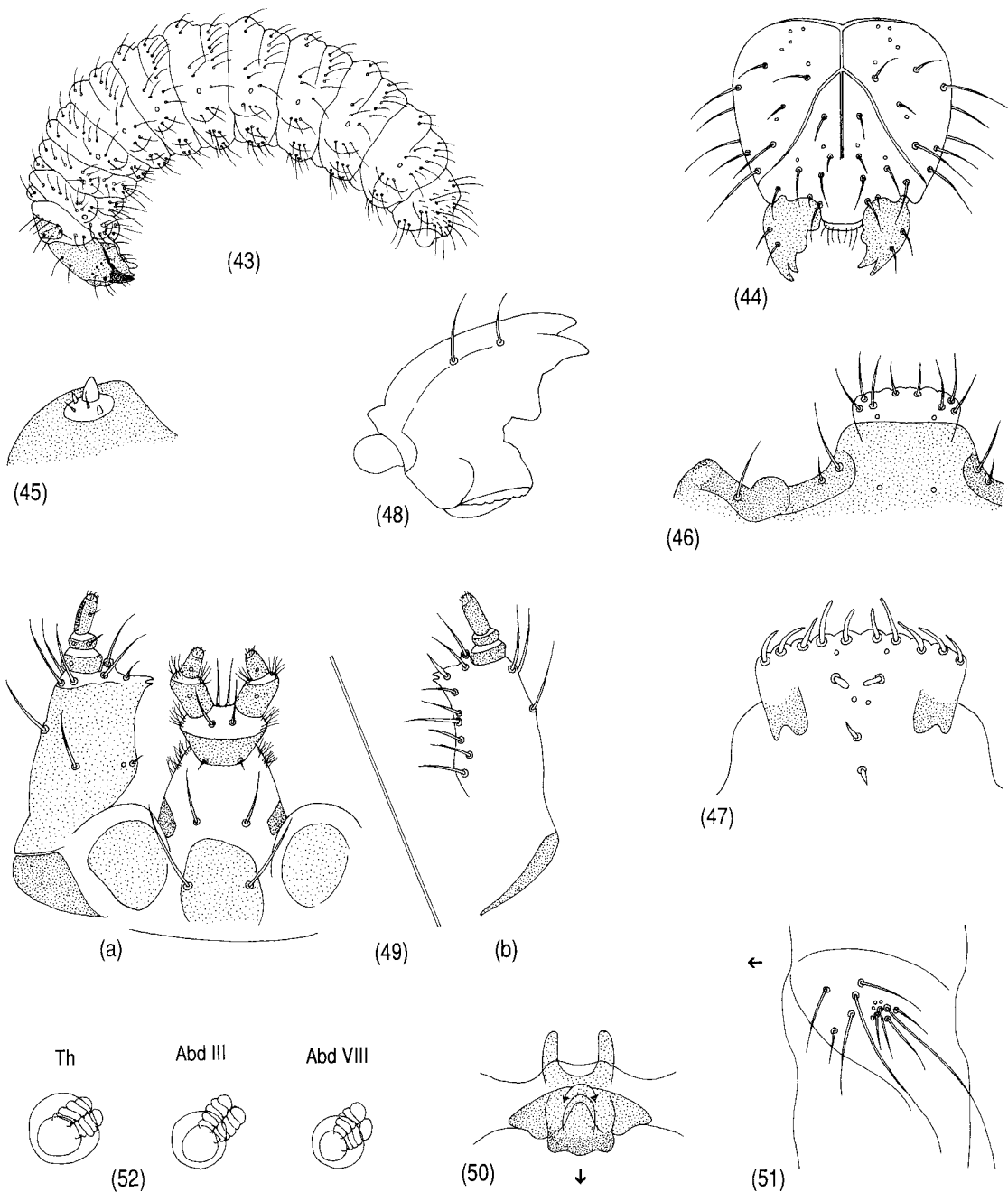
Nemomychidae: Rhinorhynchinae: Rhinorhynchini

Fig. 23–32 *Rhinorhynchus rufulus*: (23) habitus, lateral, x20; (24, 25) head, dorsal and ventral, x130; (26) antenna, x265; (27) labrum and pseudoclypeus, x265; (28) epipharyngeal lining, x265; (29) mandible, x185; (30) maxilla and labium, x220 (a, ventral; b, dorsal maxilla); (31) spiracles, x265; (32) Abd VIII–X, caudal, x55.



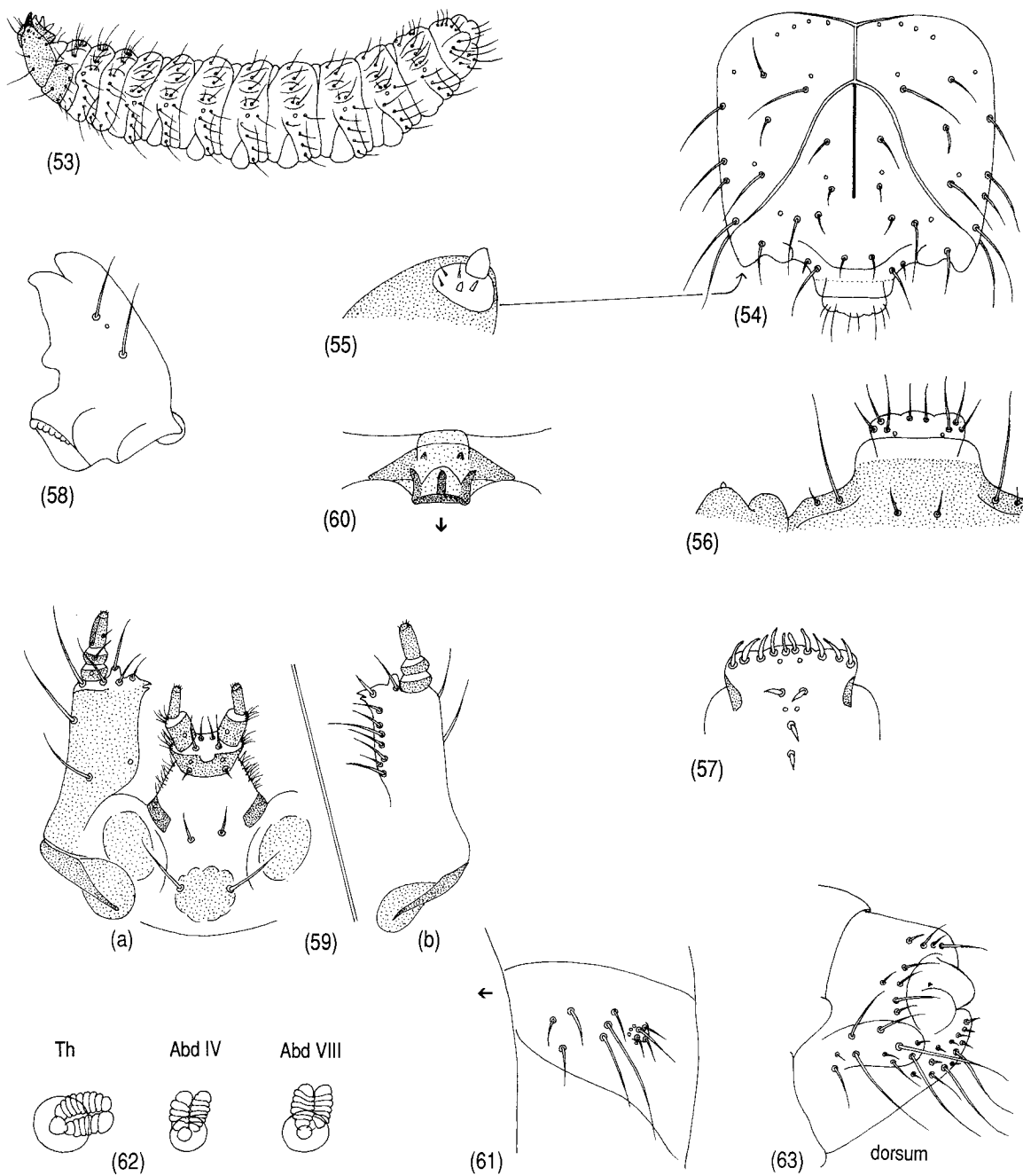
Nemonychidae: Rhinorhynchinae: Rhynchitomacerini

Fig. 33–42 *Rhynchitomacer rufus*: (33) habitus, lateral, x15; (34) head, dorsal, x85; (35) antenna, ventral, x265; (36) labrum and pseudoclypeus, x265; (37) epipharyngeal lining, x265; (38) mandible, x130; (39) maxilla and labium, x130 (a, ventral; b, dorsal maxilla); (40) hypopharyngeal bracon, x130; (41) spiracles, x265; (42) Abd IX and X, x40.



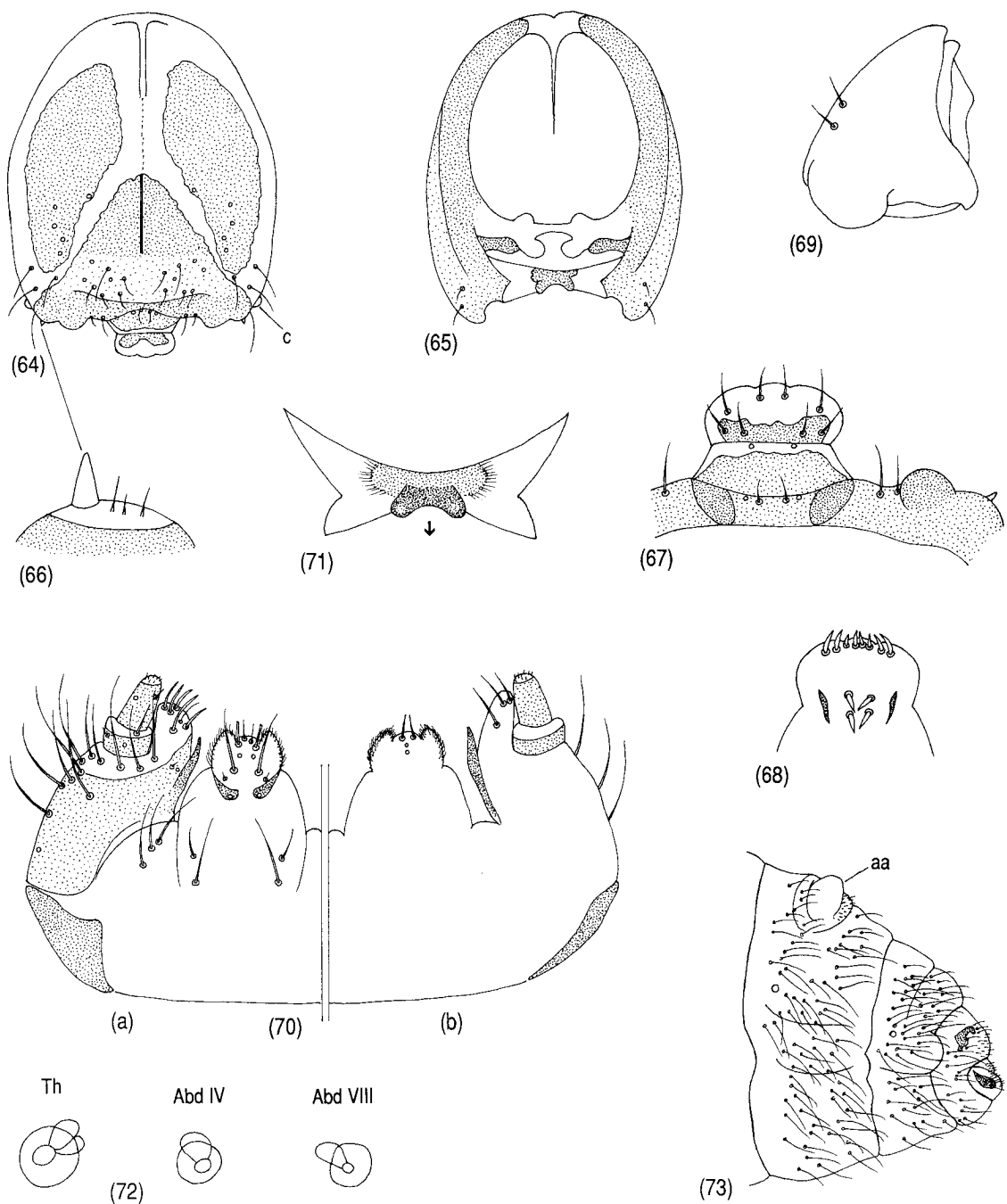
Nemomychidae: Rhinorhynchinae: Mecomacerini

Fig. 43–52 *Mecomacer scambus*: (43) habitus, lateral, x10; (44) head, dorsal, x30; (45) antenna, ventral, x130; (46) labrum and pseudoclypeus, x65; (47) epipharyngeal lining, x65; (48) mandible, x65; (49) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (50) hypopharyngeal bracon, x65; (51) pedal lobe of Th II, x55; (52) spiracles, x130.



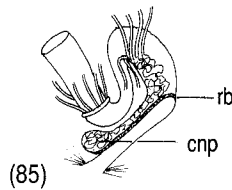
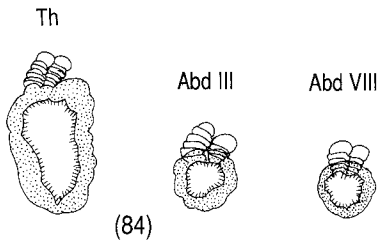
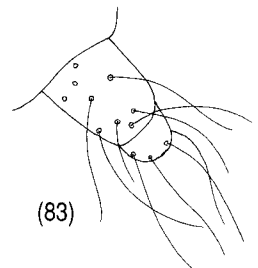
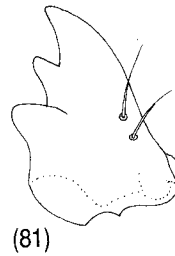
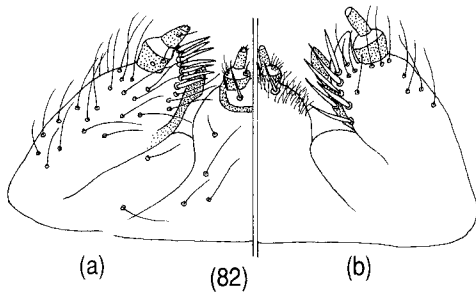
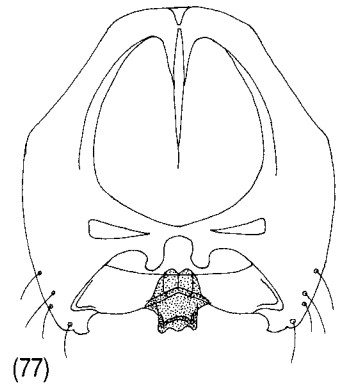
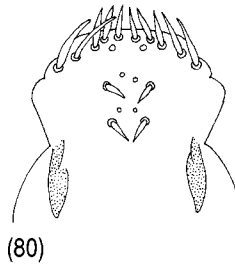
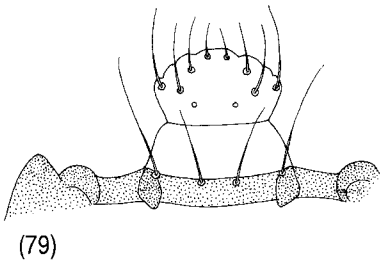
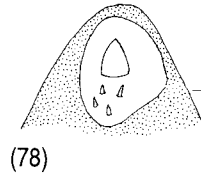
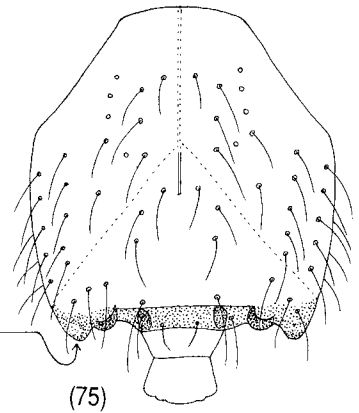
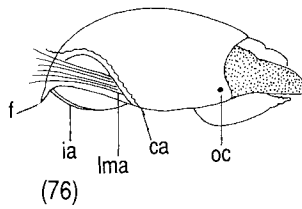
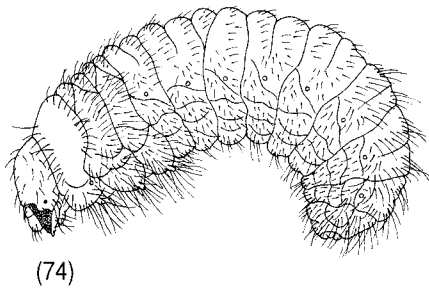
Nemomychidae: Rhinorhynchinae: Rhynchitoplesiini

Fig. 53–63 *Rhynchitomacerinus kuscheli*: (53) habitus, lateral, x15; (54) head, dorsal, x55; (55) antenna, ventral, x265; (56) labrum and pseudoclypeus, x95; (57) epipharyngeal lining, x130; (58) mandible, x95; (59) maxilla and labium, x130 (a, ventral; b, dorsal maxilla); (60) hypopharyngeal bracon, x130; (61) pedal lobe of Th II, x45; (62) spiracles, x265; (63) Abd IX and X, x45.



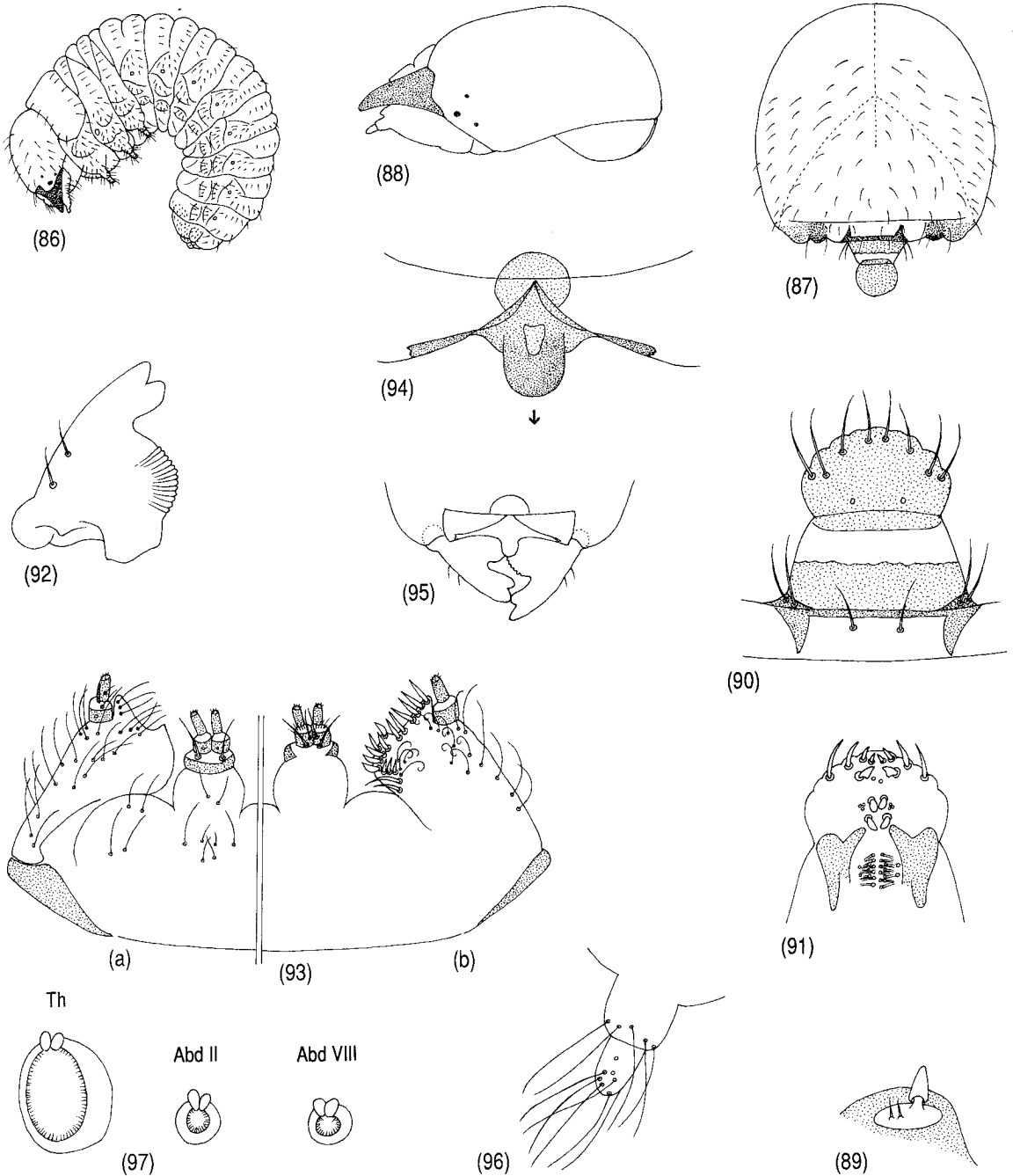
Anthribidae: Urodontinae

Fig. 64–73 *Bruchela lillii*: (64, 65) head, dorsal and ventral, x55; (66) antenna, x530; (67) labrum, clypeus, and epistoma, x130; (68) epipharyngeal lining, x130; (69) mandible, x130; (70) maxilla and labium, x130 (a, ventral; b, dorsal); (71) hypopharyngeal bracon, x130; (72) spiracles, x265; (73) Abd VII–X, x35.



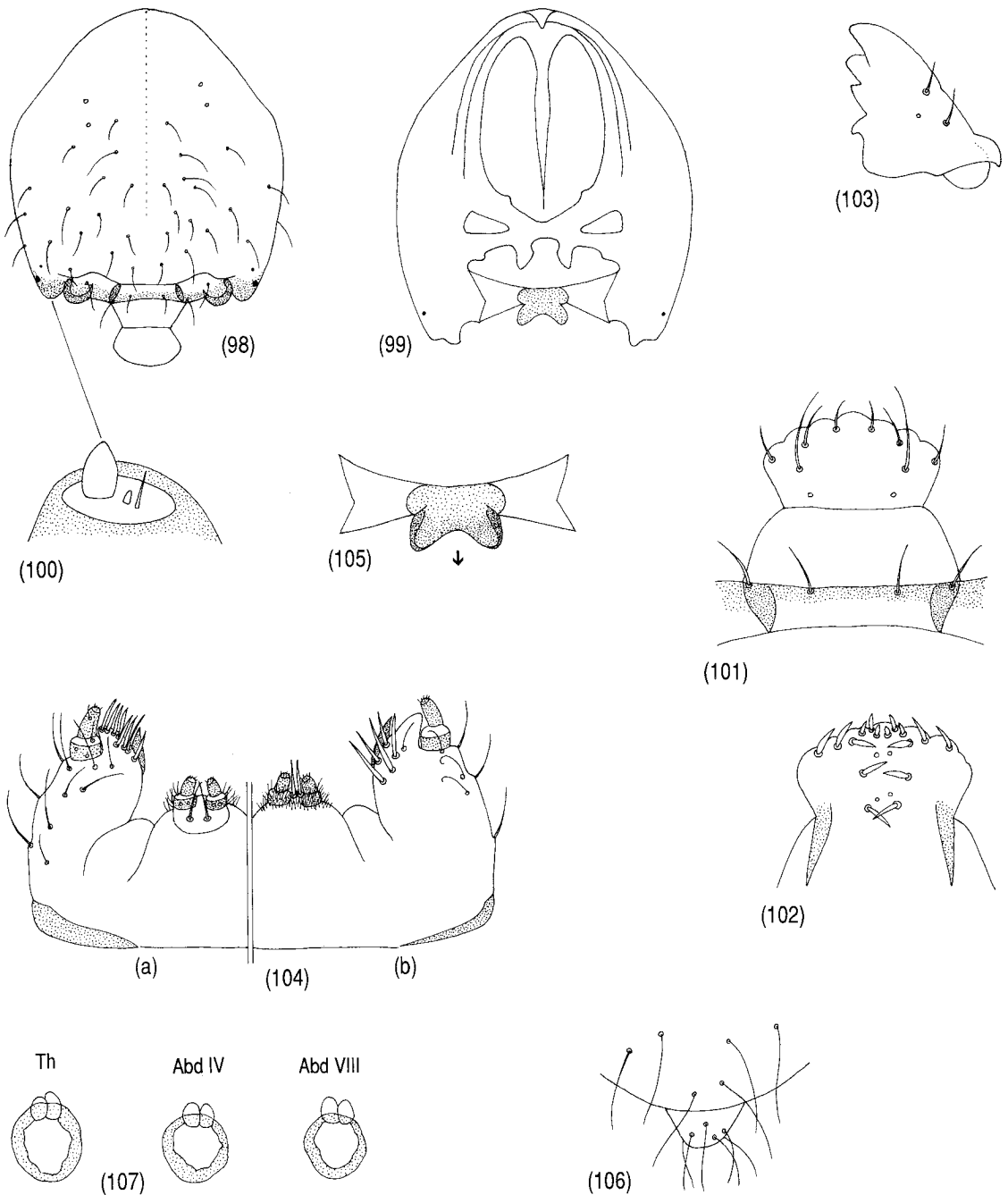
Anthribidae: Anthribinae

Fig. 74–85 *Arecopais spectabilis*: (74) habitus, lateral, x10; (75–77) head – dorsal, x45, lateral, x20, ventral, x45; (78) antenna, x265; (79) labrum, clypeus, and epistoma, x65; (80) epipharyngeal lining, x95; (81) mandible, x65; (82) maxilla and labium, x65 (a, ventral; b, dorsal); (83) pedal papilla, x185; (84) spiracles, x265; (85) hind gut, x15.



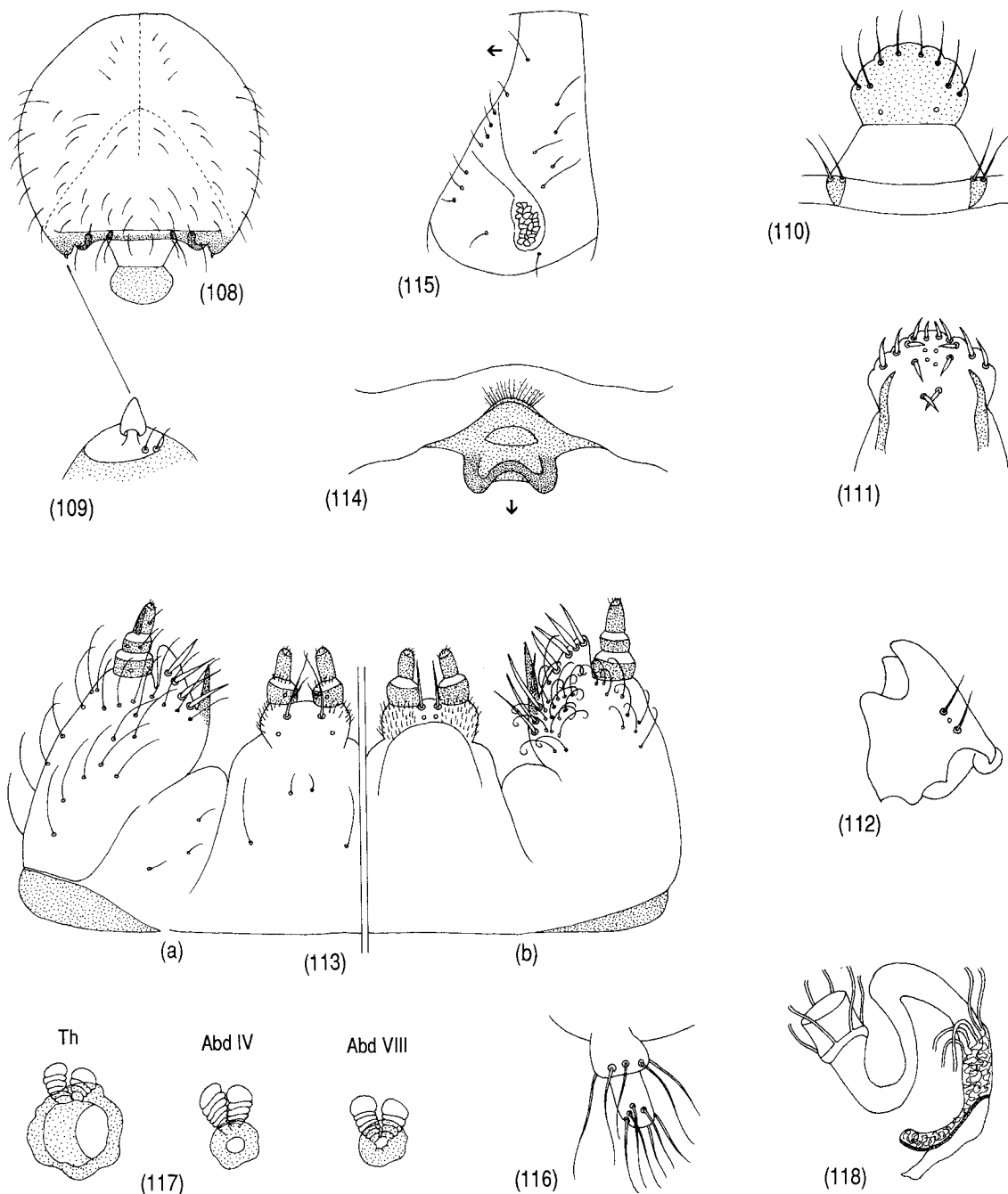
Anthribidae: Anthribinae

Fig. 86–97 *Cecephatus inornatus*: (86) habitus, lateral, x10; (87, 88) head, dorsal and lateral (setae omitted), x30; (89) antenna, x265; (90) labrum, clypeus, and epistoma, x65; (91) epipharyngeal lining, x95; (92) mandible, x55; (93) maxilla and labium, x45 (a, ventral; b, dorsal); (94) hypopharyngeal sclerome, x65; (95) position of mandibles relative to hypopharyngeal sclerome during feeding, x30; (96) pedal papilla, x65; (97) spiracles, x130.



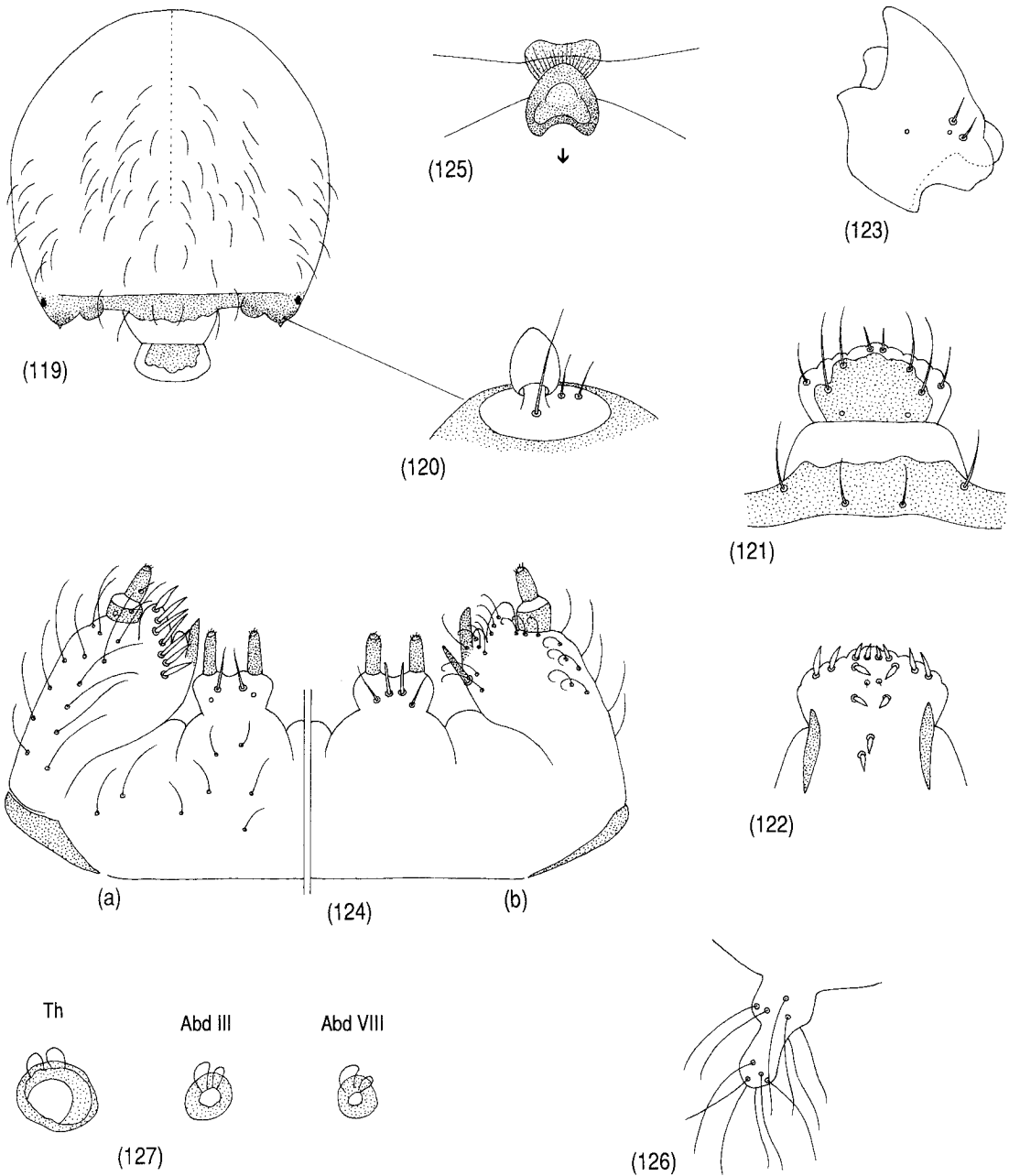
Anthribidae: Anthribinae

Fig. 98–107 *Dasyanthribus purpureus*: (98, 99) head, dorsal and ventral, x95; (100) antenna, x530; (101) labrum, clypeus, and epistoma, x265; (102) epipharyngeal lining, x265; (103) mandible, x185; (104) maxilla and labium, x185 (a, ventral; b, dorsal); (105) hypopharyngeal sclerome, x185; (106) pedal papilla, x265; (107) spiracles, x265.



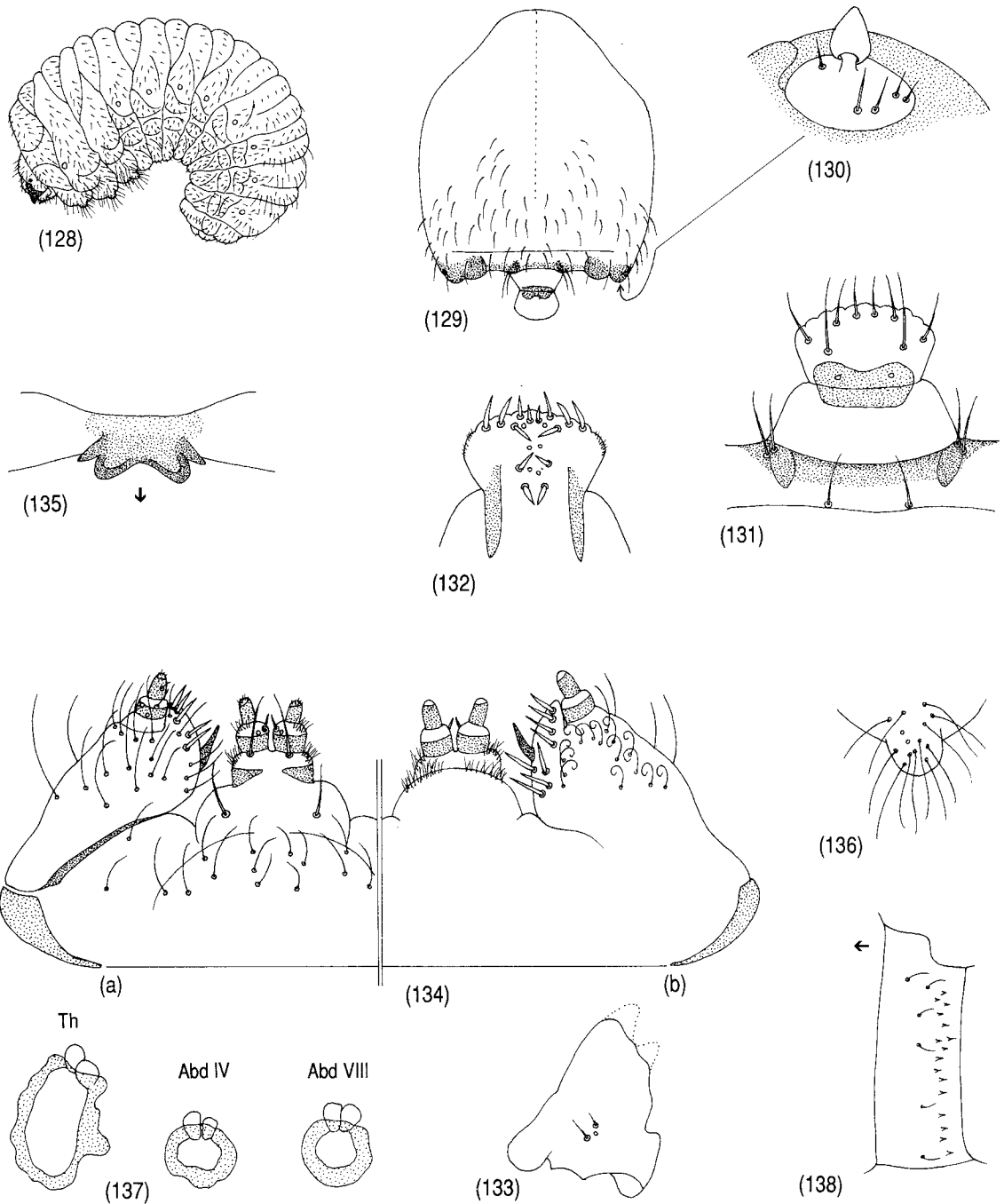
Anthribidae: Anthribinae

Fig. 108–118 *Garyus altus*: (108) head, dorsal, x30; (109) antenna, x265; (110) labrum, clypeus, and epistoma, x65; (111) epipharyngeal lining, x65; (112) mandible, x55; (113) maxilla and labium, x95 (a, ventral; b, dorsal); (114) hypopharyngeal sclerome, x40; (115) pronotal shield, lateral, x45; (116) pedal papilla, x95; (117) spiracles, x265; (118) hind gut, x15.



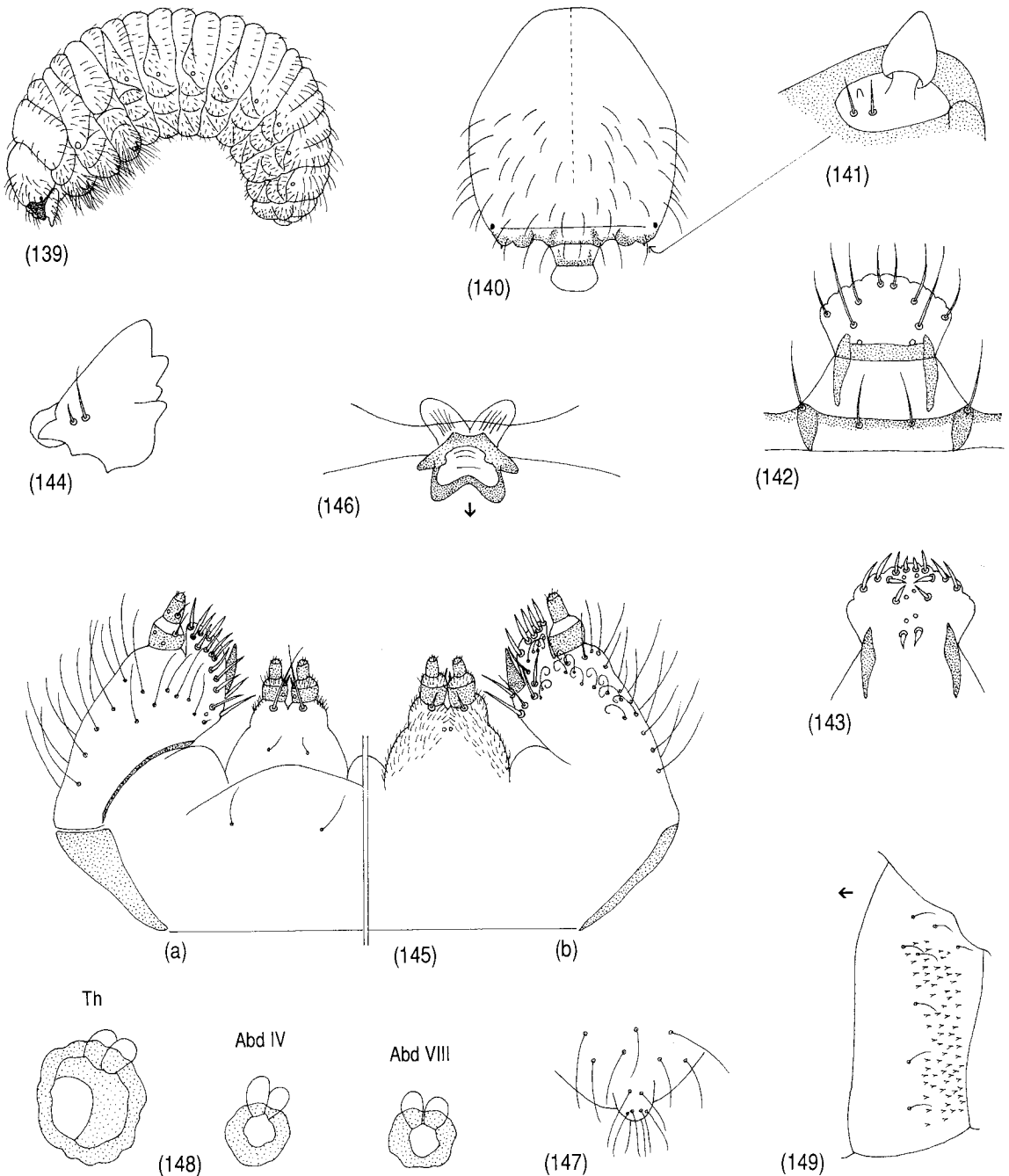
Anthribidae: Anthribinae

Fig. 119–127 *Helmoreus sharpi*: (119) head, dorsal, x55; (120) antenna, x530; (121) labrum, clypeus, and epistoma, x130; (122) epipharyngeal lining, x130; (123) mandible, x110; (124) maxilla and labium, x130 (a, ventral; b, dorsal); (125) hypopharyngeal sclerome, x110; (126) pedal papilla, x130; (127) spiracles, x265.



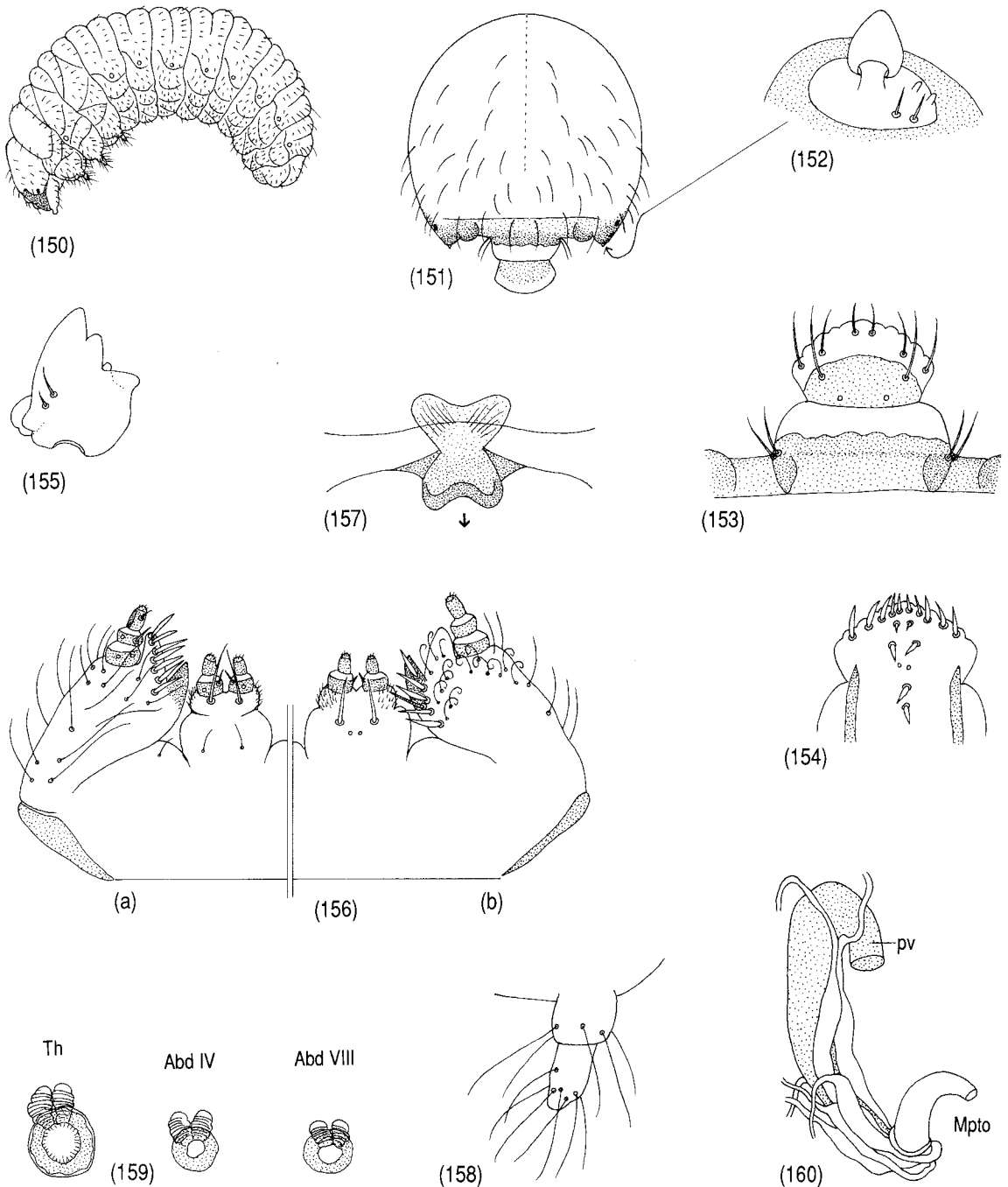
Anthribidae: Anthribinae

Fig. 128–138 *Hoherius meinertzhageni*: (128) habitus, lateral, x10; (129) head, dorsal, x30; (130) antenna, x530; (131) labrum, clypeus, and epistoma, x95; (132) epipharyngeal lining, x95; (133) mandible, x55; (134) maxilla and labium, x95 (a, ventral; b, dorsal); (135) hypopharyngeal sclerome, x95; (136) pedal papilla, x130; (137) spiracles, x185; (138) Abd IX, sternal fold, x55.



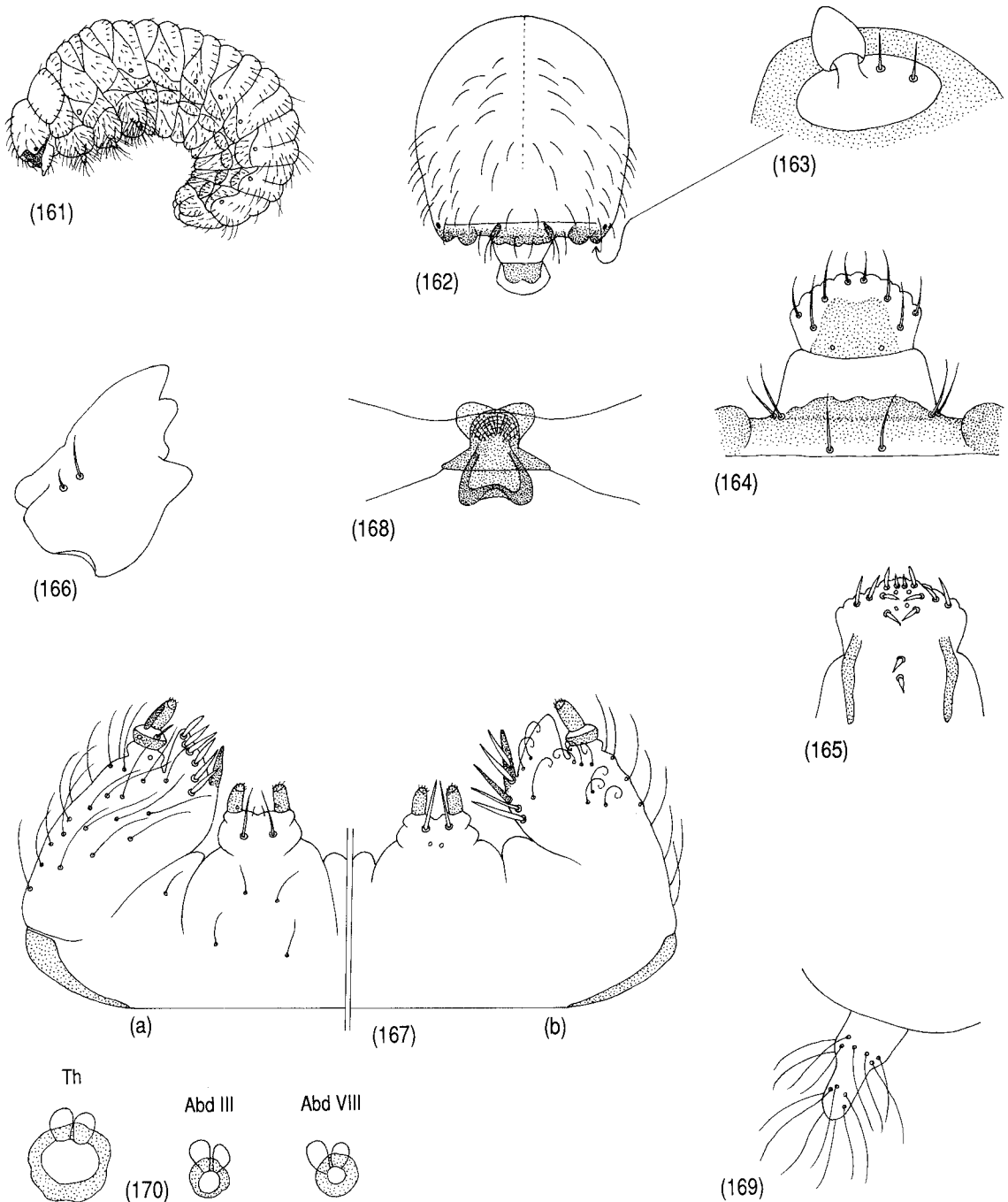
Anthribidae: Anthribinae

Fig. 139–149 *Phymatus hetaera*: (139) habitus, lateral, x10; (140) head, dorsal, x30; (141) antenna, x530; (142) labrum, clypeus, and epistoma, x65; (143) epipharyngeal lining, x65; (144) mandible, x65; (145) maxilla and labium, x65 (a, ventral; b, dorsal); (146) hypopharyngeal sclerome, x95; (147) pedal papilla, x130; (148) spiracles, x265; (149) Abd IX, sternal fold, x55.



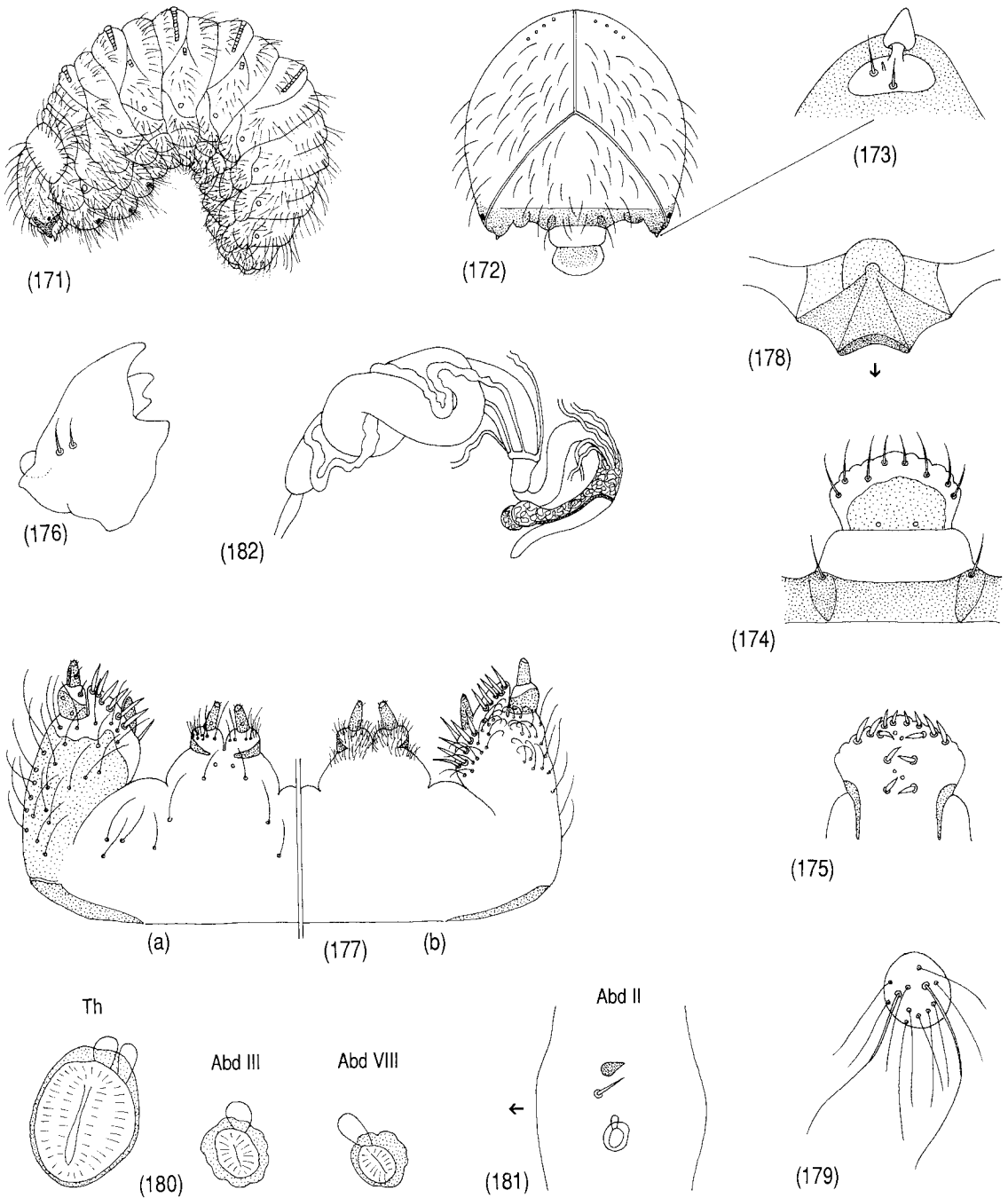
Anthribidae: Anthribinae

Fig. 150–160 *Pleosporius bullatus*: (150) habitus, lateral, x10; (151) head, dorsal, x45; (152) antenna, x530; (153) labrum, clypeus, and epistoma, x130; (154) epipharyngeal lining, x130; (155) mandible, x130; (156) maxilla and labium, x95 (a, ventral; b, dorsal); (157) hypopharyngeal sclerome, x130; (158) pedal papilla, x130; (159) spiracles, x265; (160) Malpighian tubules, swollen bases, x20.



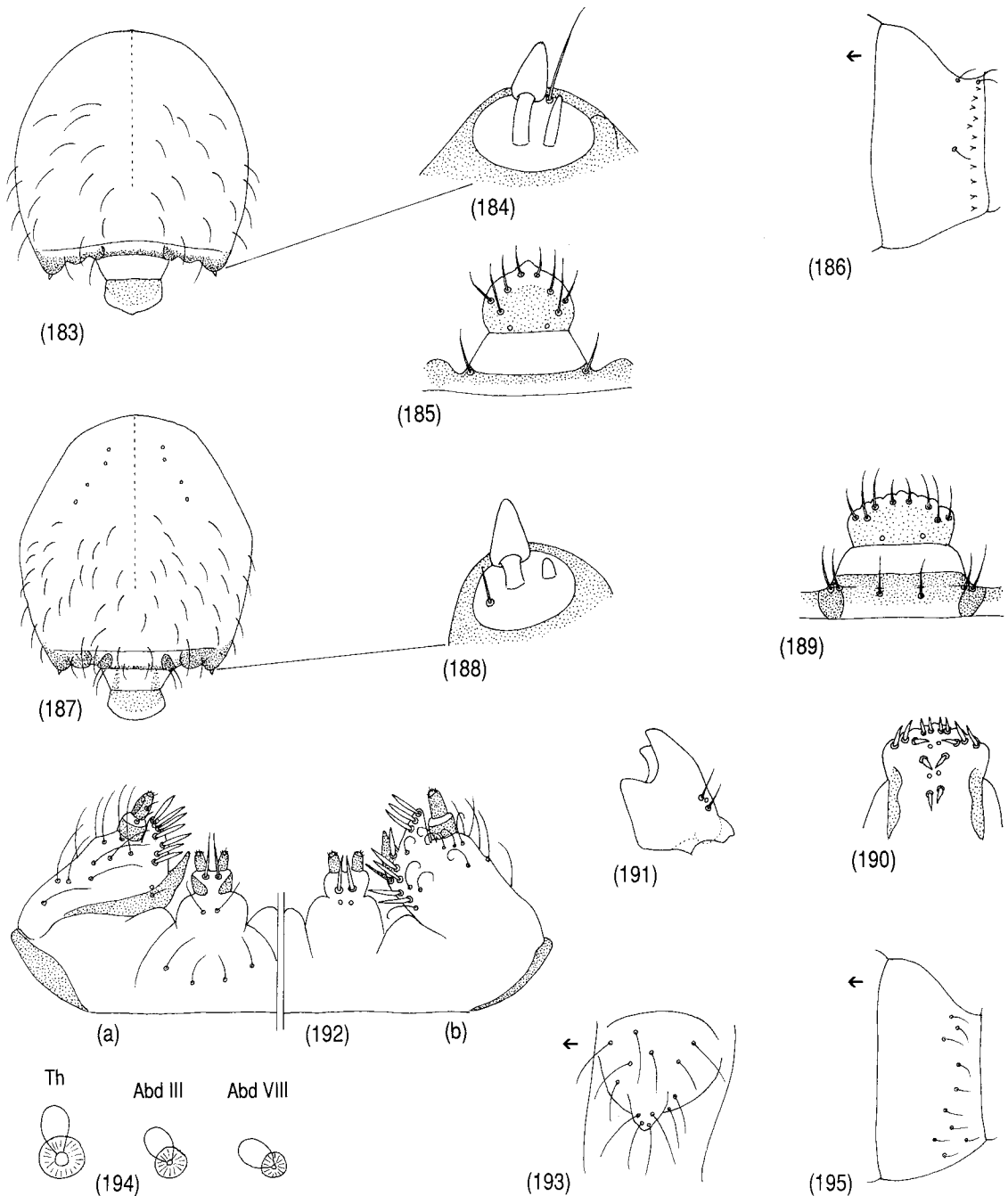
Anthribidae: Anthribinae

Fig. 161–170 *Sharpius brouni*: (161) habitus, lateral, x10; (162) head, dorsal, x45; (163) antenna, x530; (164) labrum, clypeus, and epistoma, x110; (165) epipharyngeal lining, x110; (166) mandible, x130; (167) maxilla and labium, x130 (a, ventral; b, dorsal); (168) hypopharyngeal sclerome, x110; (169) pedal papilla, x130; (170) spiracles, x265.



Anthribidae: Choraginae

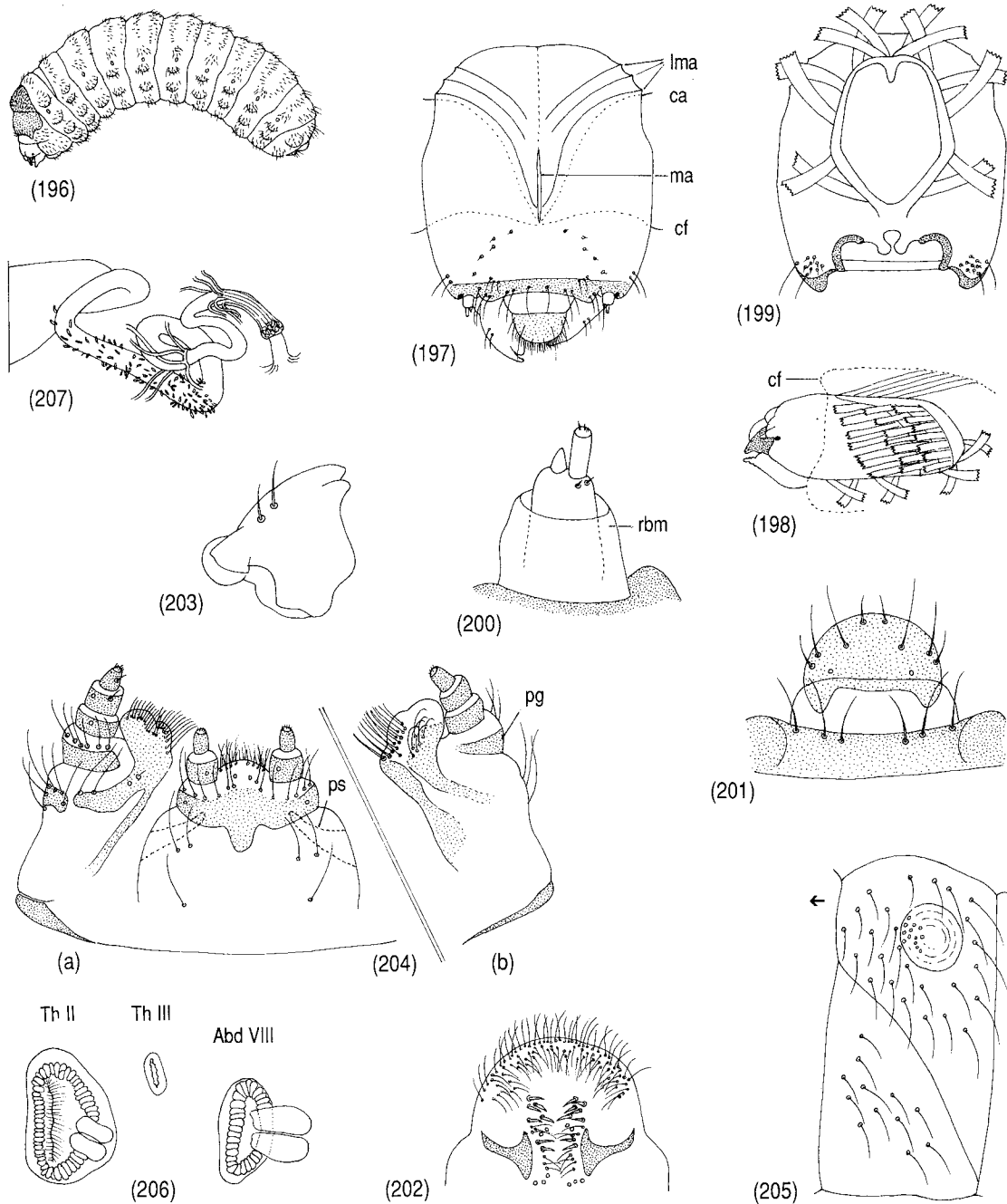
Fig. 171–182 *Araecerus palmaris*: (171) habitus, lateral, x10; (172) head, dorsal, x25; (173) antenna, x265; (174) labrum, clypeus, and epistoma, x55; (175) epipharyngeal lining, x55; (176) mandible, x45; (177) maxilla and labium, x45 (a, ventral; b, dorsal); (178) hypopharyngeal sclerome, x55; (179) pedal sclerite, x130; (180) spiracles, x130; (181) 1st instar, Abd II, egg-bursting spine, x265; (182) alimentary canal, x130.



Anthribidae: Choraginae

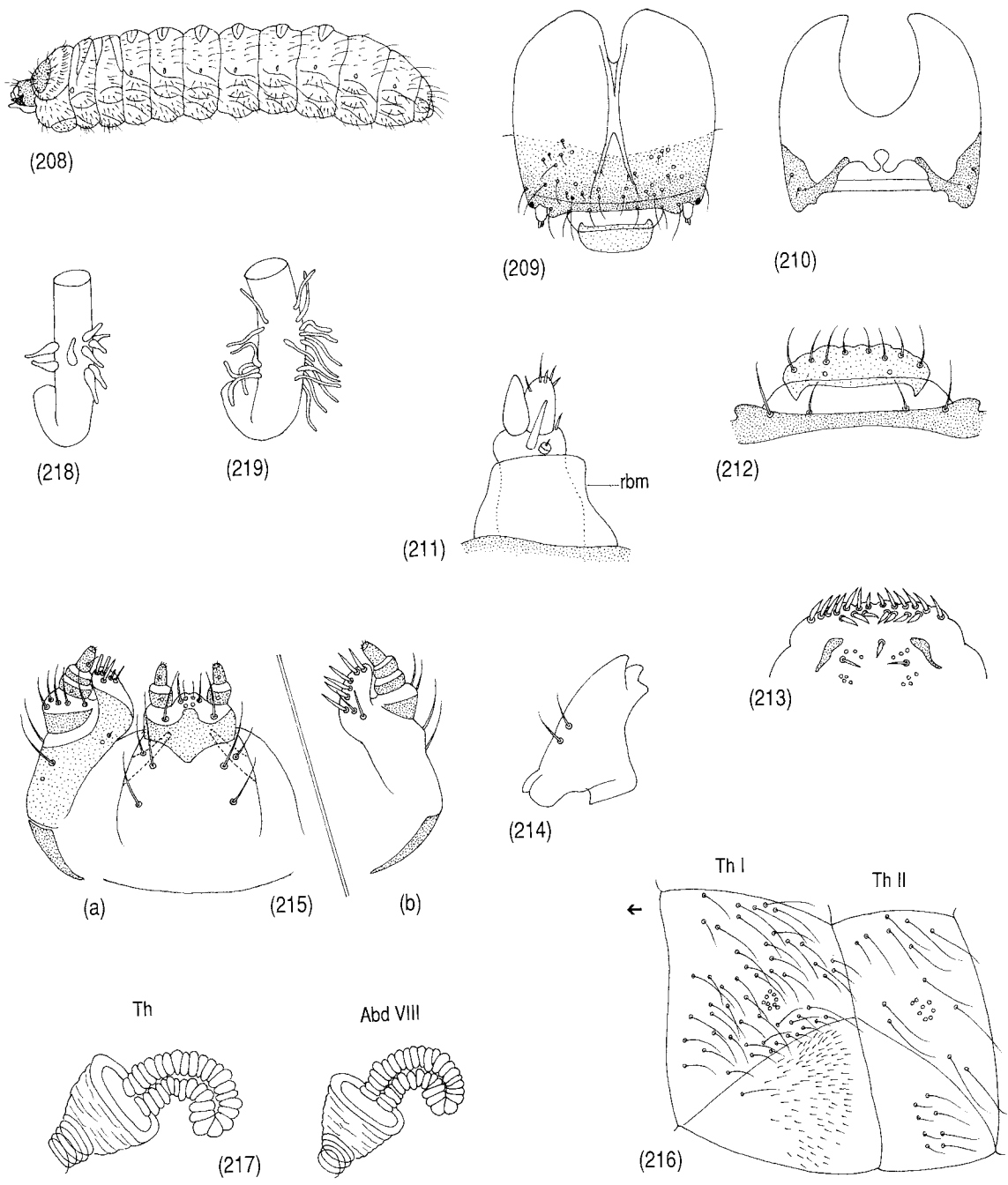
Fig. 183–186 *Dysnocryptus inflatus*: (183) head, dorsal, x95; (184) antenna, x530; (185) labrum, clypeus, and epistoma, x130; (186) Abd IX, sternal fold, x95.

Fig. 187–195 *Notochoragus crassus*: (187) head, dorsal, x65; (188) antenna, x530; (189) labrum, clypeus, and epistoma, x130; (190) epipharyngeal lining, x130; (191) mandible, x95; (192) maxilla and labium, x130 (a, ventral; b, dorsal); (193) pedal lobe and papilla, x95; (194) spiracles, x265; (195) Abd IX, sternal fold, x95.



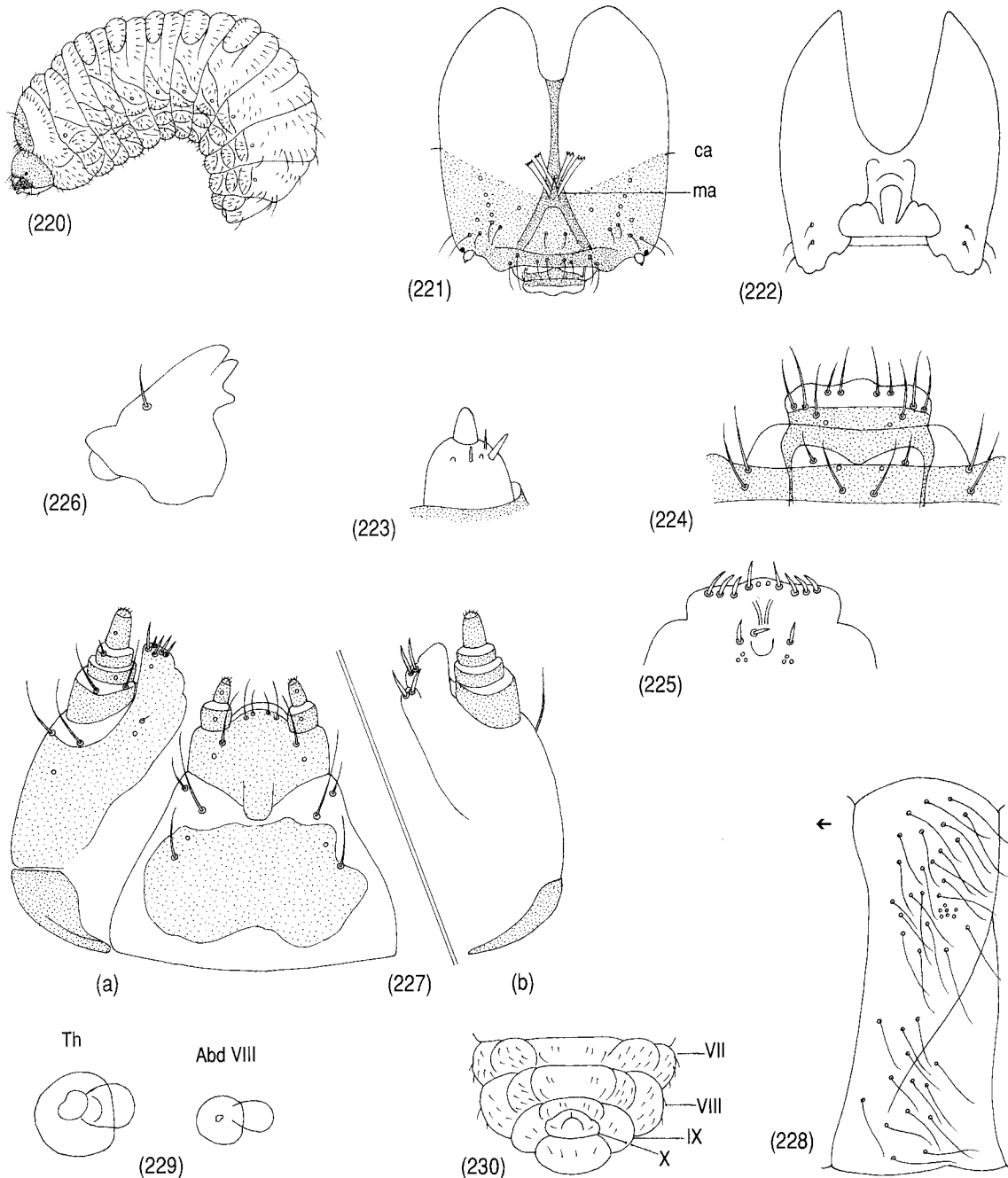
Belidae: Belinae

Fig. 196–207 *Agathinus tridens*: (196) habitus, lateral, x3; (197–199) head—dorsal, x15, lateral, x10, ventral, x15, showing musculature; (200) antenna, x95; (201) labrum, clypeus, and epistoma, x40; (202) epipharyngeal lining, x45; (203) mandible, x30; (204) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (205) Th II, pedal lobe and sternal setae, x45; (206) spiracles, x95; (207) alimentary canal, x6.



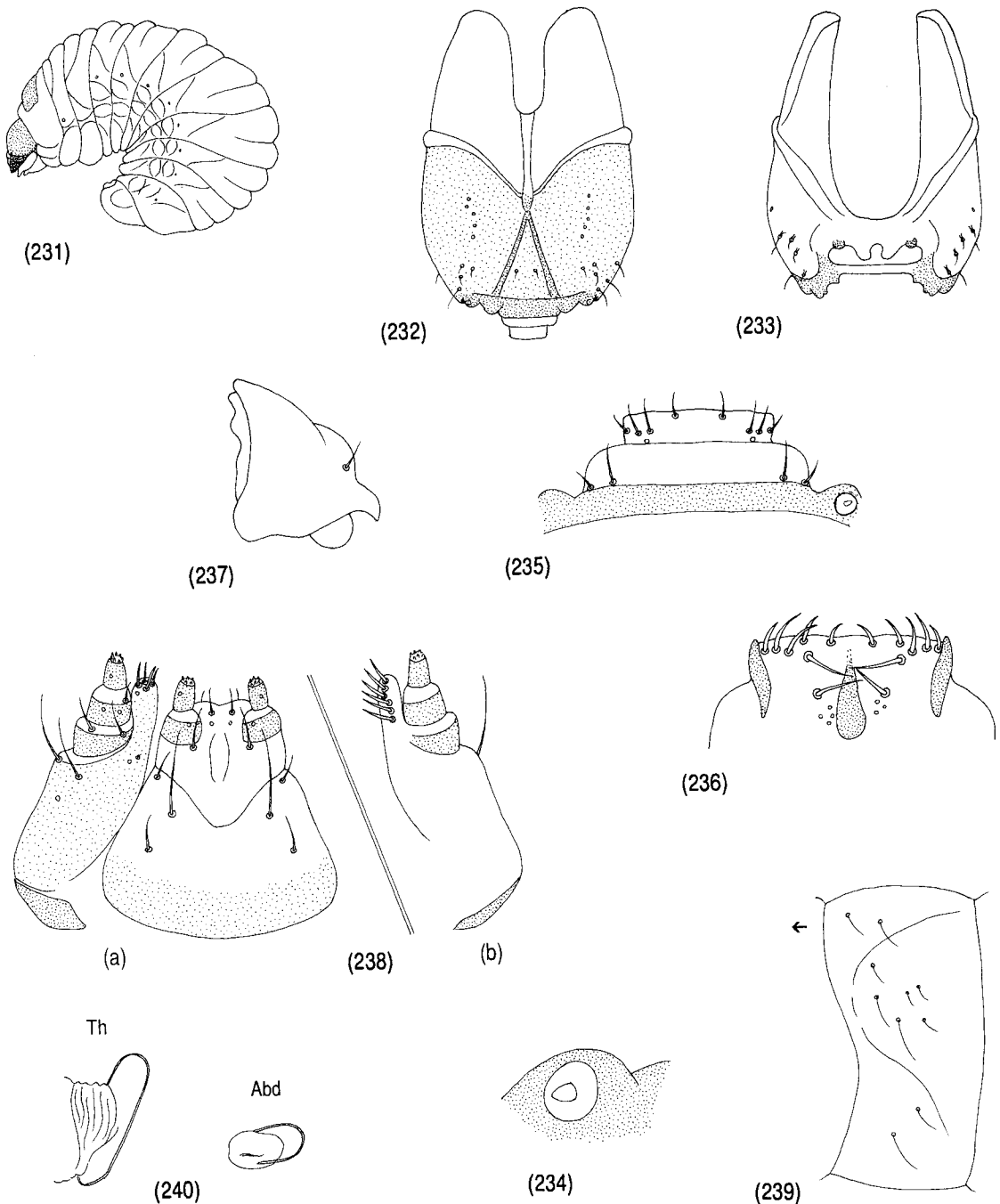
Belidae: Belinae

Fig. 208–218 *Pachyurinus rubicundus*: (208) habitus, lateral, x7; (209, 210) head, dorsal and ventral, x10; (211) antenna, x220; (212) labrum, clypeus, and epistoma, x55; (213) epipharyngeal lining, x65; (214) mandible, x55; (215) maxilla and labium, x55 (a, ventral; b, dorsal maxilla); (216) Th I/II, pedal lobe and sternal setae, x45; (217) spiracles, x220; (218) gastric caeca, x15. **Fig. 219 *P. sticticus*,** gastric caeca, x15.



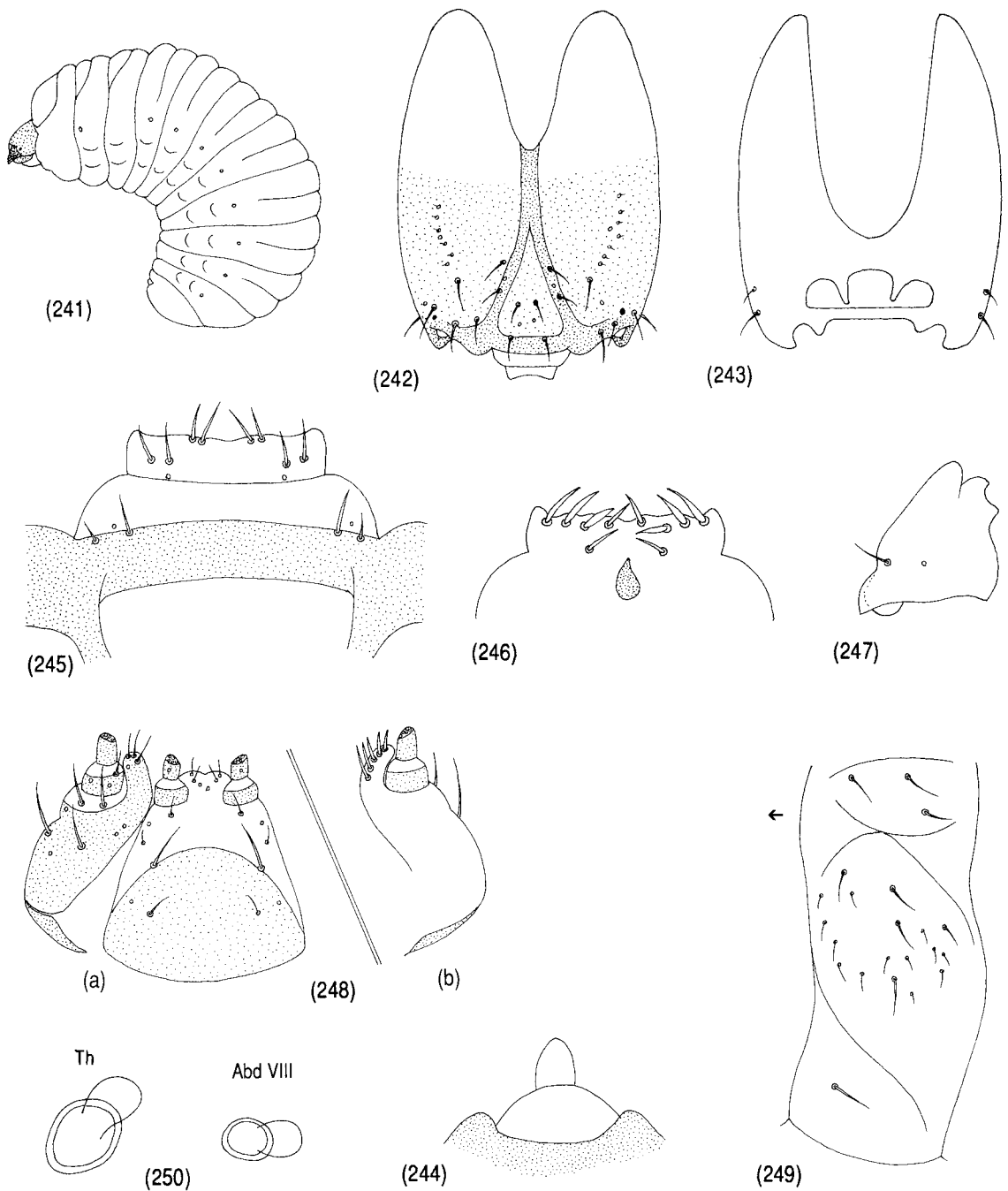
Belidae: Oxycoryninae

Fig. 220–230 *Hydnorobius* sp.: (220) habitus, lateral, x10; (221, 222) head, dorsal and ventral, x35; (223) antenna, x265; (224) labrum, clypeus, and epistoma, x110; (225) epipharyngeal lining, x110; (226) mandible, x65; (227) maxilla and labium, x110 (a, ventral; b, dorsal maxilla); (228) Th II, pedal lobe and sternal setae, x65; (229) spiracles, x135; (230) Abd VII–X, ventral, x15.



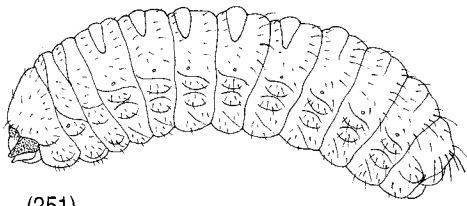
Belidae: Oxycoryninae

Fig. 231–240 *Parallocorynus* sp.: (231) habitus, lateral, x15 (setae omitted); (232, 233) head, dorsal and ventral, x45; (234) antenna, x265 (on dorsal surface of frons); (235) labrum, clypeus, and epistoma, x185; (236) epipharyngeal lining, x265; (237) mandible, x130; (238) maxilla and labium, x130 (a, ventral; b, dorsal maxilla); (239) Th II, pedal lobe with ventropleural and sternal setae, x65; (240) spiracles, x265.

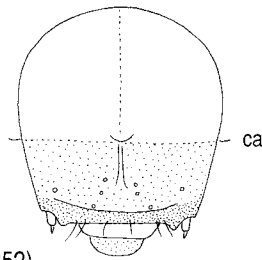


Belidae: Oxycoryninae

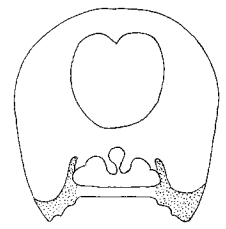
Fig. 241–250 *Rhopalotria mollis*: (241) habitus, lateral, x15; (242, 243) head, dorsal and ventral, x65; (244) antenna, x530; (245) labrum, clypeus, and epistoma, x265; (246) epipharyngeal lining, x265; (247) mandible, x130; (248) maxilla and labium, x130 (a, ventral; b, dorsal maxilla); (249) Th I, pedal and mediosternal lobes, ventropleural, x130; (250) spiracles, x265.



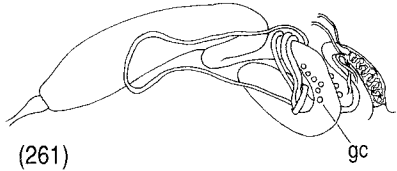
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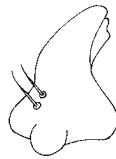
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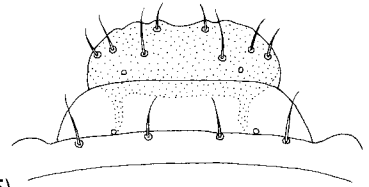
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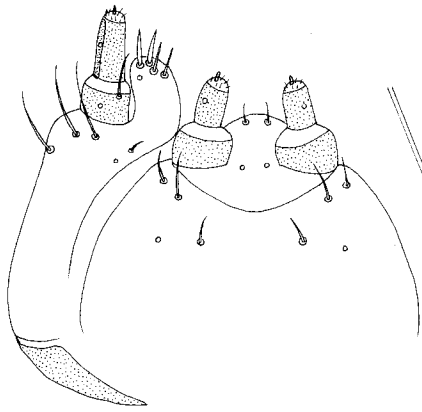
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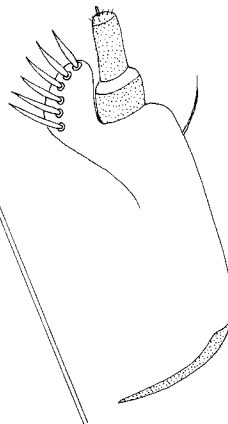
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(255)

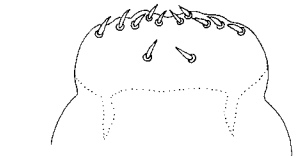


(a)

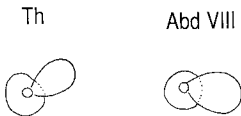


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(b)

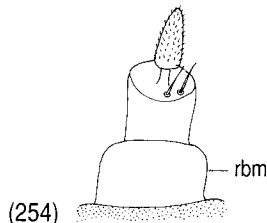


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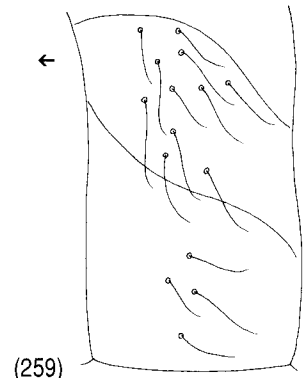


(260)

Abd VIII



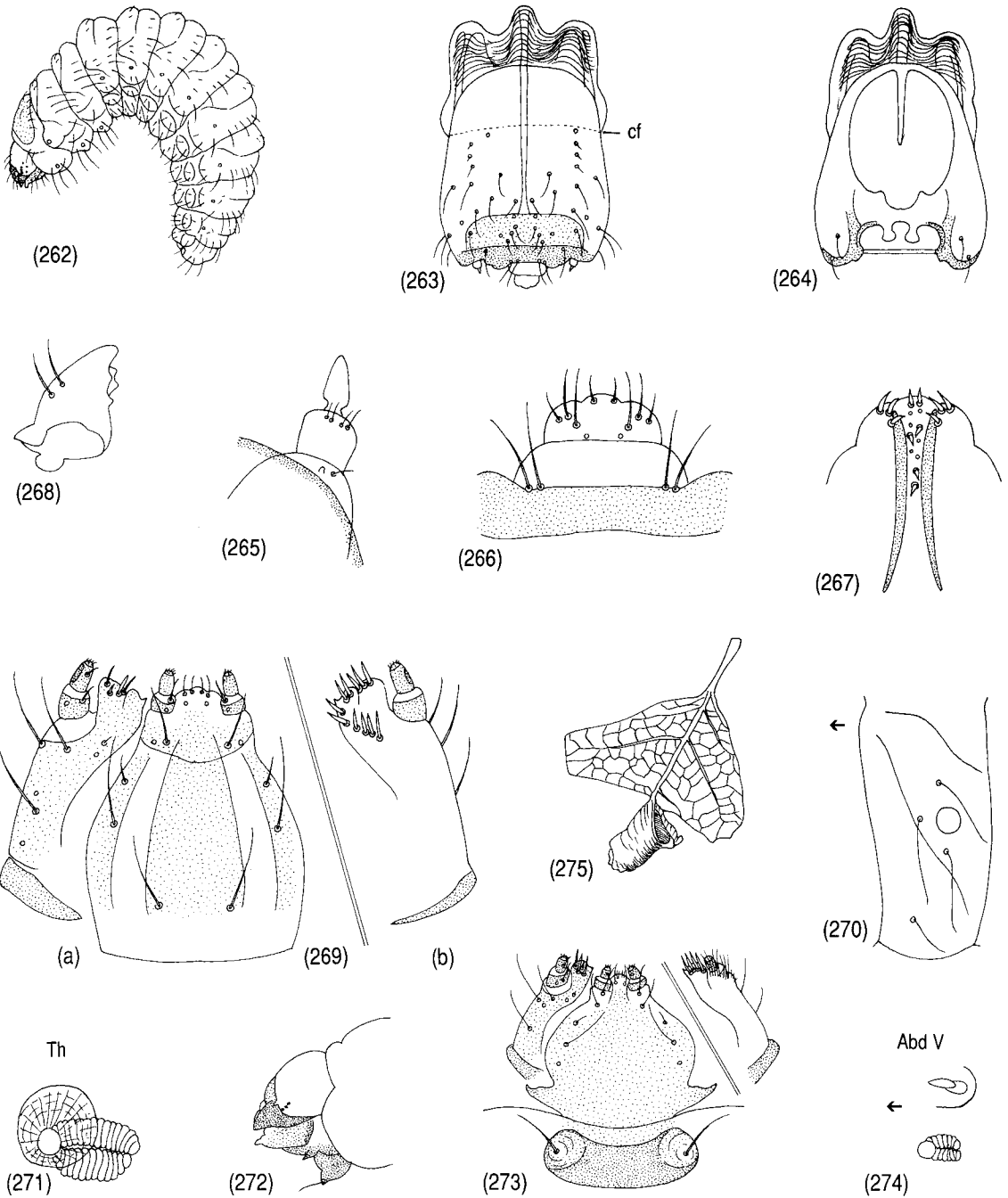
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(259)

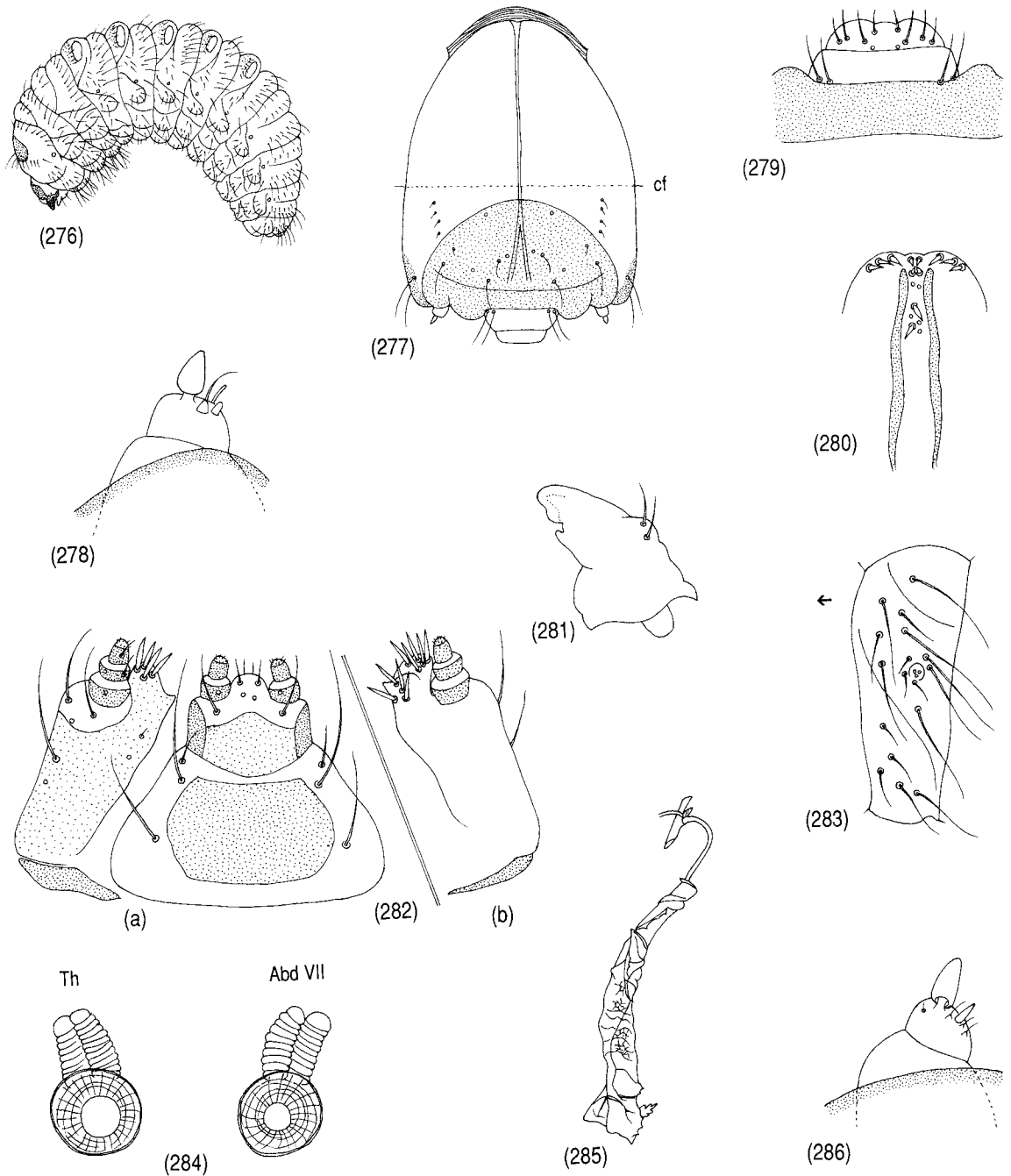
Belidae: Aglyciderinae

Fig. 251–261 *Aralius wollastoni*: (251) habitus, lateral, x20; (252, 253) head, dorsal and ventral, x85; (254) antenna, x530; (255) labrum, clypeus, and epistoma, x185; (256) epipharyngeal lining, x185; (257) mandible, x130; (258) maxilla and labium, x265 (a, ventral; b, dorsal maxilla); (259) Th II, pedicel and sternal setae, x130; (260) spiracles, x530; (261) alimentary canal, x20.



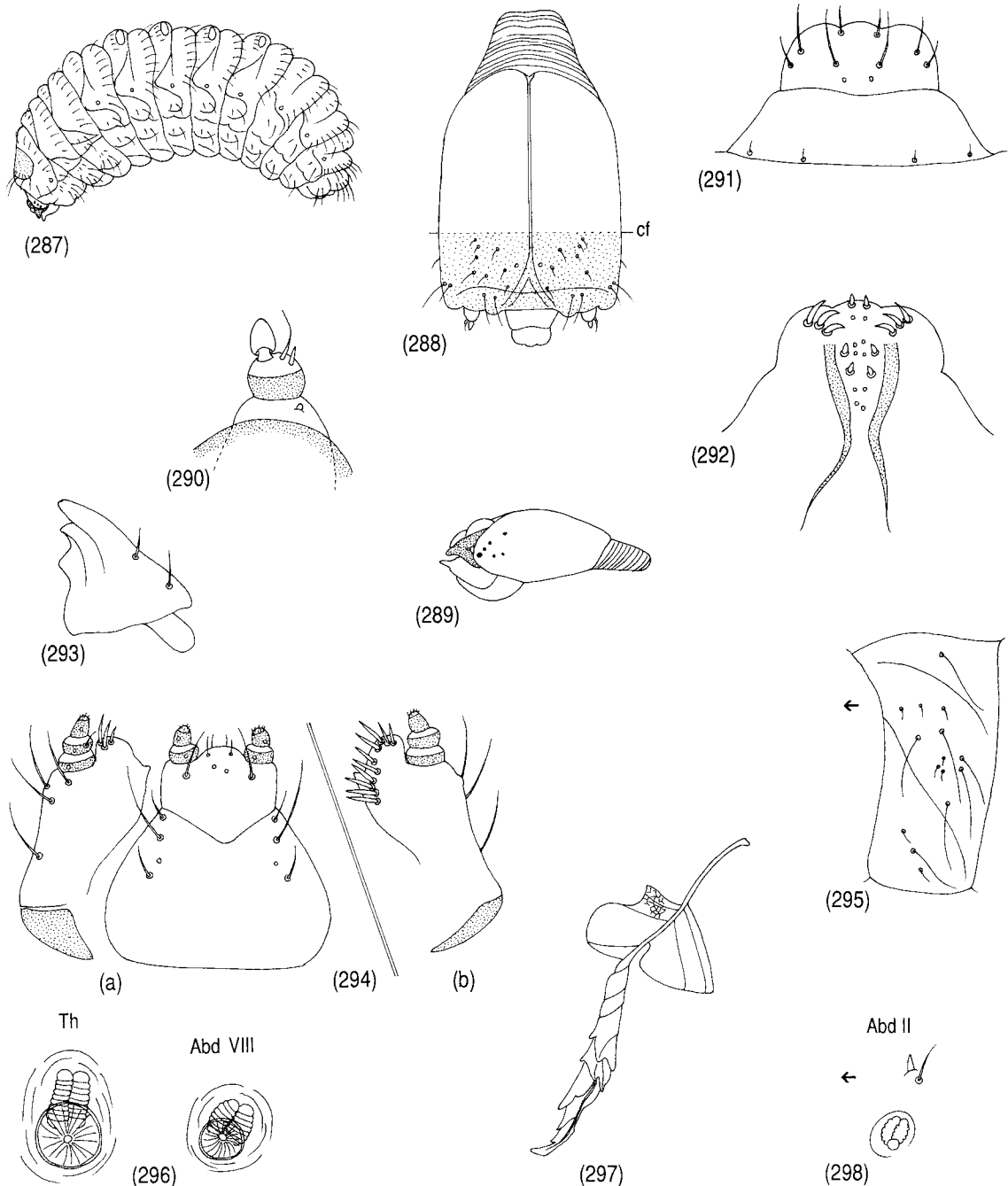
Attelabidae: Attelabinae

Fig. 262–275 *Attelabus nitens*: (262) habitus, lateral, x8; (263, 264) head, dorsal and ventral, x30; (265) antenna, x265; (266) labrum, clypeus, and epistoma, x130; (267) epipharyngeal lining, x130; (268) mandible, x65; (269) maxilla and labium, x85 (a, ventral; b, dorsal maxilla); (270) Th II, pedal lobe and sternal setae, x45; (271) thoracic spiracle, x265; (272) 1st instar, head and prothorax, x30, showing labial and prosternal processes; (273) 1st instar, maxilla, labium, and prosternum, ventral, x95; (274) 1st instar, Abd V, eggburster and spiracle, x265; (275) box leaf-roll on oak (*Quercus* sp.), x0.5 (after Prell 1924).



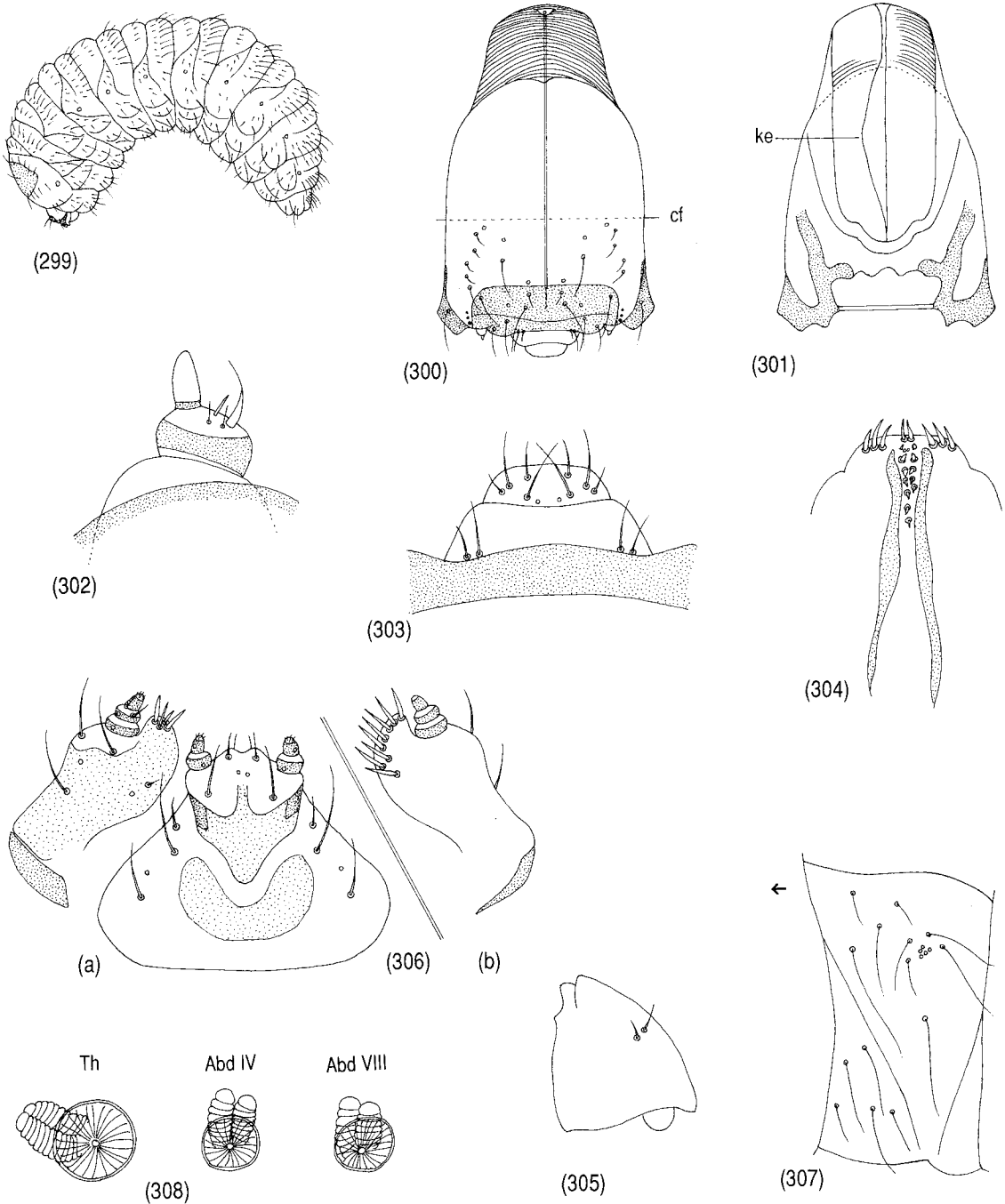
Attelabidae: Rhynchitinae

Fig. 276–285 *Byctiscus betulae*: (276) habitus, lateral, x10; (277) head, dorsal, x40; (278) antenna, x265; (279) labrum, clypeus, and epistoma, x95; (280) epipharyngeal lining, x95; (281) mandible and labium, x110 (a, ventral; b, dorsal maxilla); (282) maxilla and labium, x110 (a, ventral; b, dorsal maxilla); (283) Th II, ventropleural, pedal and sternal lobes, x95; (284) spiracles, x265; (285) cigar-shaped leaf roll on aspen (*Populus tremula*), x0.5 (after Prell 1924). **Fig. 286 *B. populi*,** antenna, x265.



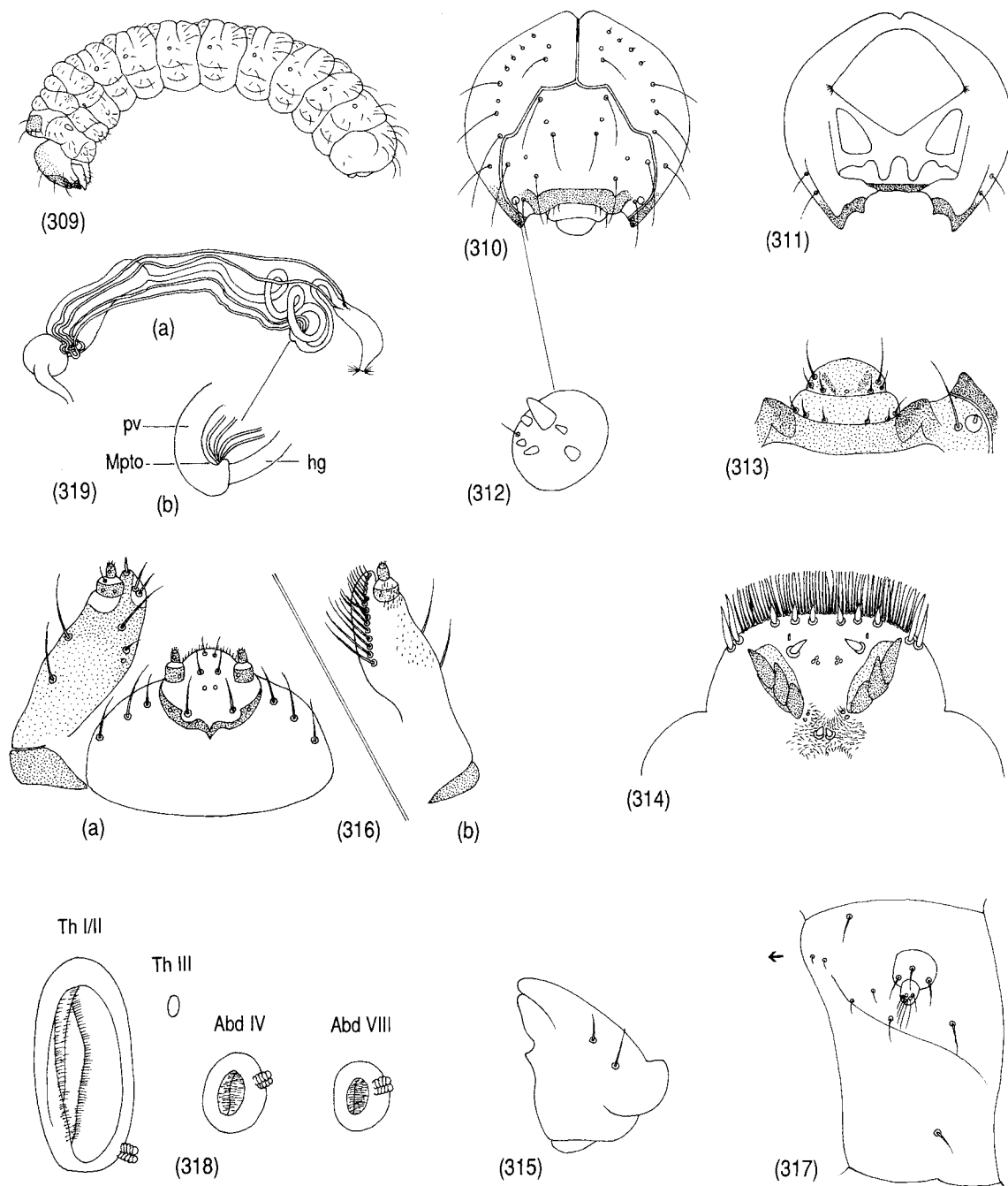
Attelabidae: Rhynchitinae

Fig. 287–298 *Deporaus betulae*: (287) habitus, lateral, x15; (288, 289) head, dorsal and lateral, x45; (290) antenna, x265; (291) labrum and clypeus, x185; (292) epipharyngeal lining, x185; (293) mandible, x185; (294) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (295) Th II, ventropleural, pedal and sternal setae, x95; (296) spiracles, x185; (297) funnel-shaped leaf roll on birch (*Betula* sp.) x0.5 (after Prell 1924); (298) 1st instar, Abd II, egg-burster and spiracle, x265.



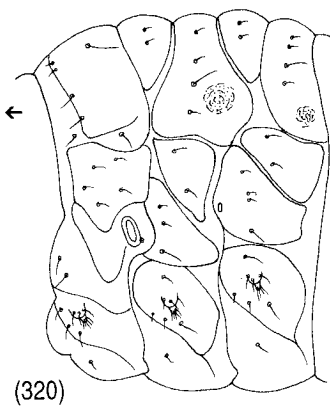
Attelabidae: Rhynchitinae

Fig. 299–308 *Rhynchites auratus*: (299) habitus, lateral, x4; (300, 301) head, dorsal and ventral, x20; (302) antenna, x265; (303) labrum and clypeus, x185; (304) epipharyngeal lining, x185; (305) mandible, x55; (306) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (307) Th II, pedal and sternal setae, x55; (308) spiracles, x265.

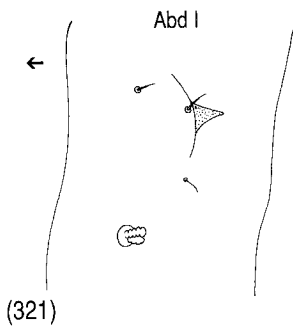


Brentidae: Brentinae

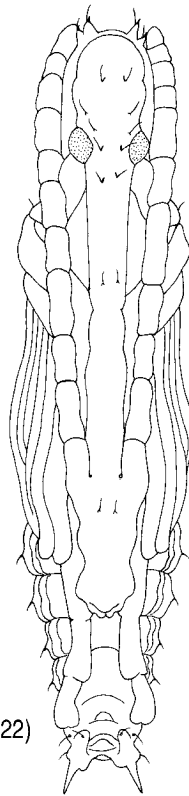
Fig. 309–319 *Lasiorhynchus barbicornis*: (309) habitus, lateral, x3; (310, 311) head, dorsal and ventral, x15; (312) antenna, x265; (313) labrum, clypeus, epistoma, and antenna, x30; (314) epipharyngeal lining, x95; (315) mandible, x45; (316) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (317) Th II, pedal and sternal areas, x40; (318) spiracles, x95; (319) alimentary canal, showing (a) Mpts of one side only, x4, and (b) origin of Mpts, x15.



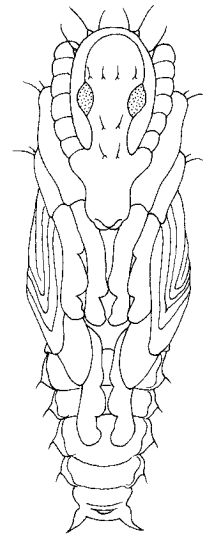
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(322)



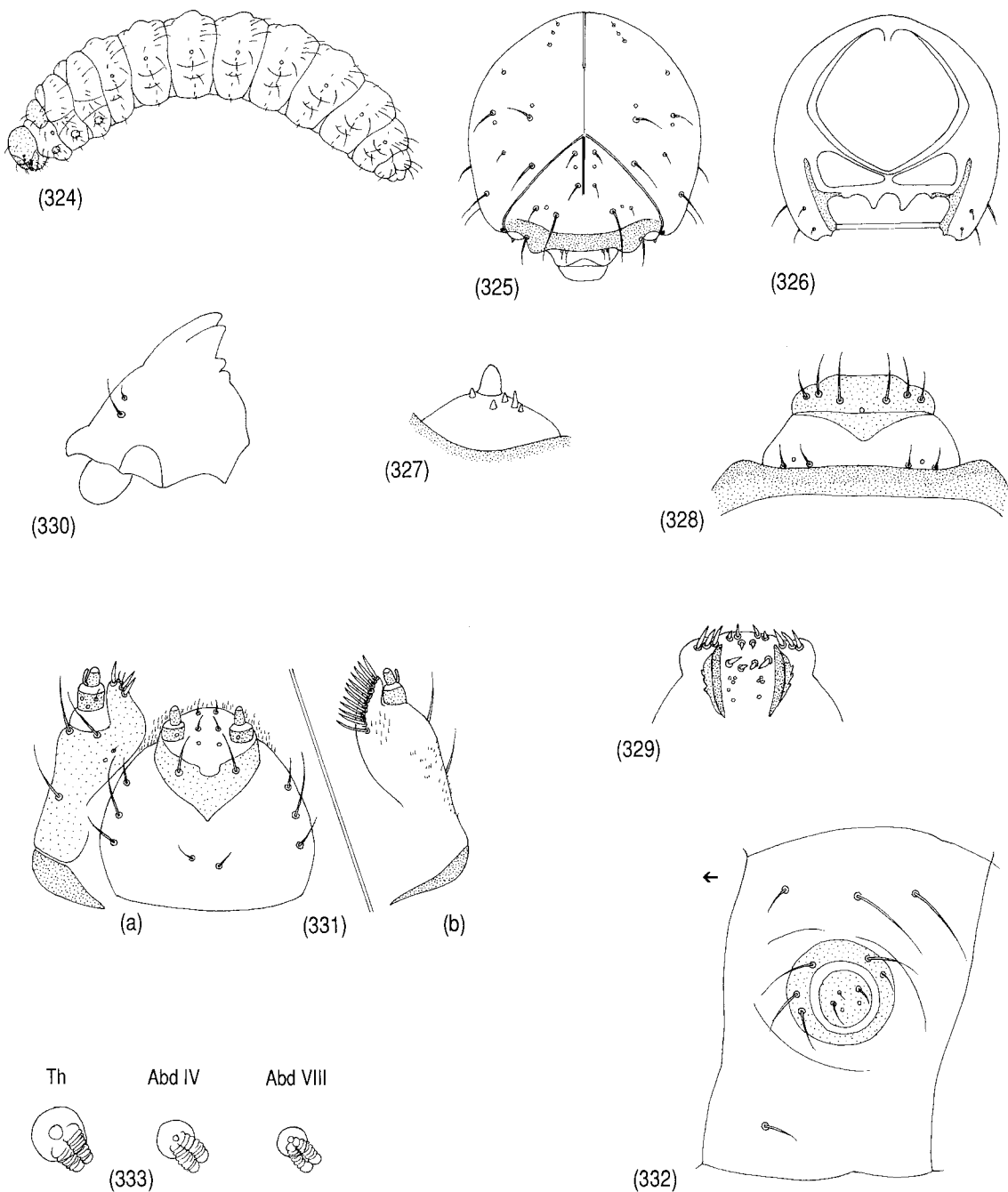
(323)

Brentidae: Brentinae

Fig. 320–322 *Lasiorhynchus barbicornis*: (320) thoracic segments, x15;
(321) 1st instar, Abd I, egg-bursting spine, x130; (322) male pupa, x7.

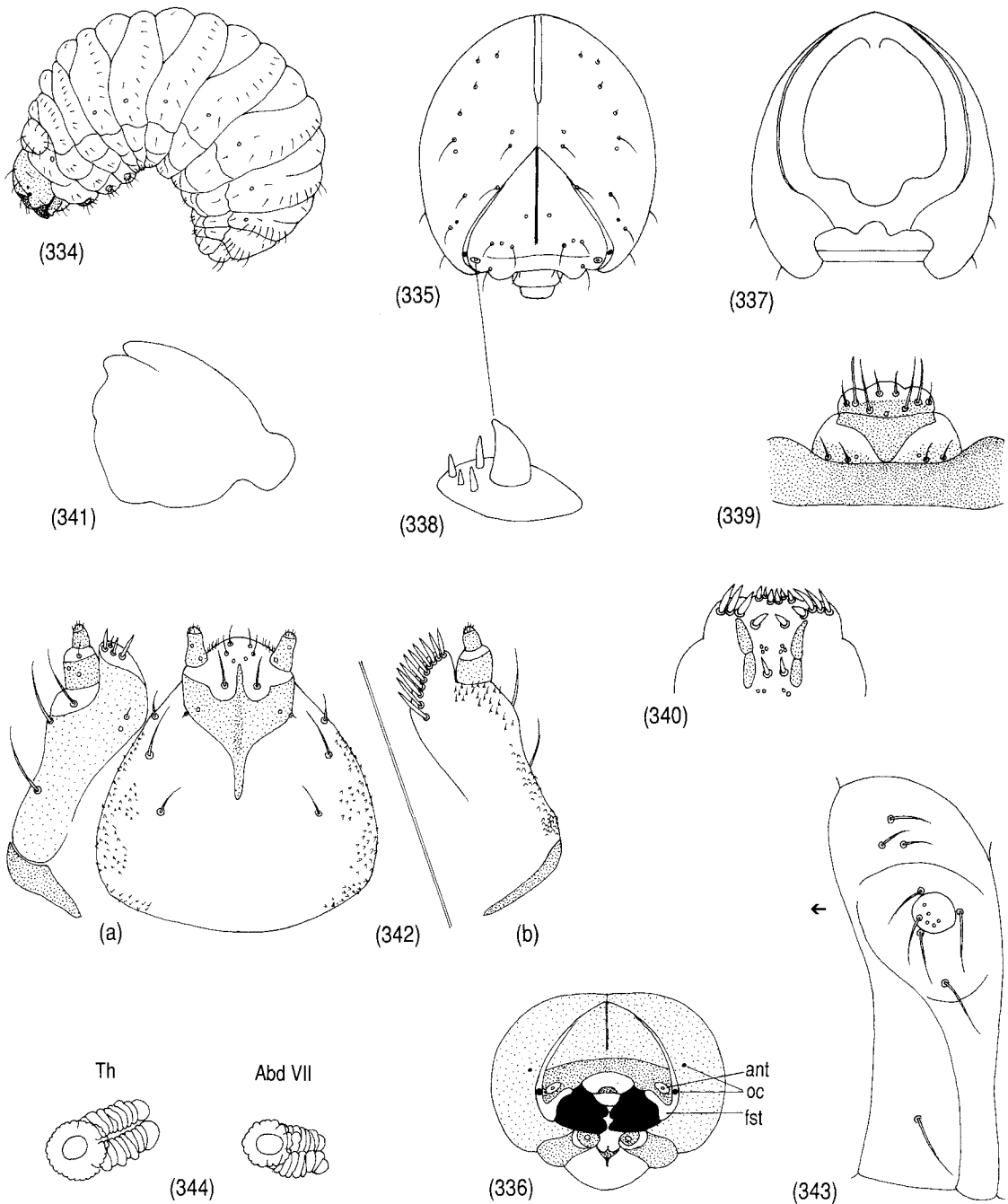
Brentidae: Cyladinae

Fig. 323 *Cylas formicarius*, male pupa, x10.



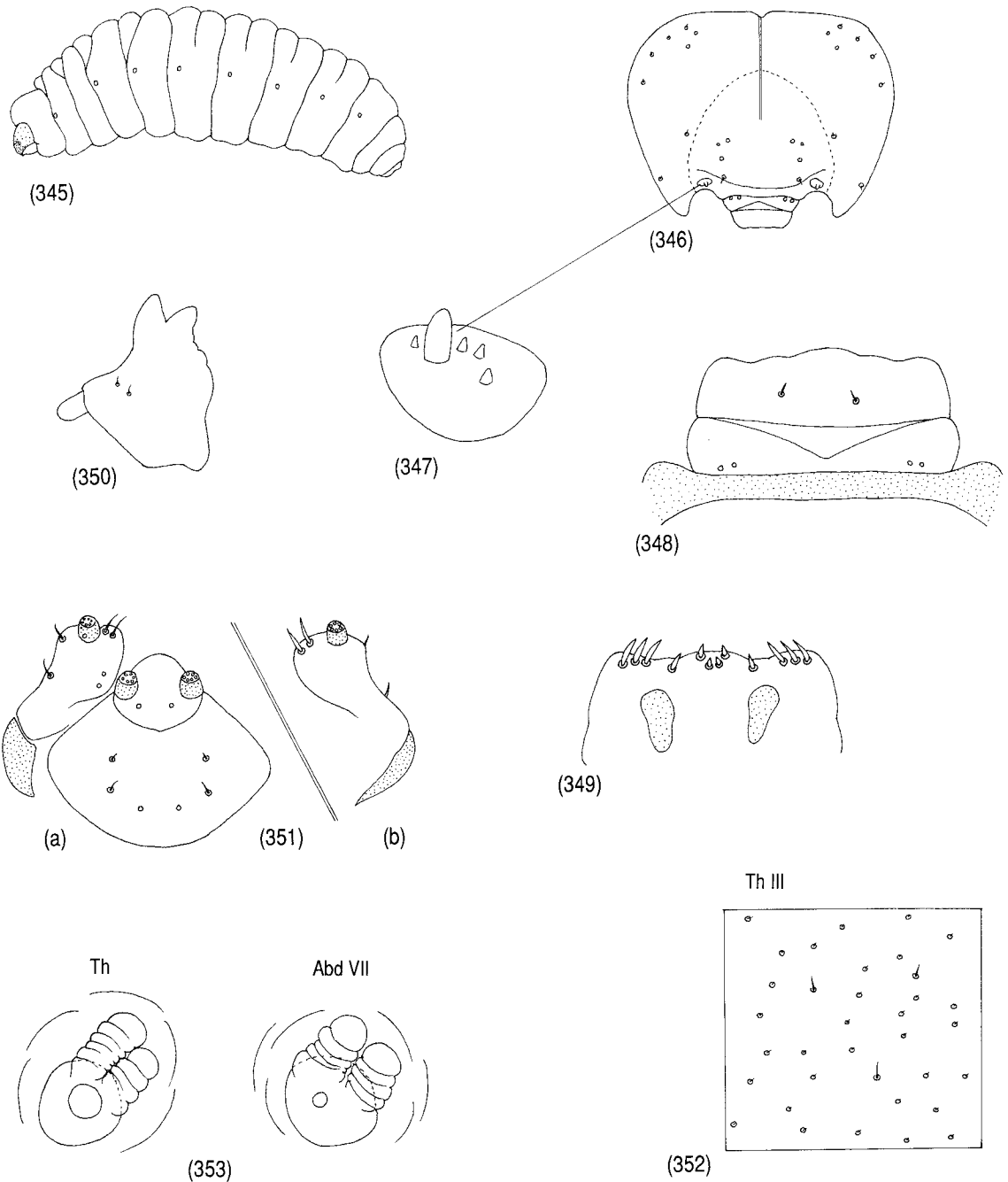
Brentidae: Cyladinae

Fig. 324–333 *Cylas formicarius*: (324) habitus, lateral, x7; (325, 326) head, dorsal and ventral, x40; (327) antenna, x265; (328) labrum, clypeus, and epistoma, x130; (329) epipharyngeal lining, x130; (330) mandible, x130; (331) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (332) Th II, ventropleural, pedal, and sternal areas, x110; (333) spiracles, x110.



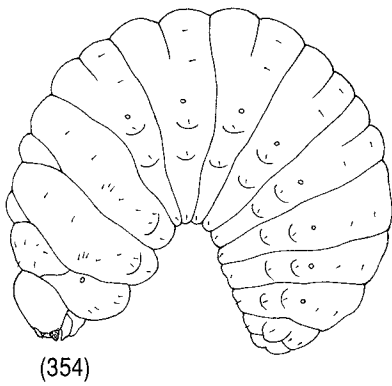
Brentidae: Antliarhinae

Fig. 334–344 *Tanaos interstitialis*: (334) habitus, lateral, x8; (335–337) head, dorsal, frontal, and ventral, x30; (338) antenna, x530; (339) labrum, clypeus, and epistoma, x95; (340) epipharyngeal lining, x130; (341) mandible, x95; (342) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (343) Th II, ventropleural, pedal, and sternal areas, x65; (344) spiracles, x265.

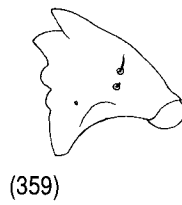


Brentidae: Antliarhininae

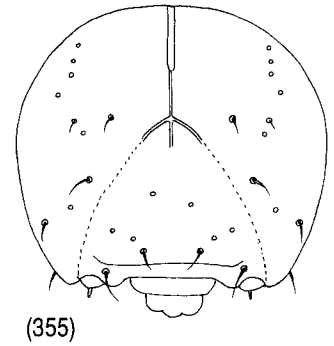
Fig. 345–353 *Antliarhis zamiae*: (345) habitus, lateral, x7; (346) head, dorsal, x65; (347) antenna, x530; (348) labrum, clypeus, and epistoma, x265; (349) epipharyngeal lining, x265; (350) mandible, x165; (351) maxilla and labium, x130 (a, ventral; b, dorsal maxilla); (352) Th III, pedal area, showing typical skin points, x130; (353) spiracles, x265.



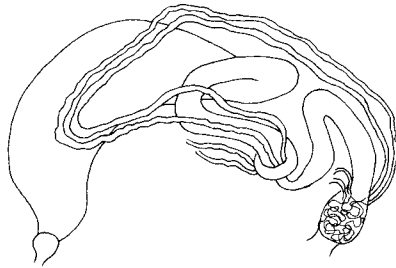
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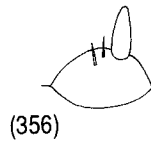
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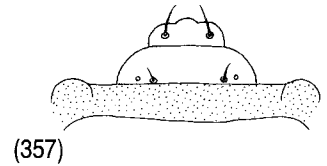
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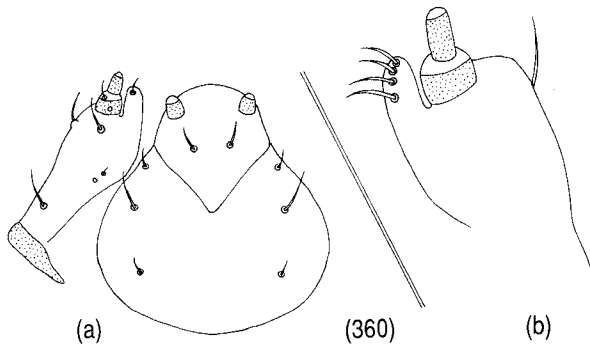
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(358)



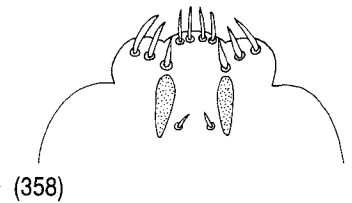
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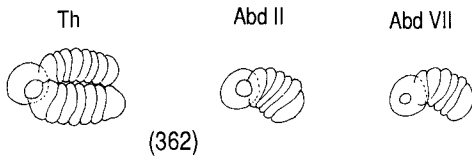
(a)

(360)

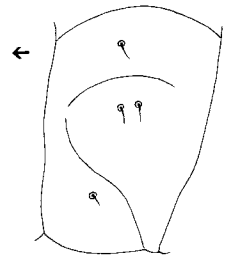
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(361)



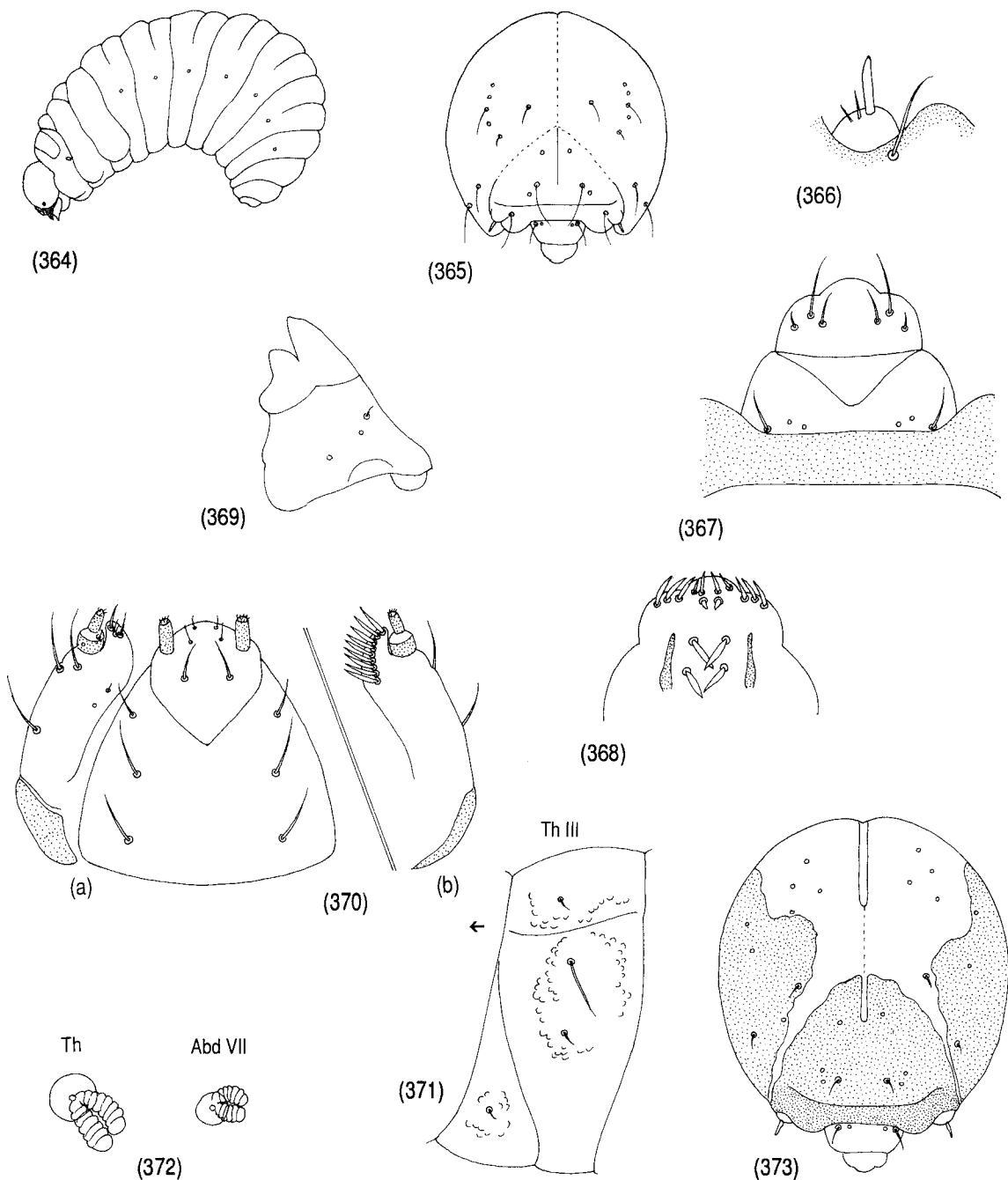
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(363)

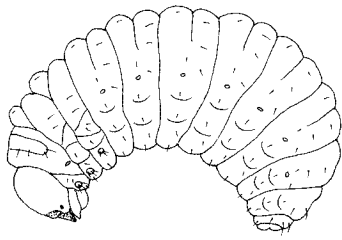
Brentidae: Apioninae

Fig. 354–363 *Exapionulicis*: (354) habitus, lateral, x45; (355) head, dorsal, x165; (356) antenna, x330; (357) labrum, clypeus, and epistoma, x165; (358) epipharyngeal lining, x165; (359) mandible, x165; (360) maxilla and labium (a, ventral, x165; b, dorsal maxilla, x330); (361) Th II, ventropleural, pedal, and sternal areas, x65; (362) spiracles, x330 (Abd VIII absent); (363) alimentary canal, x45.

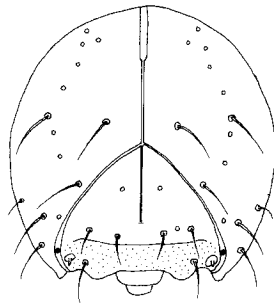


Brentidae: Apioninae

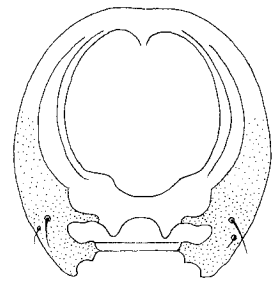
Fig. 364–372 *Neocyba metrosideros*: (364) habitus, lateral, x15 (setae omitted); (365) head, dorsal, x65; (366) antenna, x265; (367) labrum, clypeus, and epistoma, x265; (368) epipharyngeal lining, x265; (369) mandible, x165; (370) maxilla and labium, x165 (a, ventral; b, dorsal maxilla); (371) Th III, pedal and medio-sternal lobes, x130; (372) spiracles, x330. **Fig. 373 *Neocyba* sp. A,** head, dorsal, x65.



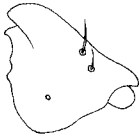
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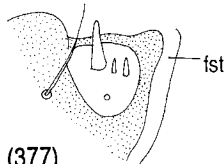
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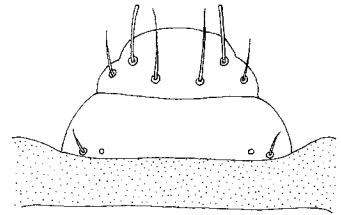
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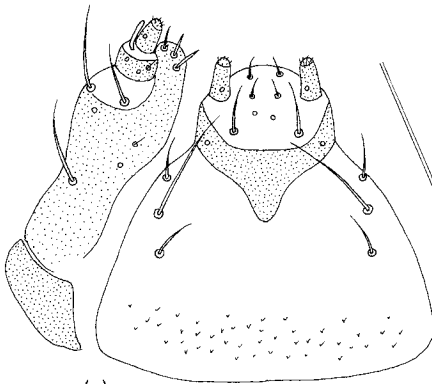
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(377)



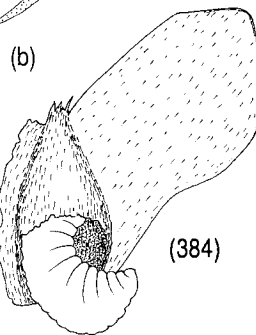
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(a)



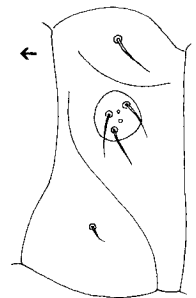
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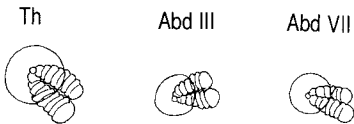
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(379)



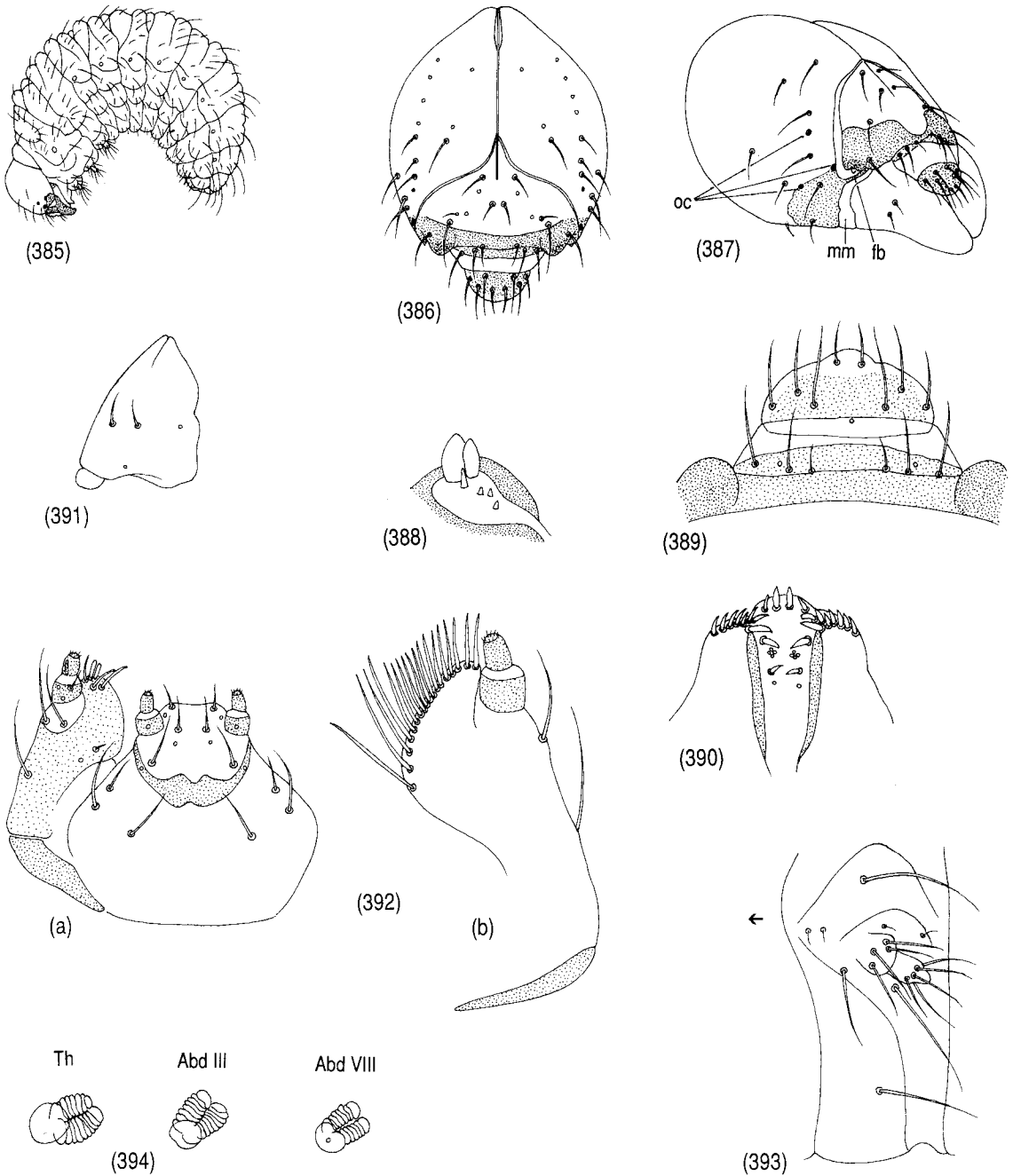
(382)



(383)

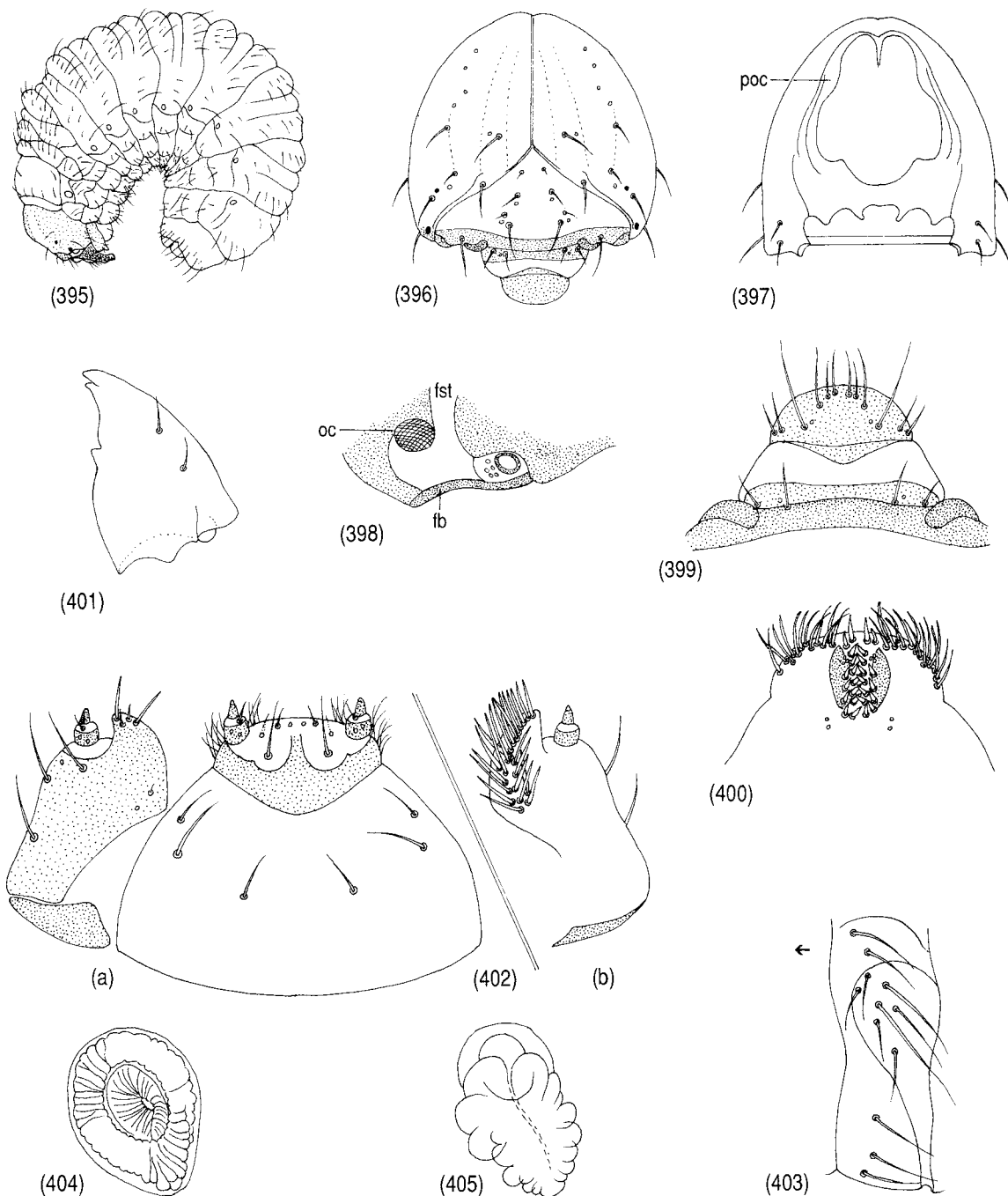
Brentidae: Apioninae

Fig. 374–384 *Neocyba* sp. B: (374) habitus, lateral, x20; (375, 376) head, dorsal and ventral, x65; (377) antenna, x100; (378) labrum, clypeus, and epistoma, x265; (379) epipharyngeal lining, x265; (380) mandible, x130; (381) maxilla and labium, x185 (a, ventral; b, dorsal maxilla); (382) Th II, ventropleural, pedal, and sternal areas, x65; (383) spiracles, x265; (384) larva in seed-case of *Libocedrus bidwilli*, x65.



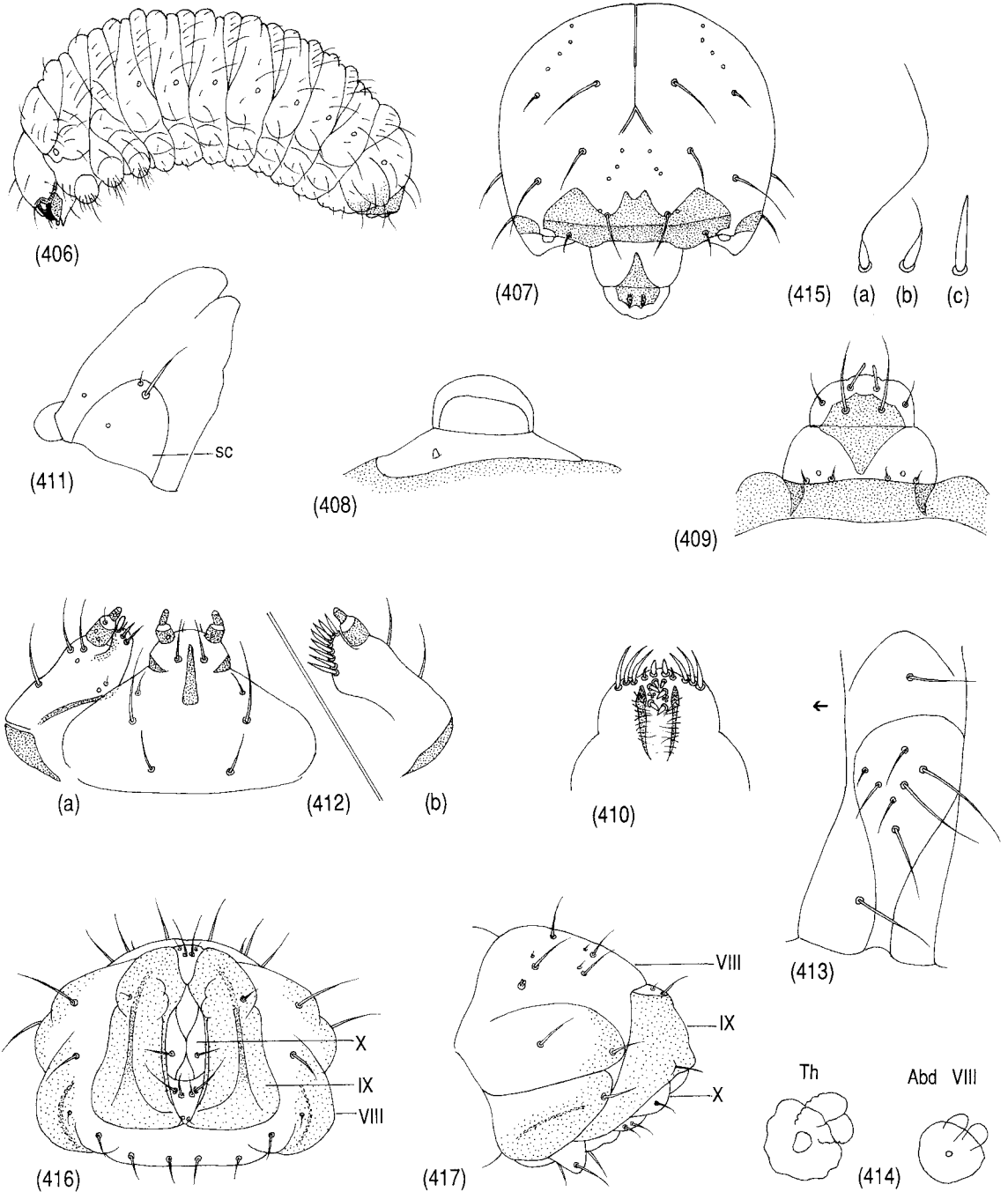
Curculionidae: Brachycerinae: Ithycerini

Fig. 385–394 *Ithycerus noveboracensis*: (385) habitus, lateral, x2; (386, 387) head, dorsal, 1st instar, x35, and laterofrontal, x10; (388) antenna, 1st instar, x265 (on ventral surface); (389) labrum, clypeus, and epistoma, 1st instar, x95; (390) epipharyngeal lining, 1st instar, x95; (391) mandible, 1st instar, x55; (392) maxilla and labium, 1st instar, x95 (a, ventral; b, dorsal maxilla); (393) Th II, 1st instar, ventropleural, pedal, and mediosternal lobes, x55; (394) spiracles, 1st instar, x265.



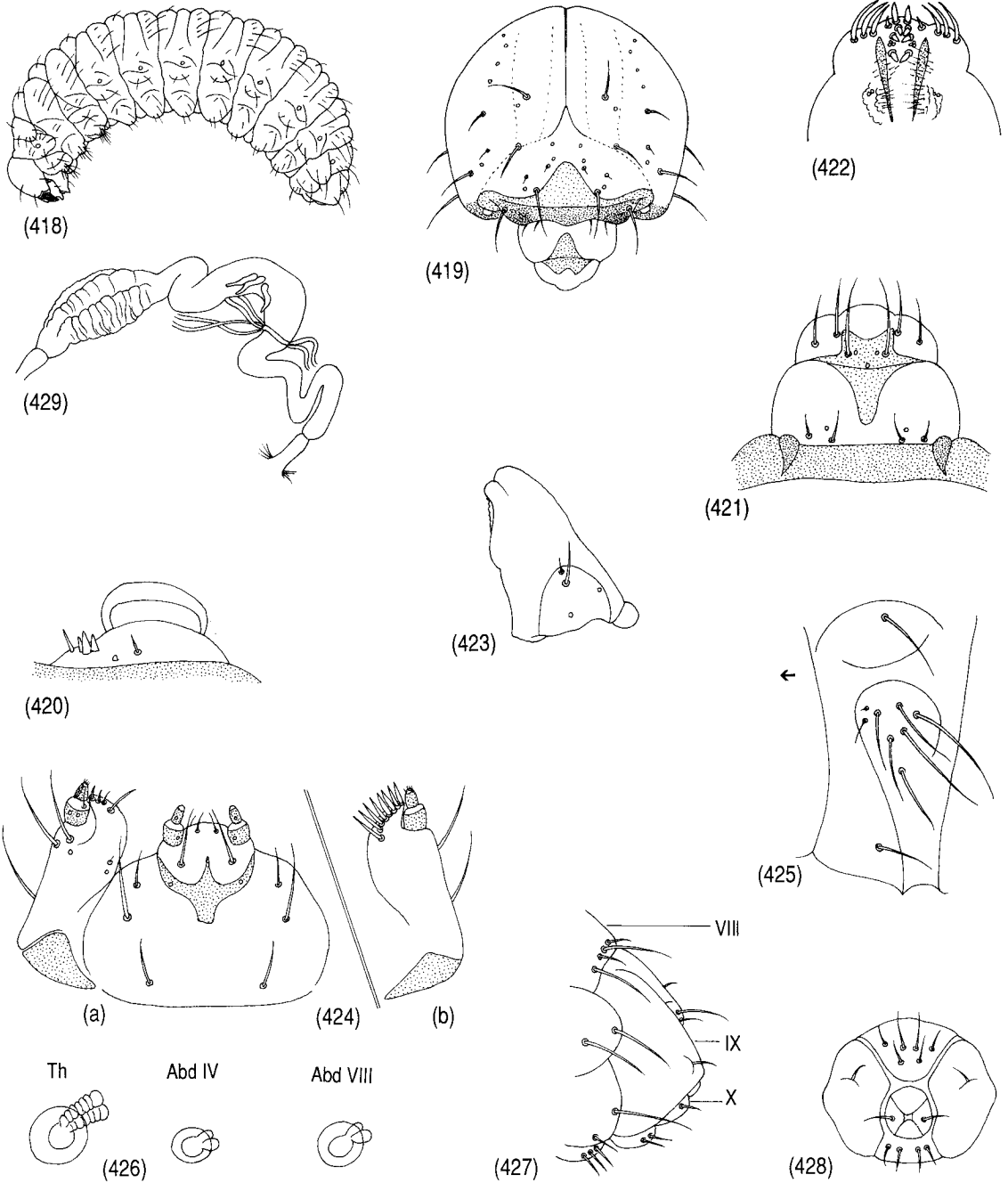
Curculionidae: Brachycerinae: Brachycerini

Fig. 395–405 *Brachycerus monachus*: (395) habitus, lateral, x2; (396, 397) head, dorsal and ventral, x4; (398) antenna and frontal suture, x35; (399) labrum, clypeus, and epistoma, 1st instar, x25; (400) epipharyngeal lining, 1st instar, x35; (401) mandible, x9; (402) maxilla and labium, x15 (a, ventral; b, dorsal maxilla); (403) Th II, ventropleural, pedal, and mediosternal lobes, 1st instar, x40; (404) spiracles, x70; (405) abdominal spiracle, 1st instar, x40.



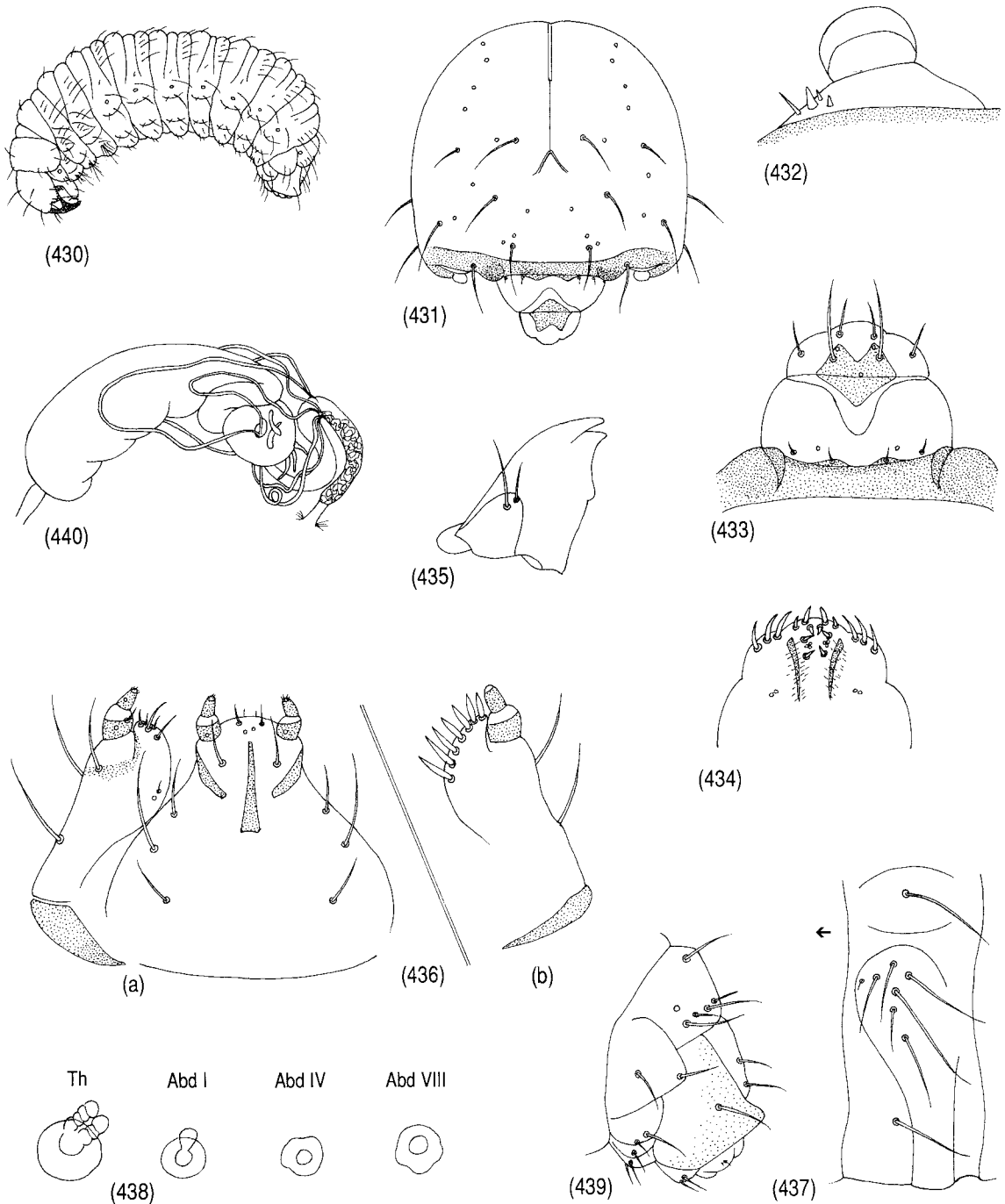
Curculionidae: Brachycerinae: Entimini: Leptopiina

Fig. 406–417 *Catoptes cuspidatus*: (406) habitus, lateral, x10; (407) head, dorsal, x20; (408) antenna, x265; (409) labrum, clypeus, and epistoma, x65; (410) epipharyngeal lining, x65; (411) mandible, x65; (412) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (413) Th III, ventropleural and mediosternal lobes, x40; (414) spiracles, x165; (415) types of abdominal setae, x95 (a, major *pds*; b, minor *pds*; c, *msts*); (416, 417) abdominal segments VIII–X, caudoventral and lateral, x10.



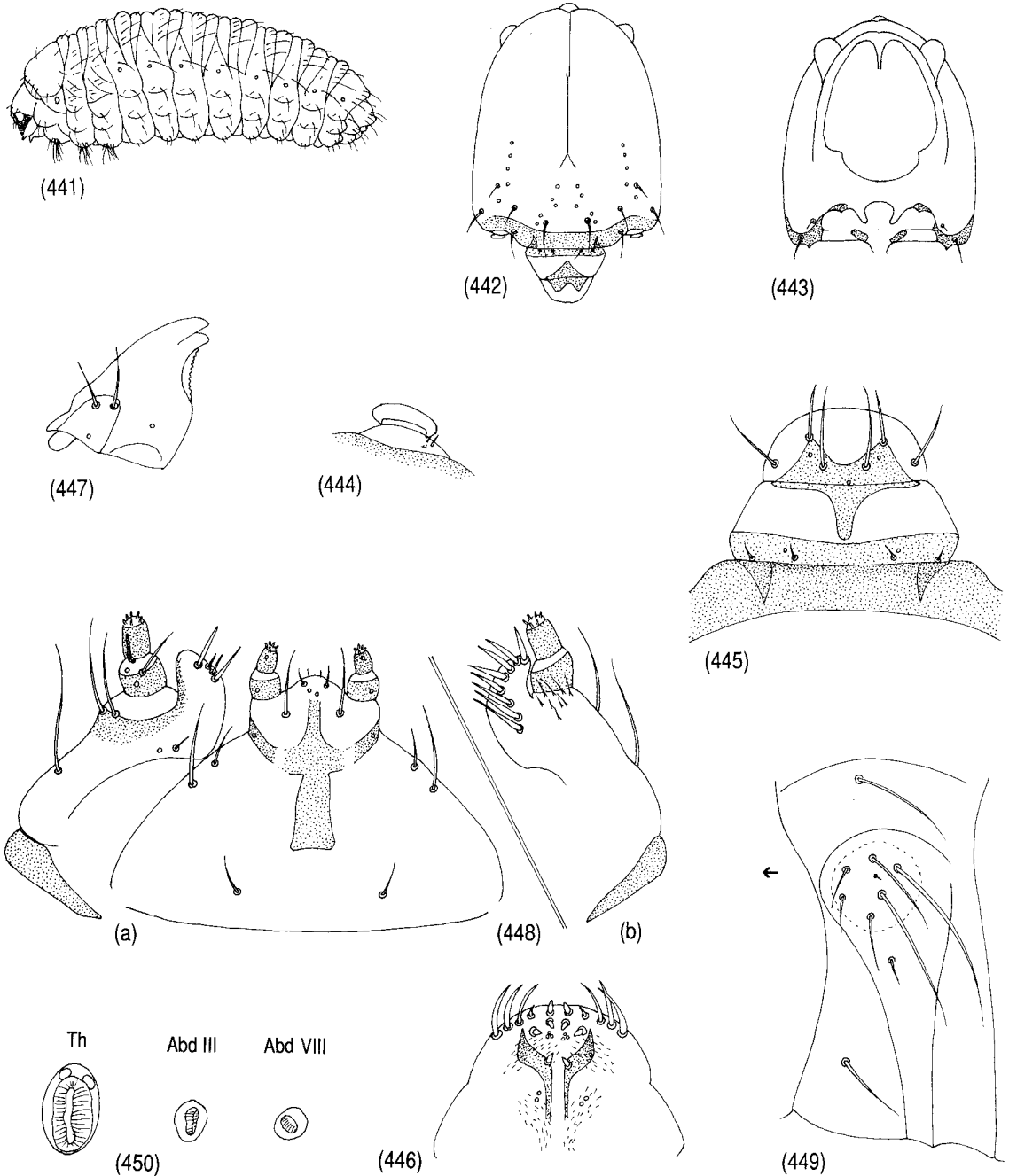
Curculionidae: Brachycerinae: Entimini: Leptopiina

Fig. 418–429 *Irenimus compressus*: (418) habitus, lateral, x7; (419) head, dorsal, x20; (420) antenna, x265; (421) labrum, clypeus, and epistoma, x65; (422) epipharyngeal lining, x65; (423) mandible, x45; (424) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (425) Th II, ventropleural, pedal, and mediosternal lobes, x55; (426) spiracles, x65; (427) abdominal segments VIII–X, lateral, x30; (428) abdominal segments IX and X, caudal, x15; (429) alimentary canal (distorted), x7.



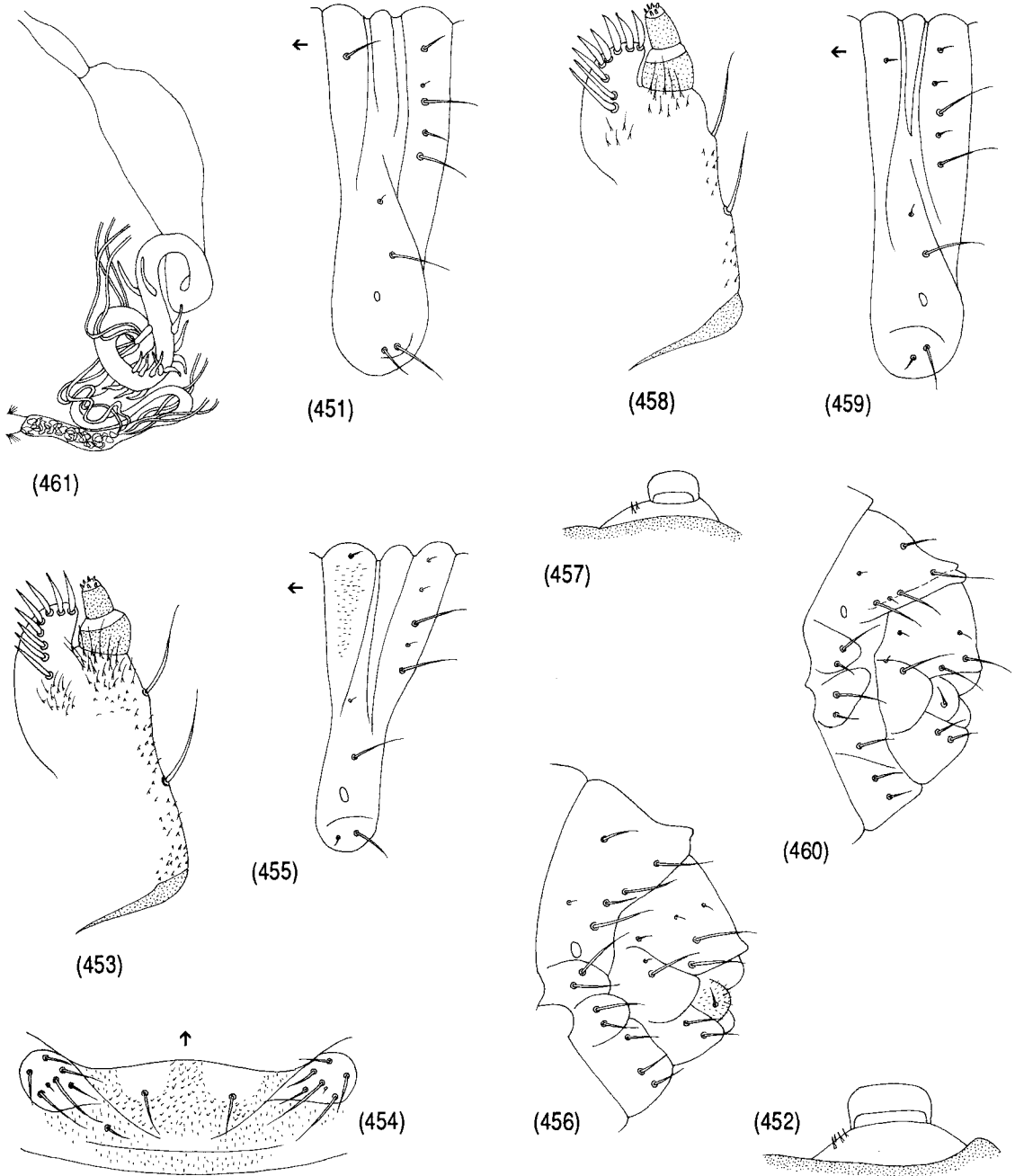
Curculionidae: Brachycerinae: Entimini: Leptopiina

Fig. 430–440 *Mandalotus miricollis*: (430) habitus, lateral, x6; (431) head, dorsal, x45; (432) antenna, x265; (433) labrum, clypeus, and epistoma, x35; (434) epipharyngeal lining, x35; (435) mandible, x20; (436) maxilla and labium, x35 (a, ventral; b, dorsal maxilla); (437) Th II, ventropleural, pedal, and mediosternal lobes, x45; (438) spiracles, x65; (439) abdominal segments VIII–X, x10; (440) alimentary canal, x6.



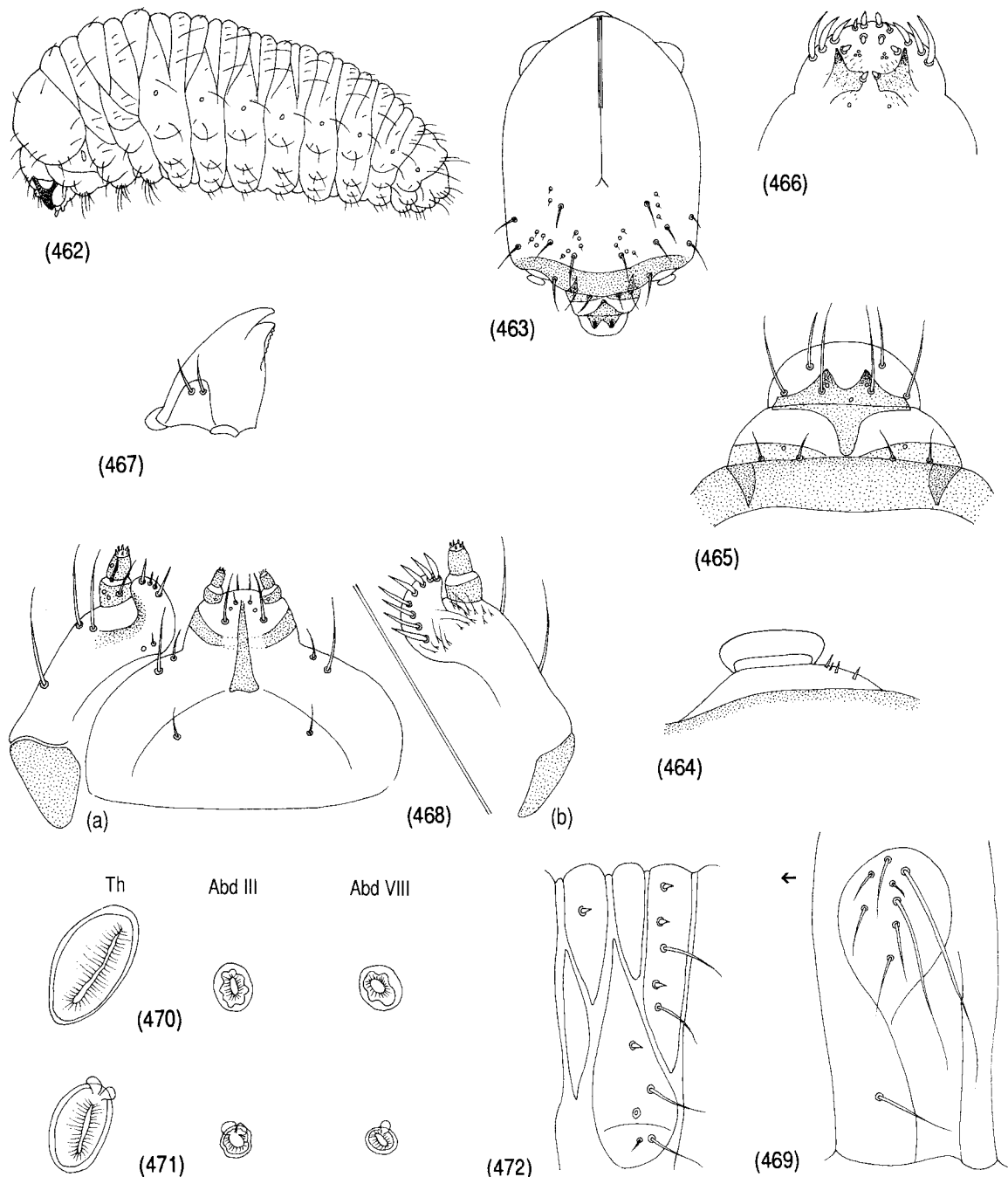
Curculionidae: Brachycerinae: Entimini: Naupactina

Fig. 441–450 *Asynonychus cervinus*: (441) habitus, lateral, x7; (442, 443) head, dorsal and ventral, x20; (444) antenna, x130; (445) labrum, clypeus, and epistoma, x65; (446) epipharyngeal lining, x65; (447) mandible, x65; (448) maxilla and labium, x35 (a, ventral; b, dorsal maxilla); (449) Th II, ventropleural, pedal, and mediosternal lobes, x65; (450) spiracles, x130.



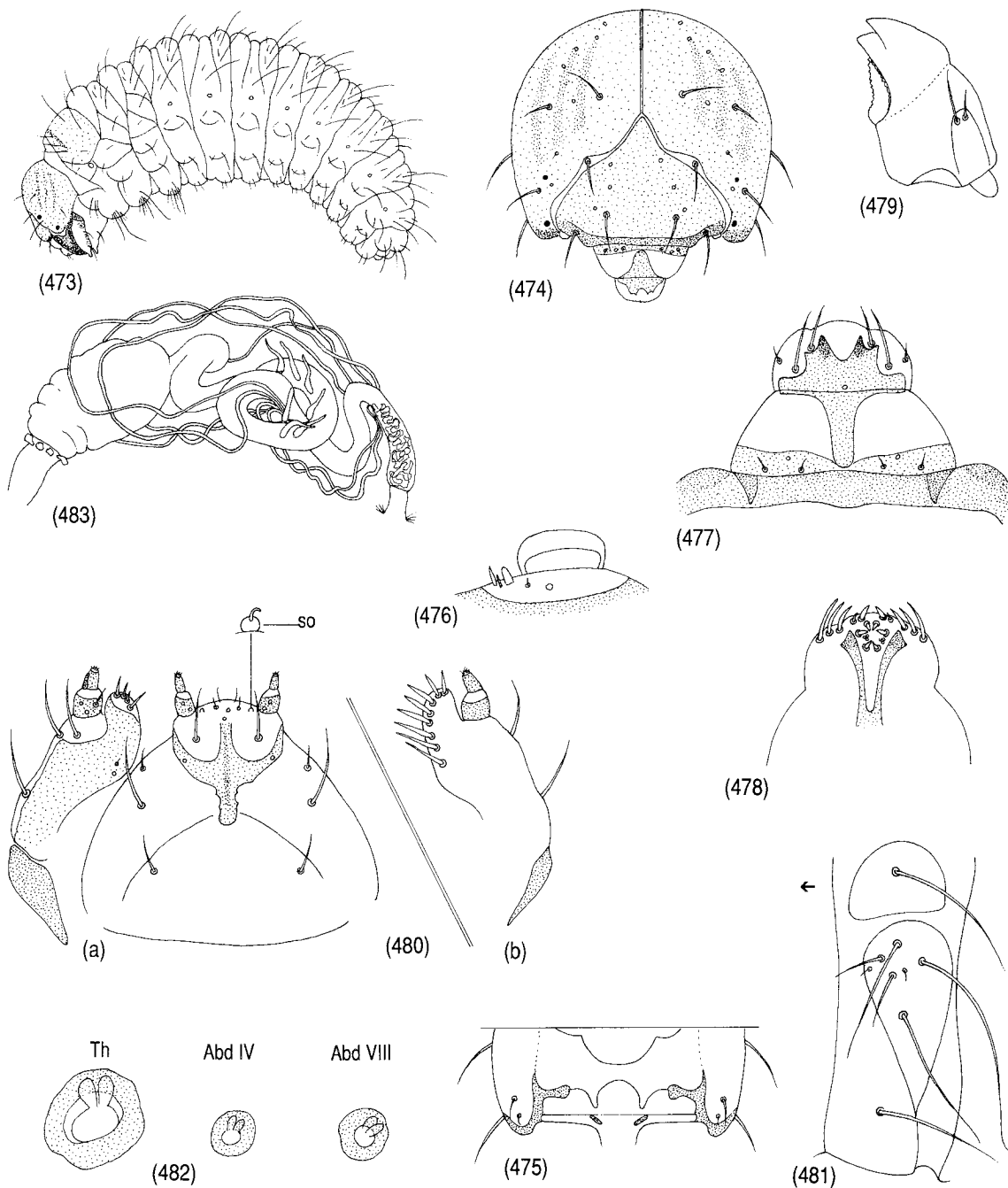
Curculionidae: Brachycerinae: Entimini

Fig. 451–461 Naupactina: 451, *Asynonychus cervinus*, Abd I, dorsal, spiracular, and dorsopleural areas, x20. 452–456, *Atrichonotus minimus*: (452) antenna, x130; (453) maxilla, dorsal, x55; (454) Th II, mediosternal and pedal areas, x20; (455) Abd I, dorsal, spiracular, and dorsopleural areas, x20; (456) Abd VIII–X, lateral, x20. 457–460, *Floresianus sordidus*: (457) antenna, x130; (458) maxilla, dorsal, x65; (459) Abd I, dorsal, spiracular, and dorsopleural areas, x20; (460) Abd VIII–X, lateral, x20. 461, *Graphognathus leucoloma*, alimentary canal, x4 (typical of the subtribe).



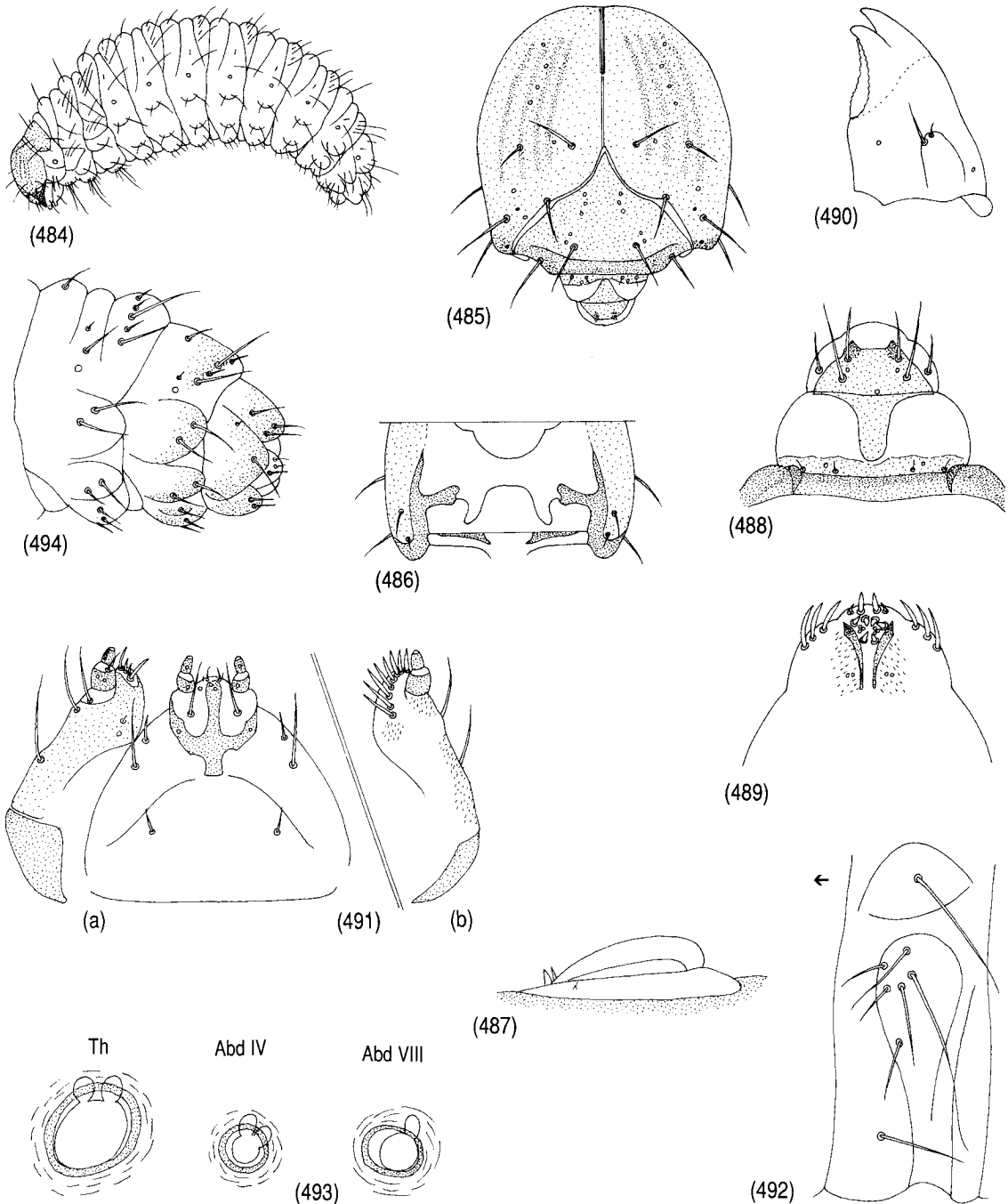
Curculionidae: Brachycerinae: Entimini: Naupactina

Fig. 462–472 *Graphognathus leucoloma*: (462) habitus, lateral, x4; (463) head, dorsal, x9; (464) antenna, x95; (465) labrum, clypeus, and epistoma, x35; (466) epipharyngeal lining, x35; (467) mandible, x20; (468) maxilla and labium, x20 (a, ventral; b, dorsal maxilla); (469) Th II, pedal and mediosternal lobes, x30; (470) spiracles, x55; (471) spiracles, early instar, x55; (472) Abd III, dorsal and dorsolateral areas, early instar, x20.



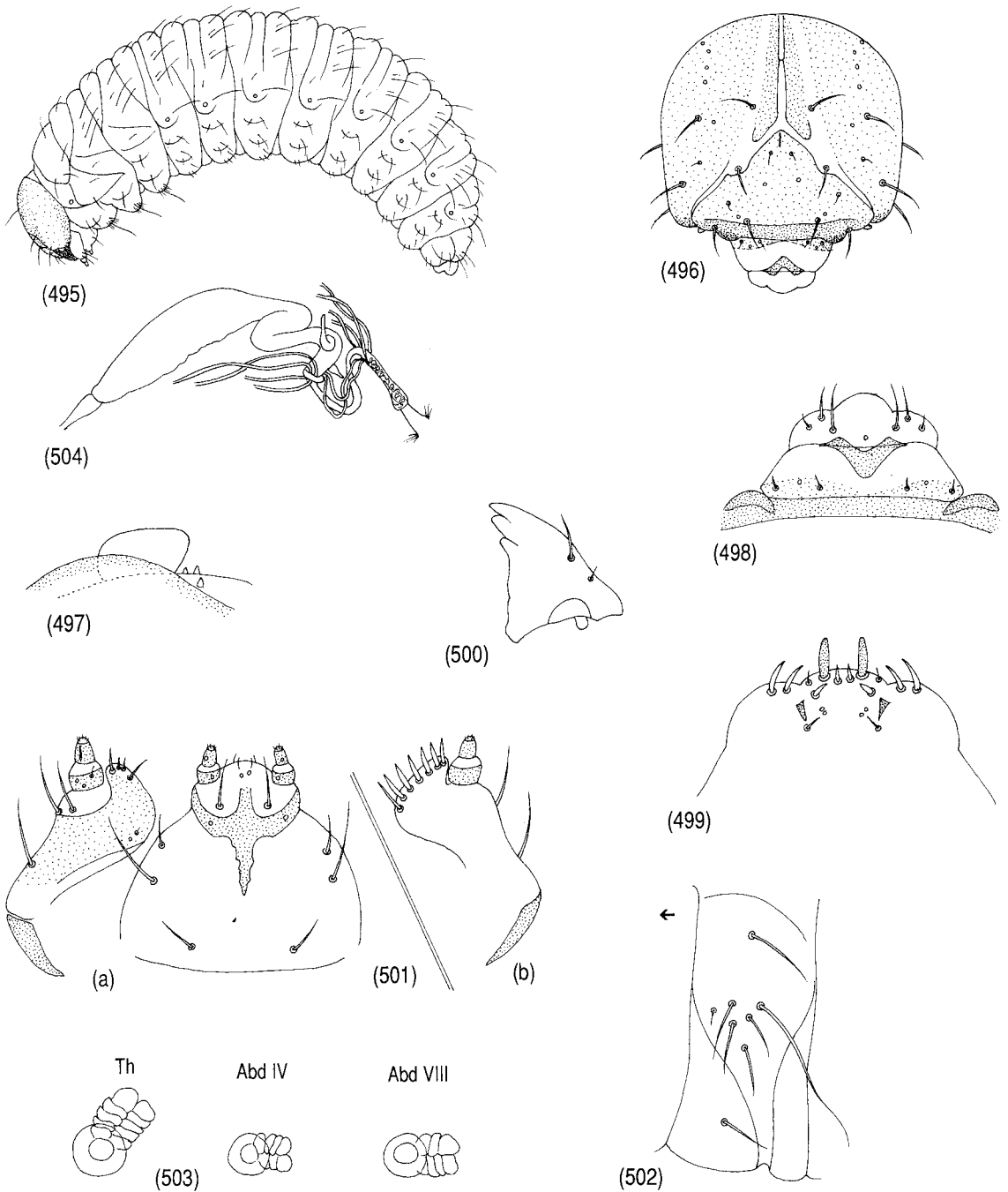
Curculionidae: Brachycerinae: Entimini: Otiorhynchina

Fig. 473–483 *Otiorhynchus sulcatus*: (473) habitus, lateral, x4; (474, 475) head, dorsal and ventral (anterior half only), x10; (476) antenna, x265; (477) labrum, clypeus, and epistoma, x35; (478) epipharyngeal lining, x35; (479) mandible, x25; (480) maxilla and labium, x25 (a, ventral; b, dorsal maxilla); (481) Th II, ventropleural, pedal, and mediosternal lobes, x20; (482) spiracles, x55; (483) alimentary canal, x4.



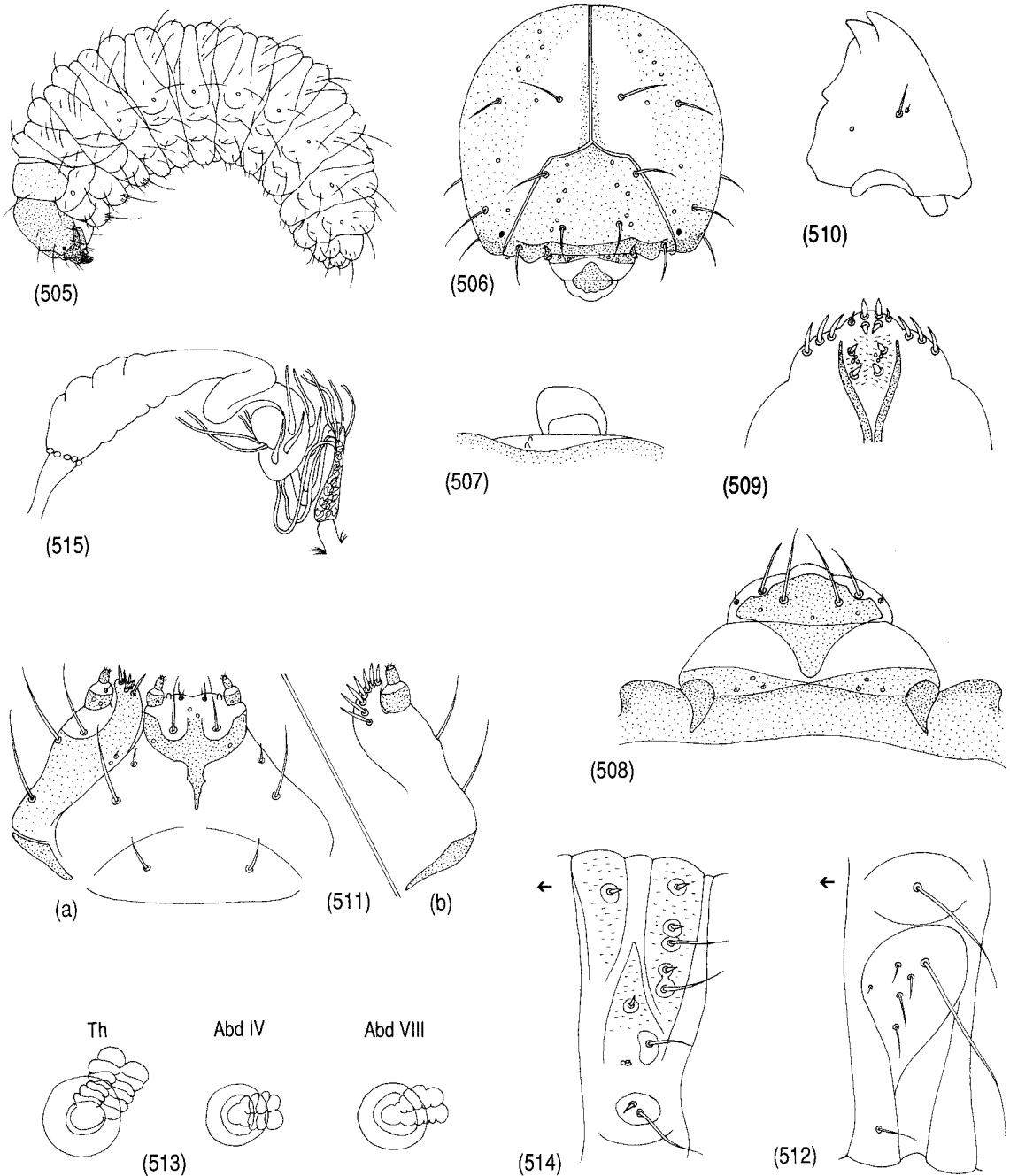
Curculionidae: Brachycerinae: Entimini: Otorhynchina

Fig. 484–494 *Phlyctinus callosus*: (484) habitus, lateral, x4; (485, 486) head, dorsal and ventral (anterior half only), x15; (487) antenna, x265; (488) labrum, clypeus, and epistoma, x30; (489) epipharyngeal lining, x35; (490) mandible, x45; (491) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (492) Th II, ventropleural, pedal, and mediosternal lobes, x30; (493) spiracles, x130; (494) Abd VII–X, x20.



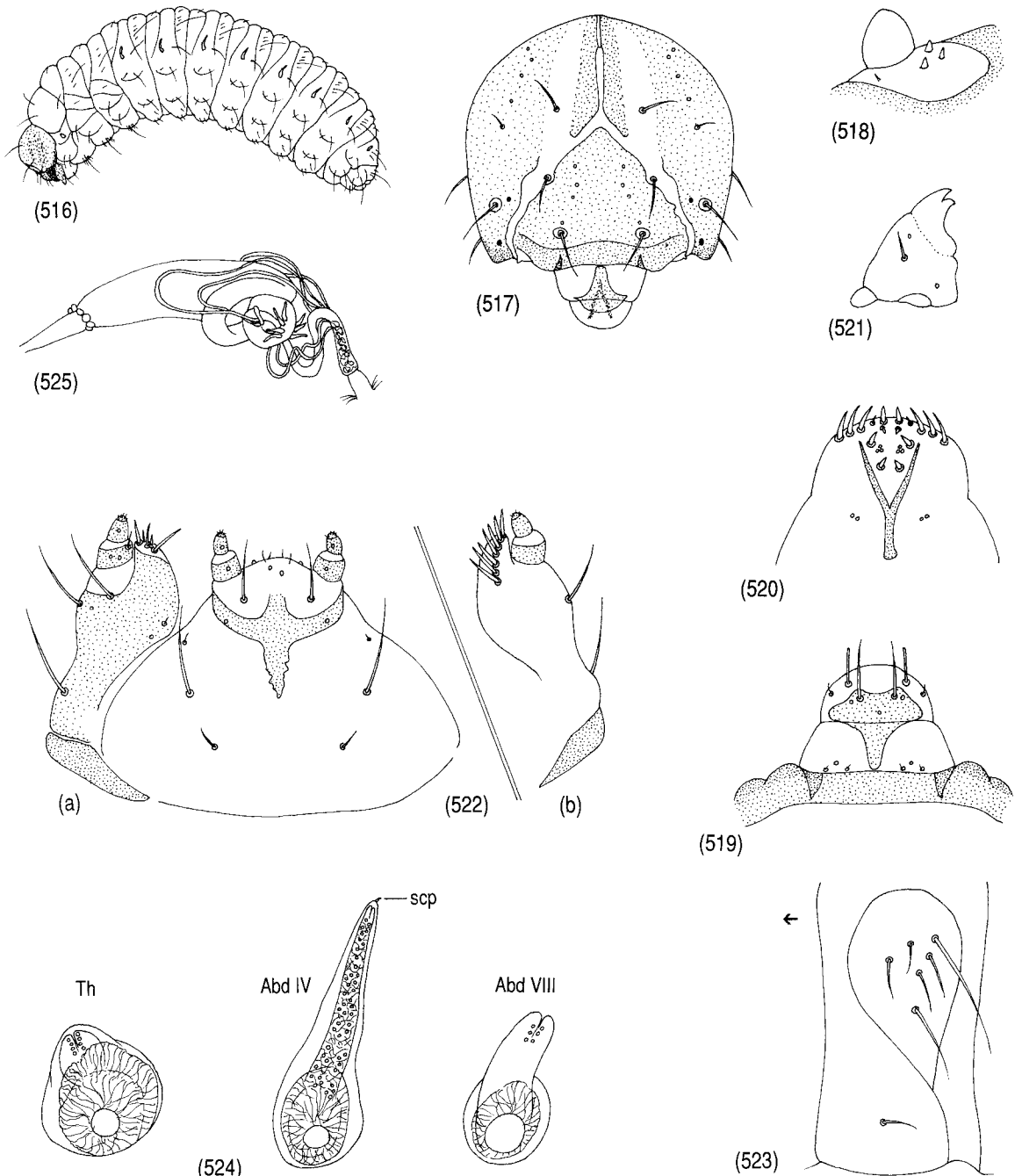
Curculionidae: Brachycerinae: Entimini: Sitonina

Fig. 495–504 *Sitona discoidea*: (495) habitus, lateral, x15; (496) head, dorsal, x25; (497) antenna, x130; (498) labrum, clypeus, and epistoma, x55; (499) epipharyngeal lining, x85; (500) mandible, x35; (501) maxilla and labium, x55 (a, ventral; b, dorsal maxilla); (502) Th II, ventropleural, pedal, and mediosternal lobes, x45; (503) spiracles, x120; (504) alimentary canal, x10.



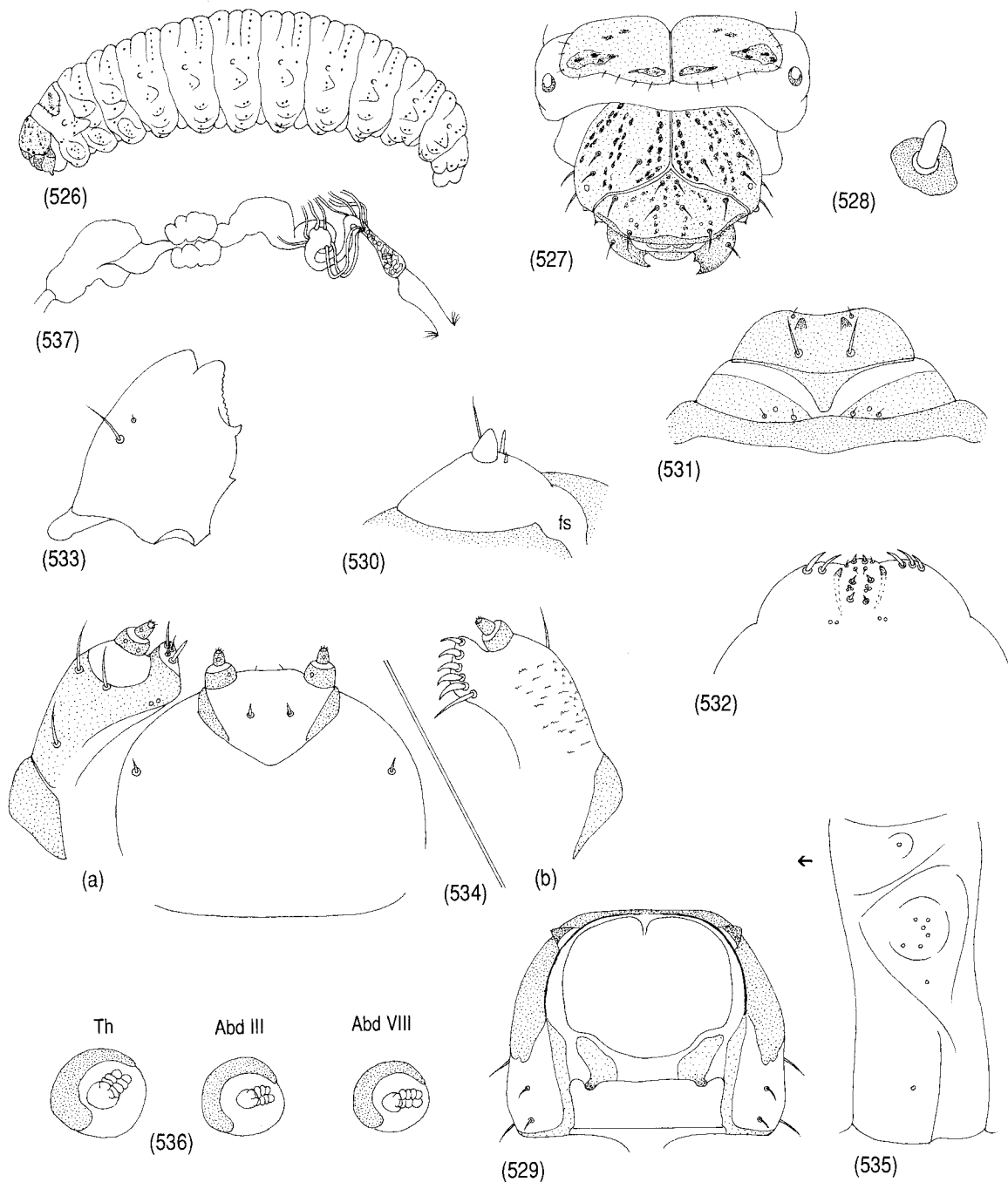
Curculionidae: Brachycerinae: Rhytirhinini

Fig. 505–515 *Gromilus thoracicus*: (505) habitus, lateral, x10; (506) head, dorsal, x20; (507) antenna, x265; (508) labrum, clypeus, and epistoma, x45; (509) epipharyngeal lining, x45; (510) mandible, x55; (511) maxilla and labium, x35 (a, ventral; b, dorsal maxilla); (512) Th II, ventropleural, pedal, and mediosternal lobes, x40; (513) spiracles, x110; (514) Abd IV, dorsal, spiracular, and dorsopleural areas, x30; (515) alimentary canal, x10.



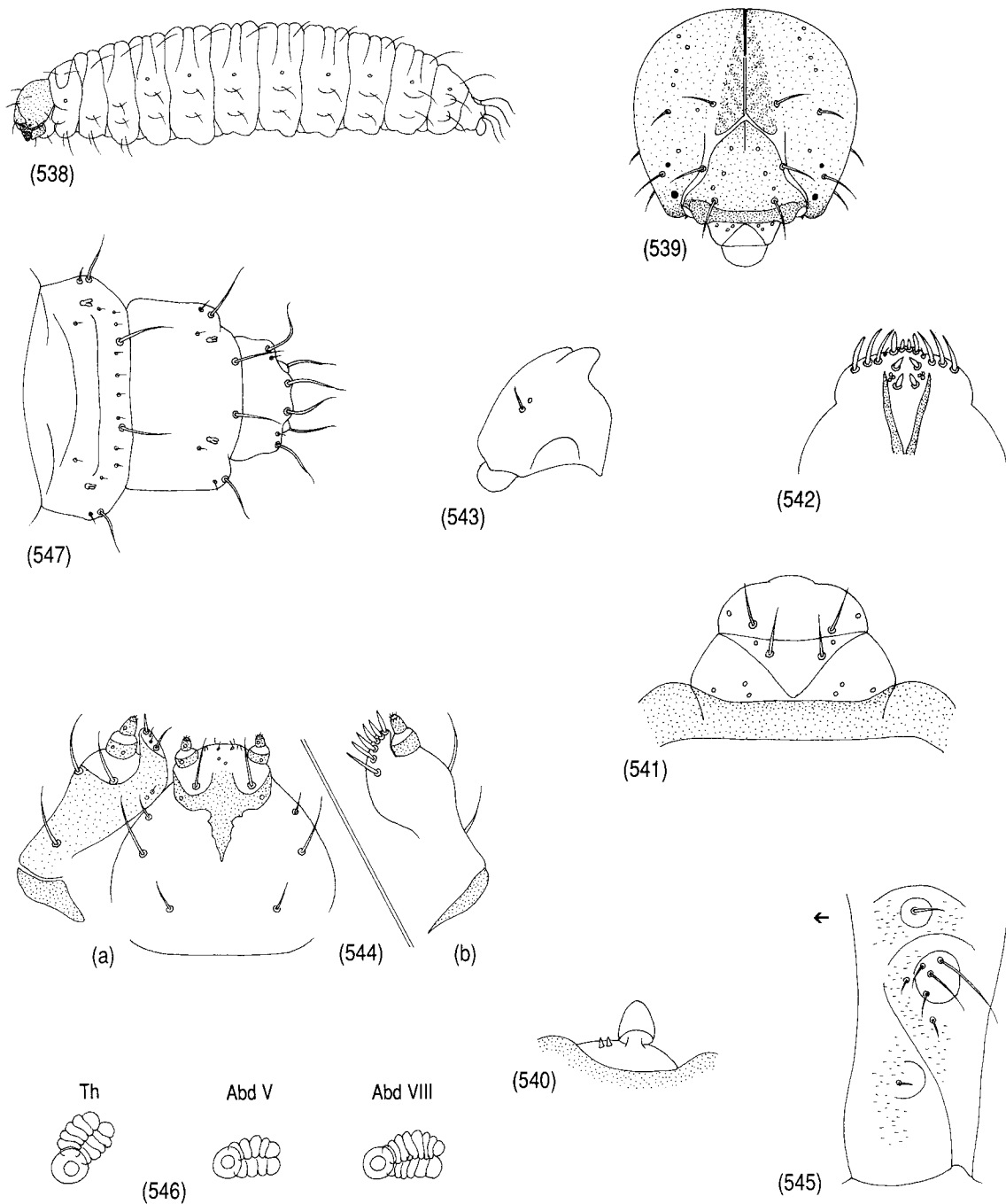
Curculionidae: Brachycerinae: Rhytirhinini

Fig. 516–525 *Steriphus diversipes lineata*: (516) habitus, lateral, x4; (517) head, dorsal, x25; (518) antenna, x265; (519) labrum, clypeus, and epistoma, x35; (520) epipharyngeal lining, x45; (521) mandible, x25; (522) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (523) Th II, pedal and mediosternal lobes, x55; (524) spiracles, x110; (525) alimentary canal, x4.



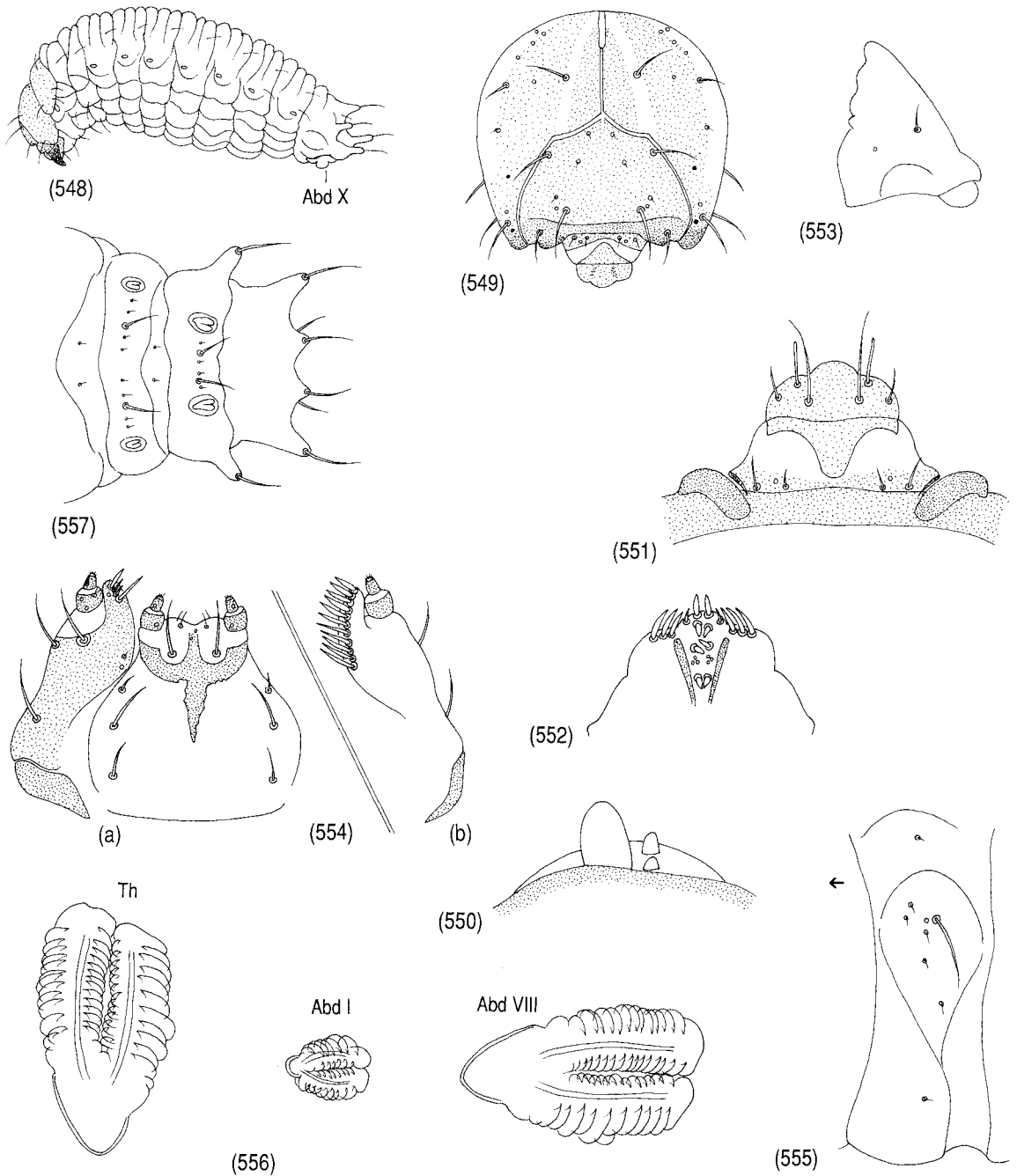
Curculionidae: Brachycerinae: Rhytirhinini

Fig. 526–537 *Listroderes difficilis*: (526) habitus, lateral, x6; (527) head and pronotum, dorsal, x15; (528) dorsal seta, x265; (529) head, ventral, x30; (530) antenna, x185; (531) labrum, clypeus, and epistoma, x35; (532) epipharyngeal lining, x35; (533) mandible, x35; (534) maxilla and labium, x55 (a, ventral; b, dorsal maxilla); (535) Th II, ventropleural, pedal, and mediosternal lobes, x30; (536) spiracles, x85; (537) alimentary canal, x6.



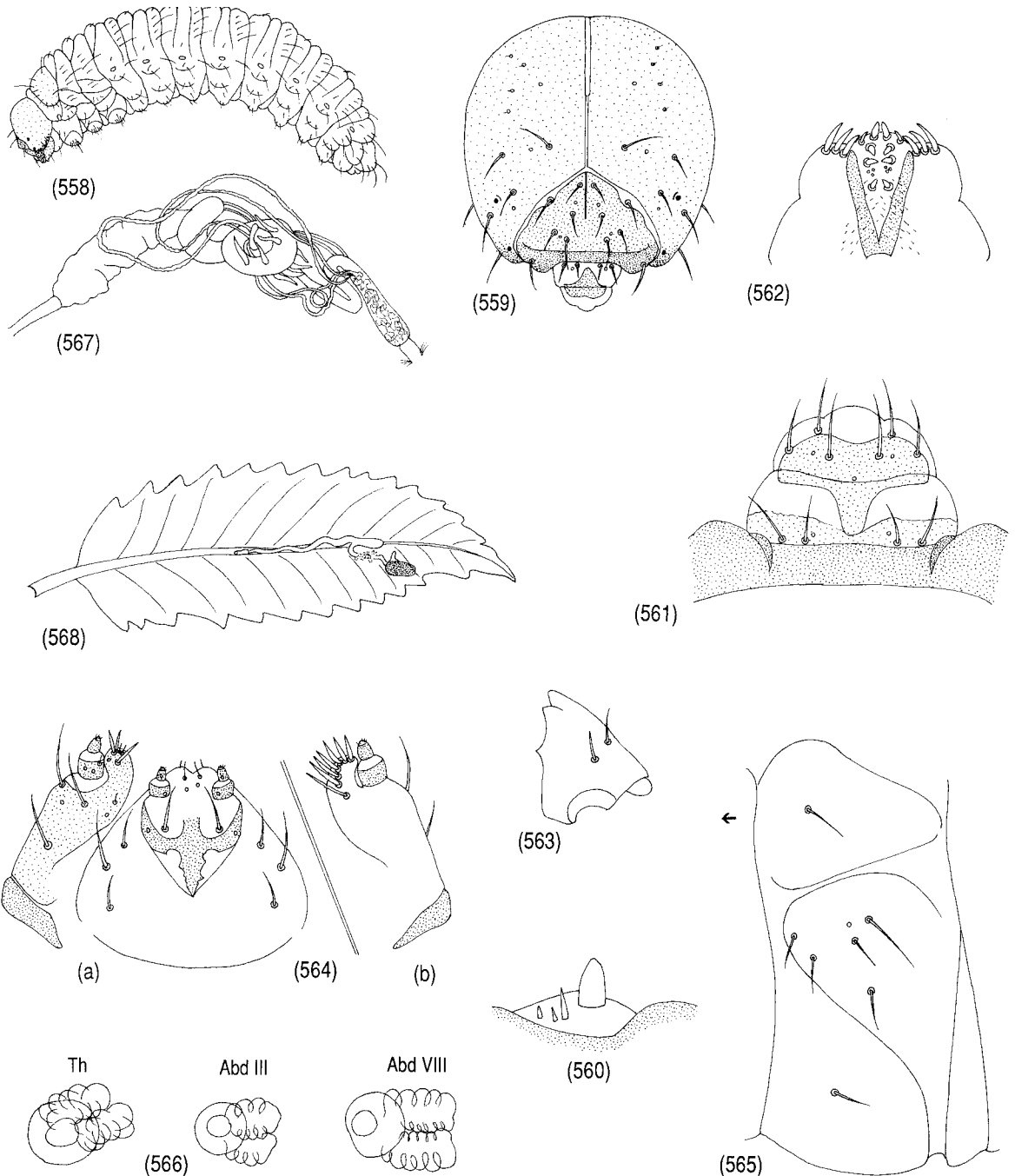
Curculionidae: Brachycerinae: Rhytirhinini

Fig. 538–547 *Listronotus bonariensis*: (538) habitus, lateral, x15; (539) head, dorsal, x35; (540) antenna, x365; (541) labrum, clypeus, and epistoma, x110; (542) epipharyngeal lining, x110; (543) mandible, x55; (544) maxilla and labium, x85 (a, ventral; b, dorsal maxilla); (545) Th II, ventropleural, pedal, and mediosternal lobes, x65; (546) spiracles, x110; (547) Abd VIII–X, dorsal, x30.



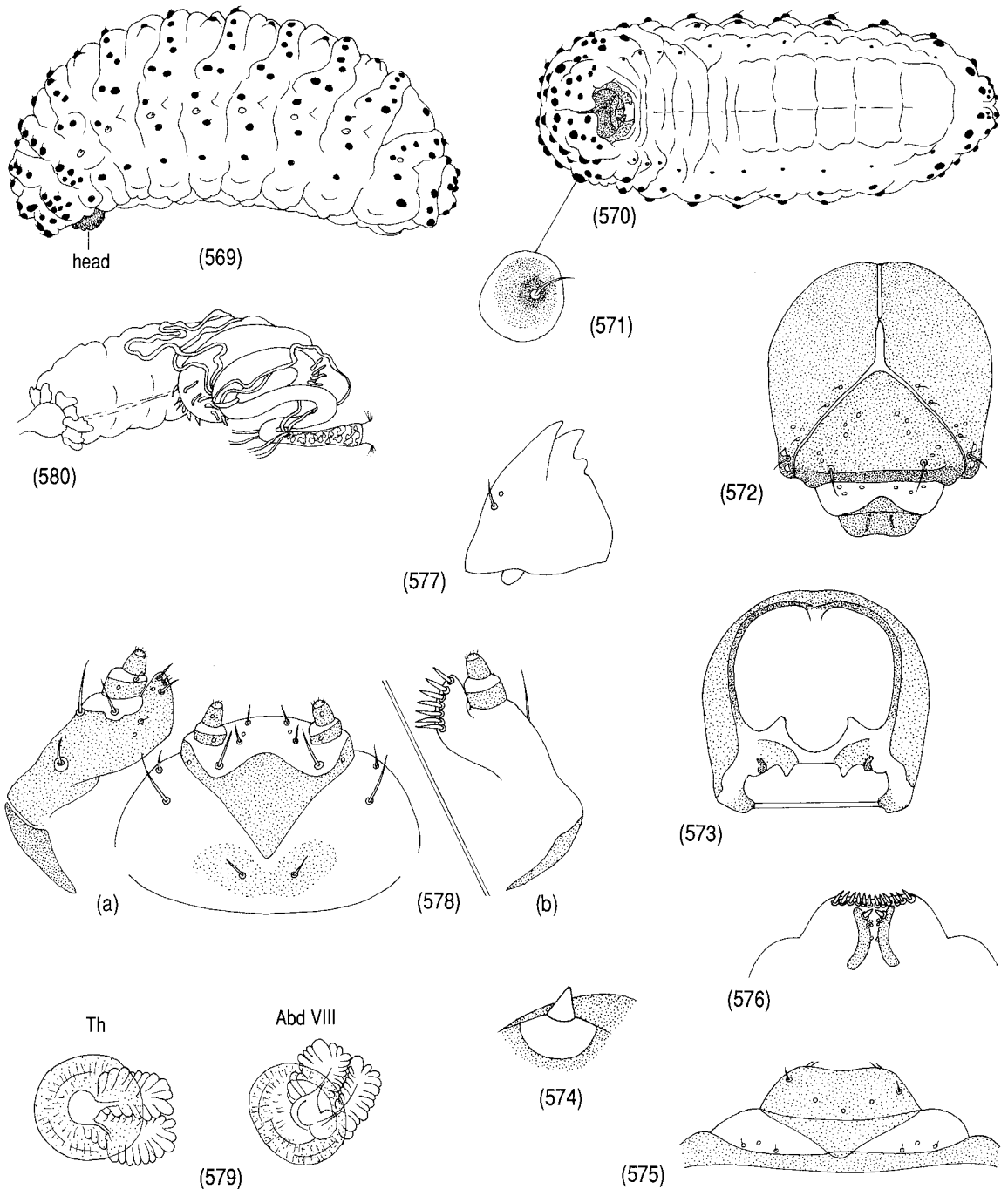
Curculionidae: Brachycerinae: Aterpini

Fig. 548–557 *Anagotus helmsi*: (548) habitus, lateral, x3; (549) head, dorsal, x15; (550) antenna, x265; (551) labrum, clypeus, and epistoma, x65; (552) epipharyngeal lining, x65; (553) mandible, x45; (554) maxilla and labium, x55 (a, ventral; b, dorsal maxilla); (555) Th II, ventropleural, pedal, and mediosternal lobes, x30; (556) spiracles, x110; (557) Abd VII–IX, dorsal, x15.



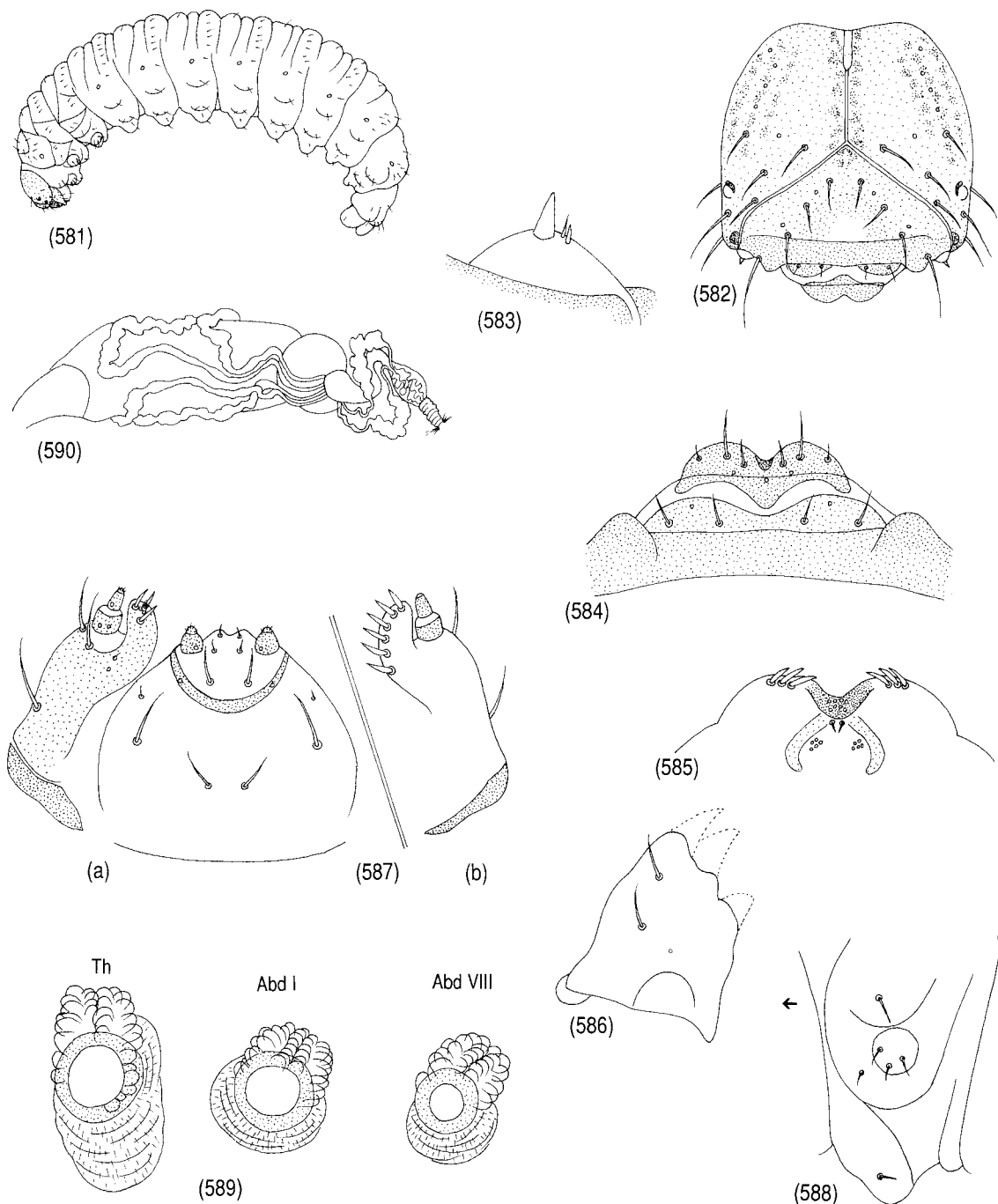
Curculionidae: Brachycerinae: Aterpini

Fig. 558–568 *Rhadinosomus acuminatus*: (558) habitus, lateral, x7; (559) head, dorsal, x30; (560) antenna, x265; (561) labrum, clypeus, and epistoma, x95; (562) epipharyngeal lining, x95; (563) mandible, x55; (564) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (565) Th II, ventropleural, pedal, and mediosternal lobes, x55; (566) spiracles, x185; (567) alimentary canal, x7; (568) egg, and 1st instar working on leaf of *Haloragis erecta*.



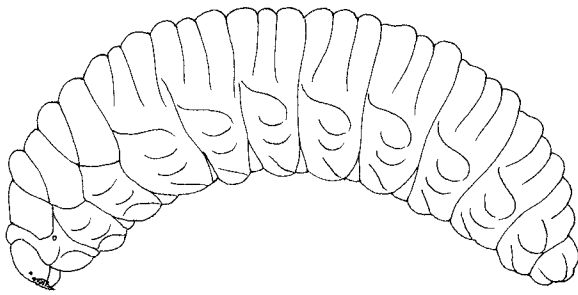
Curculionidae: Brachycerinae: Gonipterini

Fig. 569–580 *Gonipterus scutellatus*: (569, 570) habitus, lateral and ventral, x6; (571) detail of seta, x65; (572, 573) head, dorsal and ventral, x20; (574) antenna, x265 (on ventral surface); (575) labrum, clypeus, and epistoma, x65; (576) epipharyngeal lining, x65; (577) mandible, x65; (578) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (579) spiracles, x95; (580) alimentary canal, x4.

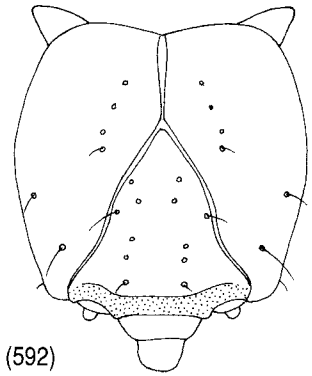


Curculionidae: Brachycerinae: Hyperini

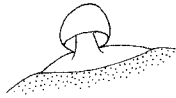
Fig. 581–590 *Hyperapunctata*: (581) habitus, lateral, x6; (582) head, dorsal, x30; (583) antenna, x185; (584) labrum, clypeus, and epistoma, x65; (585) epipharyngeal lining, x110; (586) mandible, x65; (587) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (588) Th II, ventropleural, pedal, and mediosternal lobes, x30; (589) spiracles, x220; (590) alimentary canal, x7 (semi-diagrammatic).



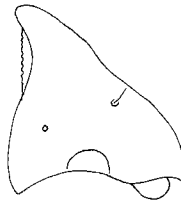
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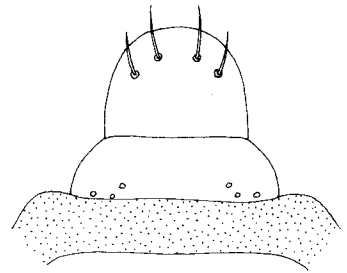
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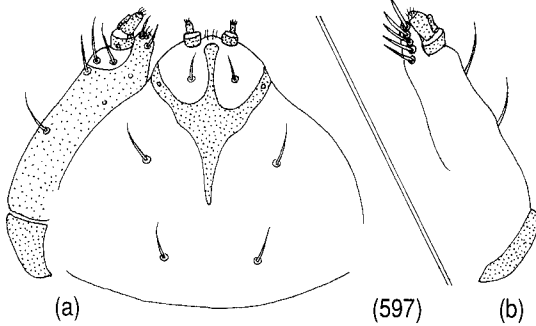
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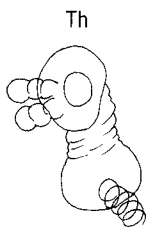
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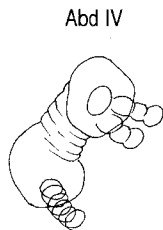
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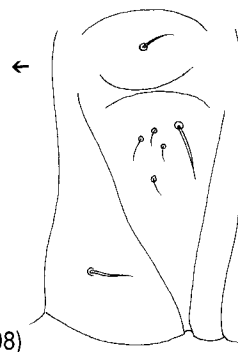
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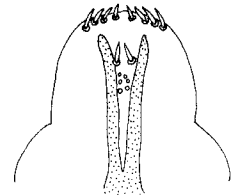


Abd IV

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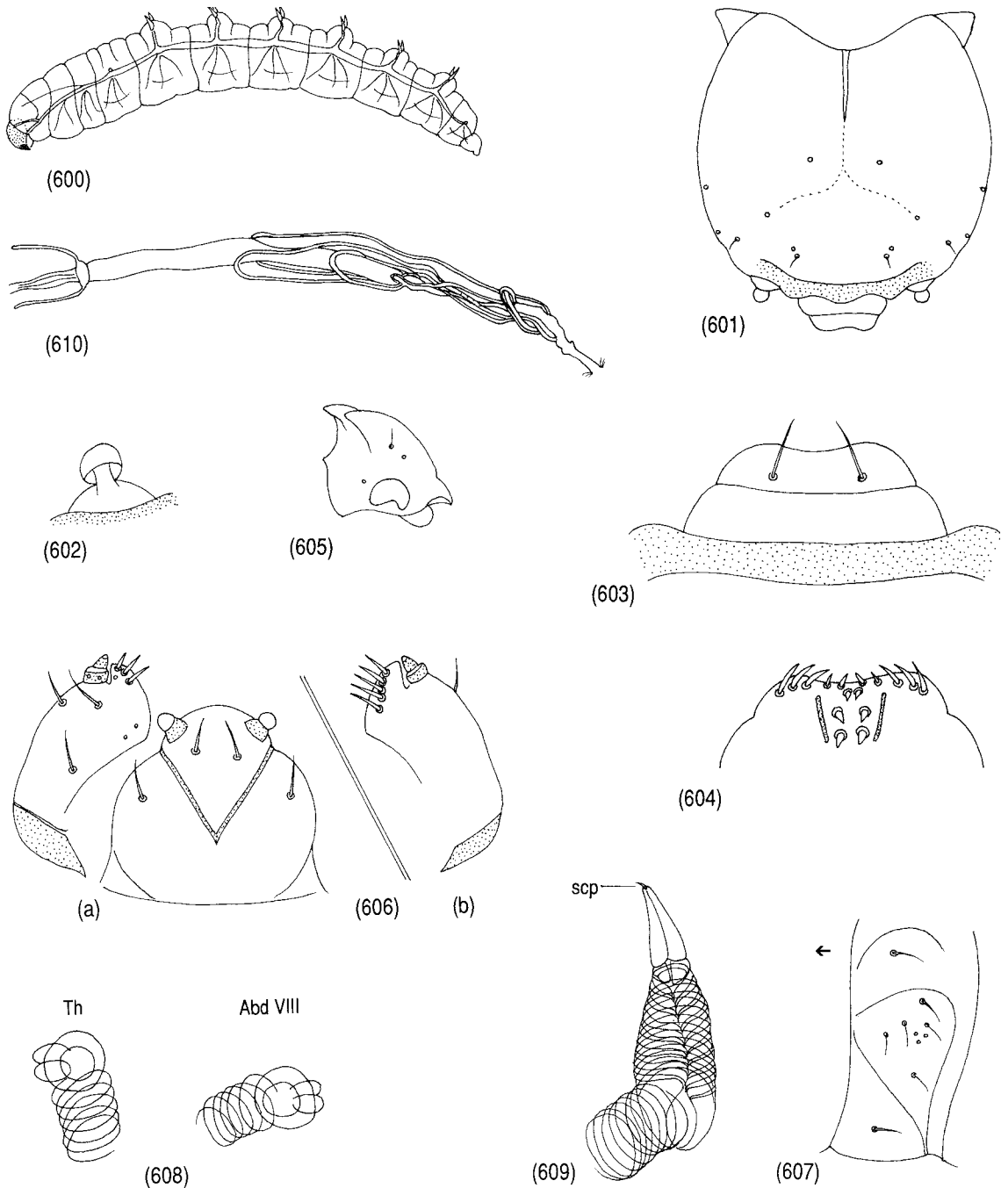
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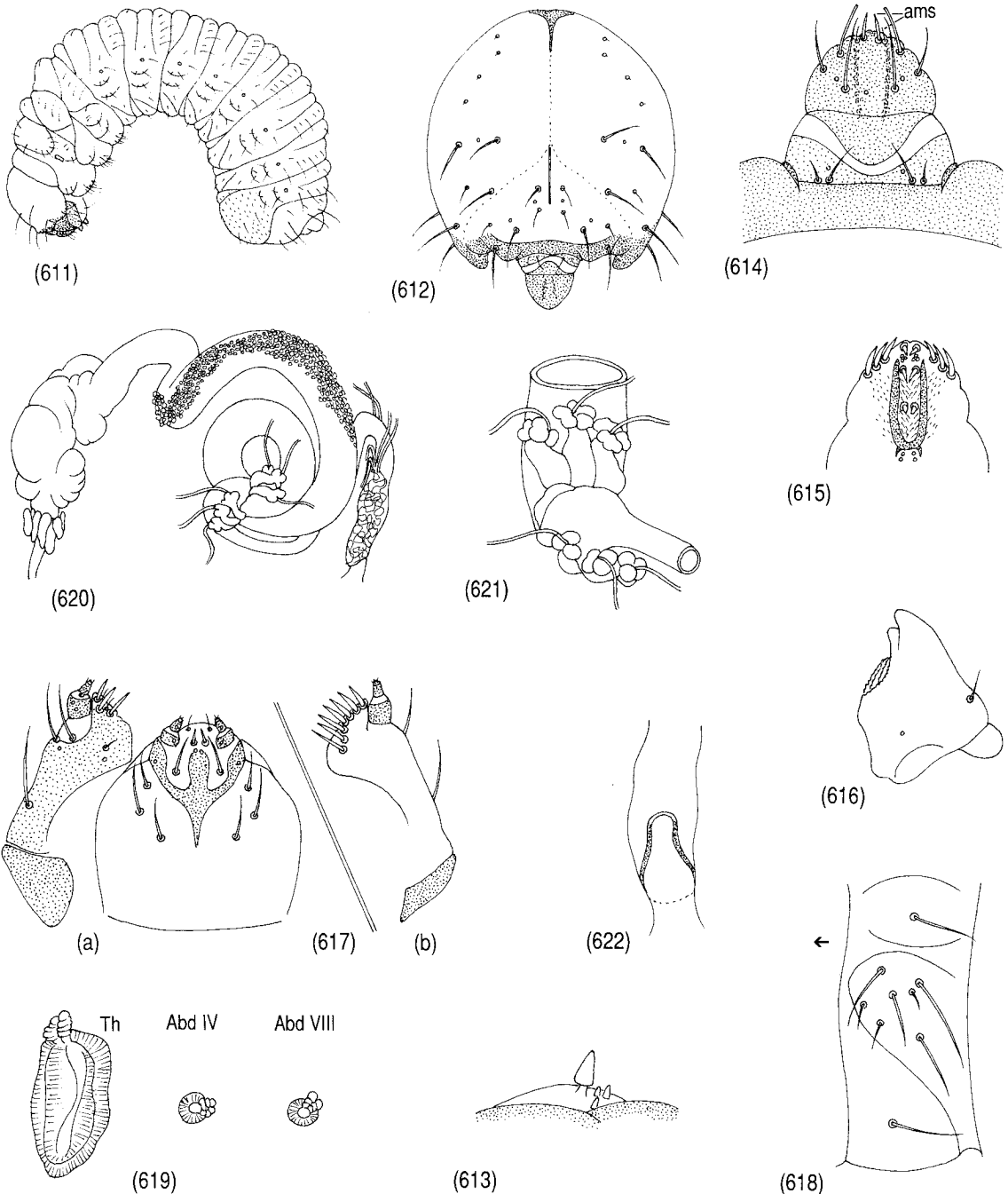
Curculionidae: Curculioninae: Erihini

Fig. 591–599 *Bryocatus amplus*: (591) habitus, lateral, x15 (setae omitted); (592) head, dorsal, x95; (593) antenna, x265; (594) labrum, clypeus, and epistoma, x265; (595) epipharyngeal lining, x265; (596) mandible, x185; (597) maxilla and labium, x185 (a, ventral; b, dorsal maxilla); (598) Th II, ventropleural, pedal, and mediosternal lobes, x55; (599) spiracles, x530.



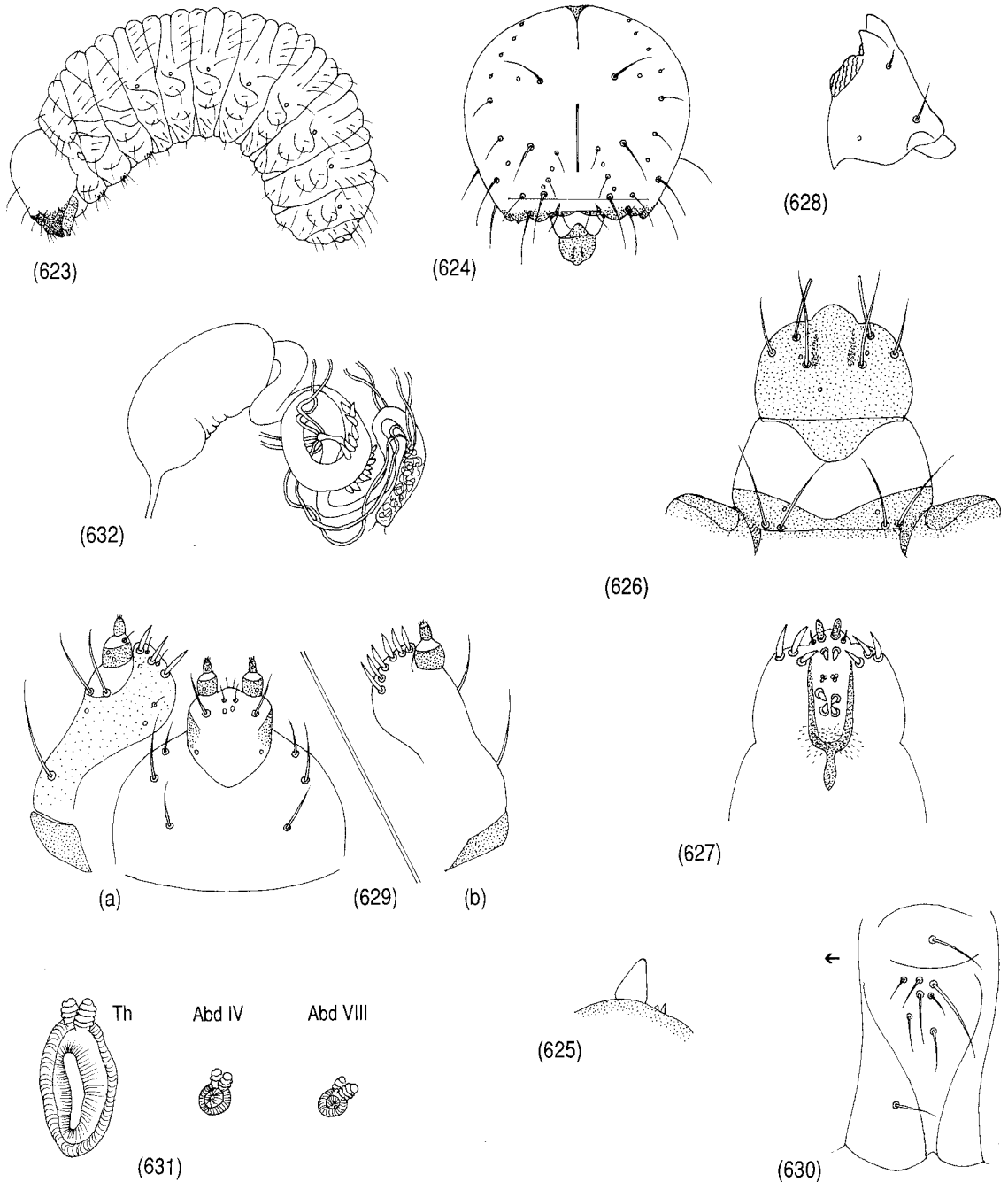
Curculionidae: Curculioninae: Eriirhinini

Fig. 600–610 *Lissorhoptus oryzophilus*: (600) habitus, lateral, x45, showing tracheal trunks (setae omitted); (601) head, dorsal, x65; (602) antenna, x265; (603) labrum, clypeus, and epistoma, x265; (604) epipharyngeal lining, x265; (605) mandible, x130; (606) maxilla and labium, x130 (a, ventral; b, dorsal maxilla); (607) Th II, ventropleural, pedal, and mediosternal lobes, x65; (608, 609) spiracles of Th and Abd VIII, and of other Abd segments, x130; (610) alimentary canal, x65.



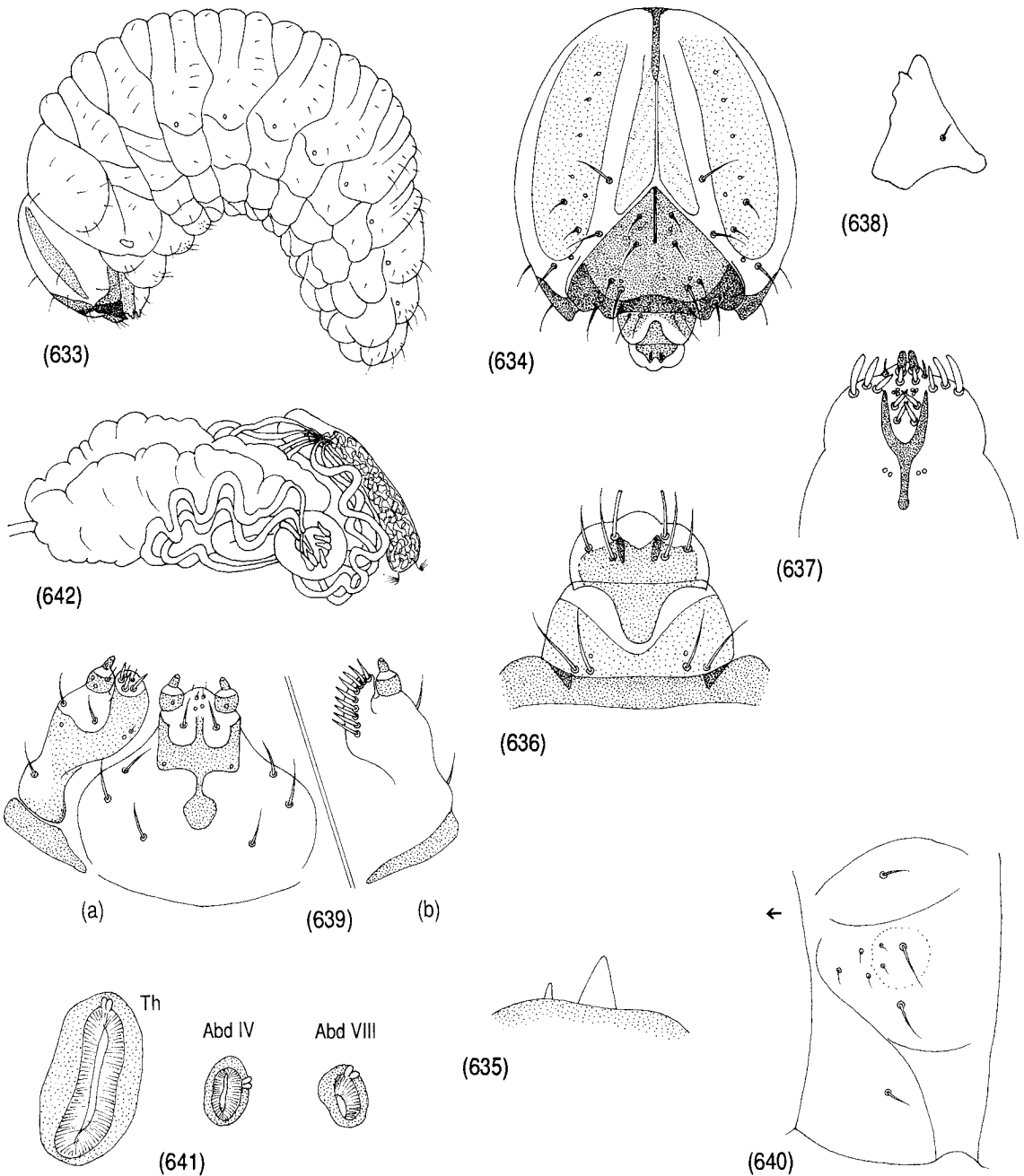
Curculionidae: Curculioninae: Cryptorhynchini

Fig. 611–622 *Psepholax tibialis*: (611) habitus, lateral, x4; (612) head, dorsal, x10; (613) antenna, x130; (614) labrum, clypeus, and epistoma, x45; (615) epipharyngeal lining, x45; (616) mandible, x45; (617) maxilla and labium, x15 (a, ventral; b, dorsal maxilla); (618) Th II, ventropleural, pedal, and mediosternal lobes, x20; (619) spiracles, x45; (620) alimentary canal, x6; (621) base of Malpighian tubules, x9; (622) rectal bracon, x9.



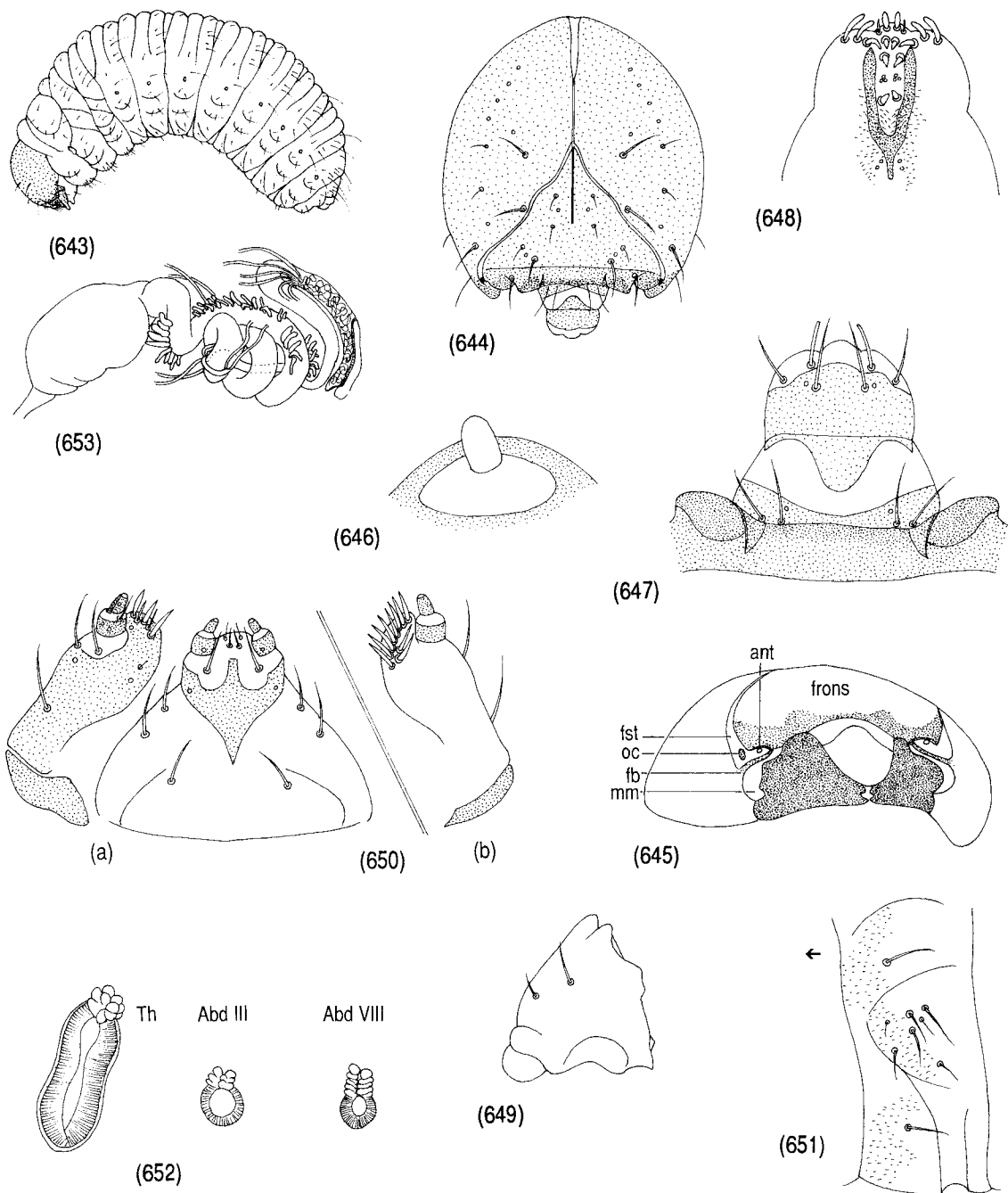
Curculionidae: Curculioninae: Cryptorhynchini

Fig. 623–632 *Mitrastethus baridioides*: (623) habitus, lateral, x20; (624) head, dorsal, x15; (625) antenna, x130; (626) labrum, clypeus, and epistoma, x65; (627) epipharyngeal lining, x65; (628) mandible, x35; (629) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (630) Th II, ventropleural, pedal, and mediosternal lobes, x20; (631) spiracles, x55; (632) alimentary canal, x20.



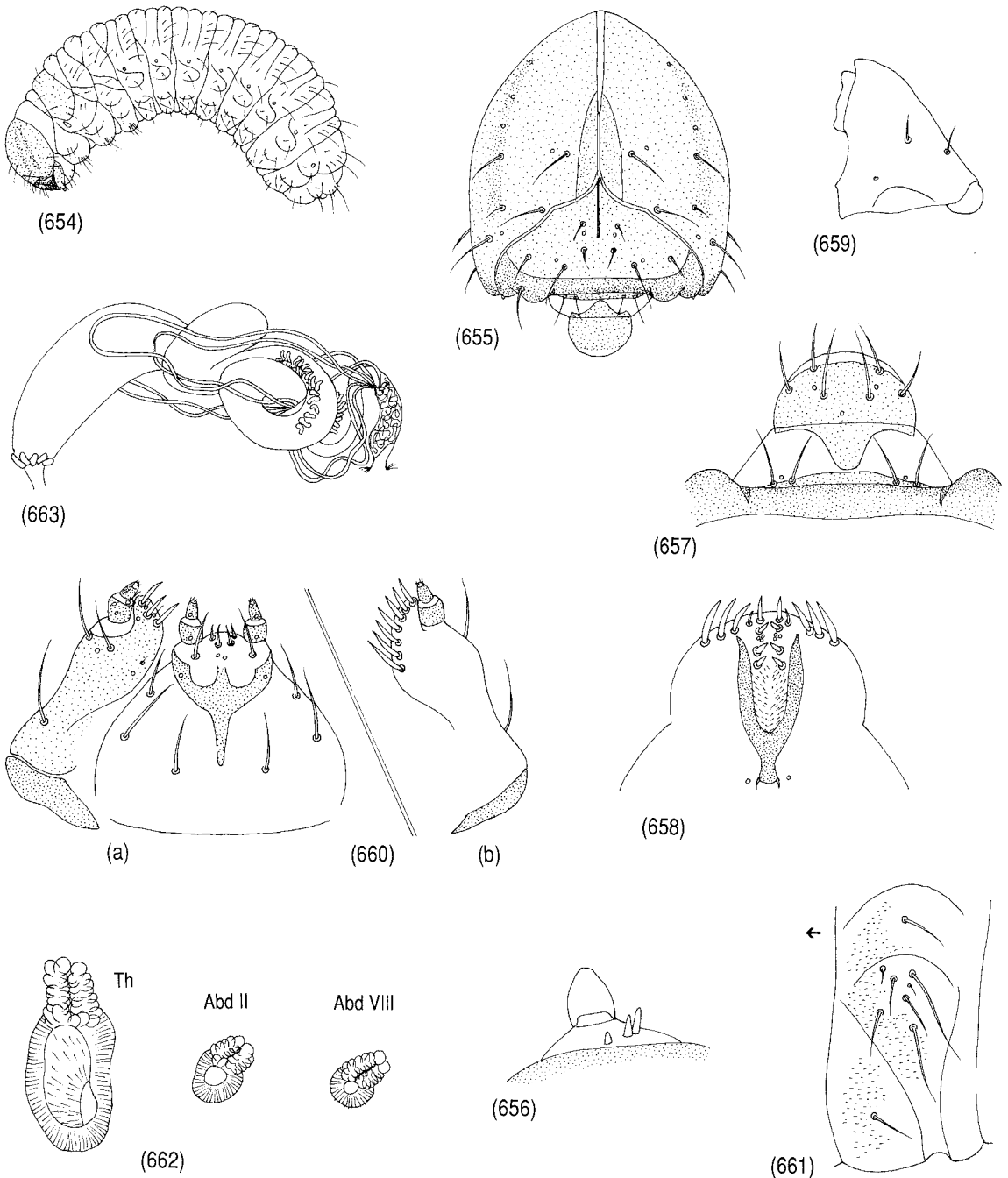
Curculionidae: Curculioninae: Cryptorhynchini

Fig. 633–642 *Rhynchodes ursus*: (633) habitus, lateral, x3; (634) head, dorsal, x10; (635) antenna, x185; (636) labrum, clypeus, and epistoma, x55; (637) epipharyngeal lining, x65; (638) mandible, x30; (639) maxilla and labium, x20 (a, ventral; b, dorsal maxilla); (640) Th II, ventropleural, pedal, and mediosternal lobes, x15; (641) spiracles, x40; (642) alimentary canal, x3.

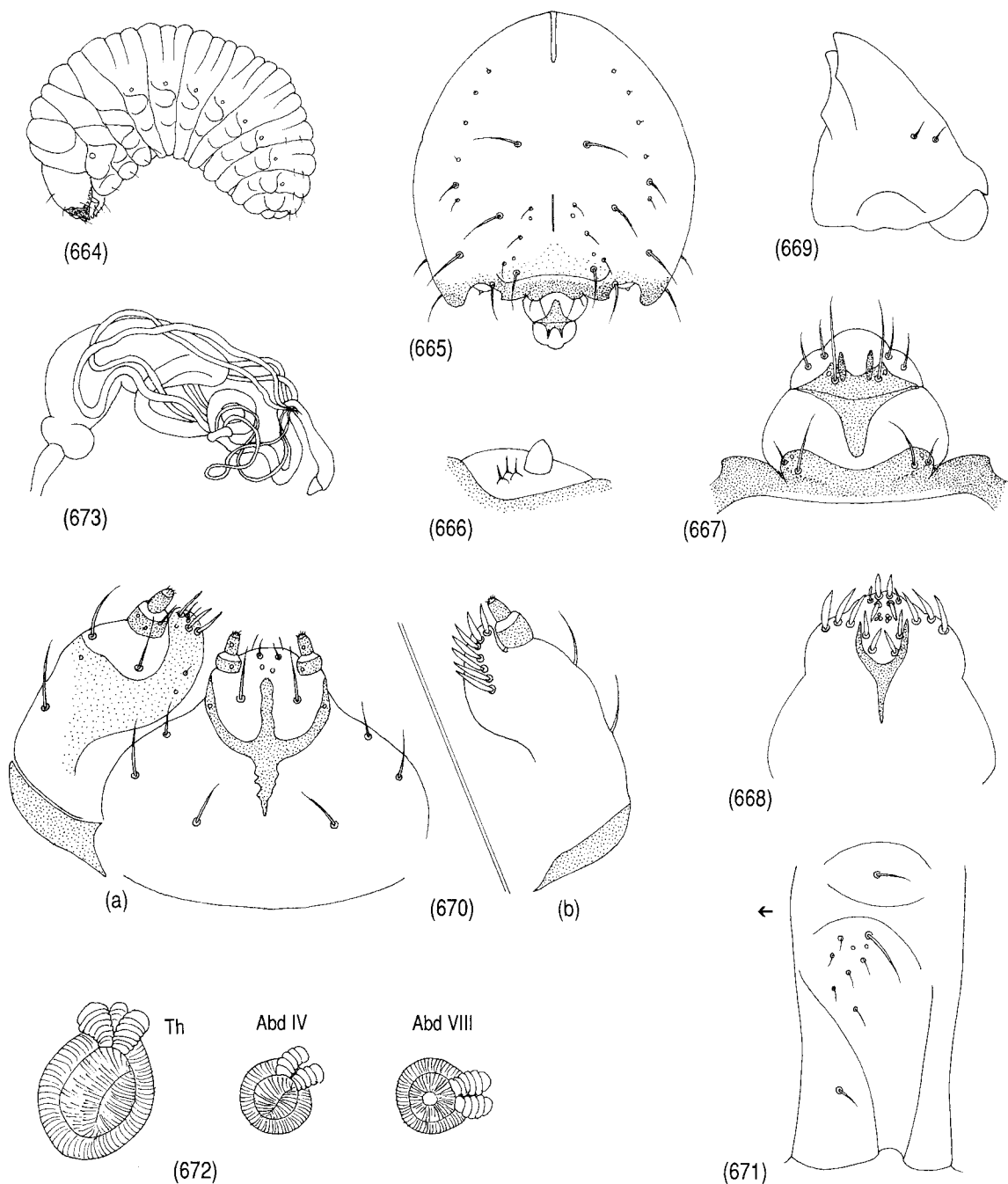


Curculionidae: Curculioninae: Cryptorhynchini

Fig. 643–653 *Tychanus gibbus*: (643) habitus, lateral, x3; (644, 645) head, dorsal and frontal, x20; (646) antenna, x265 (on ventral surface); (647) labrum, clypeus, and epistoma, x65; (648) epipharyngeal lining, x65; (649) mandible, x35; (650) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (651) Th II, ventropleural, pedal, and mediosternal lobes, x30; (652) spiracles, x130; (653) alimentary canal, x3.

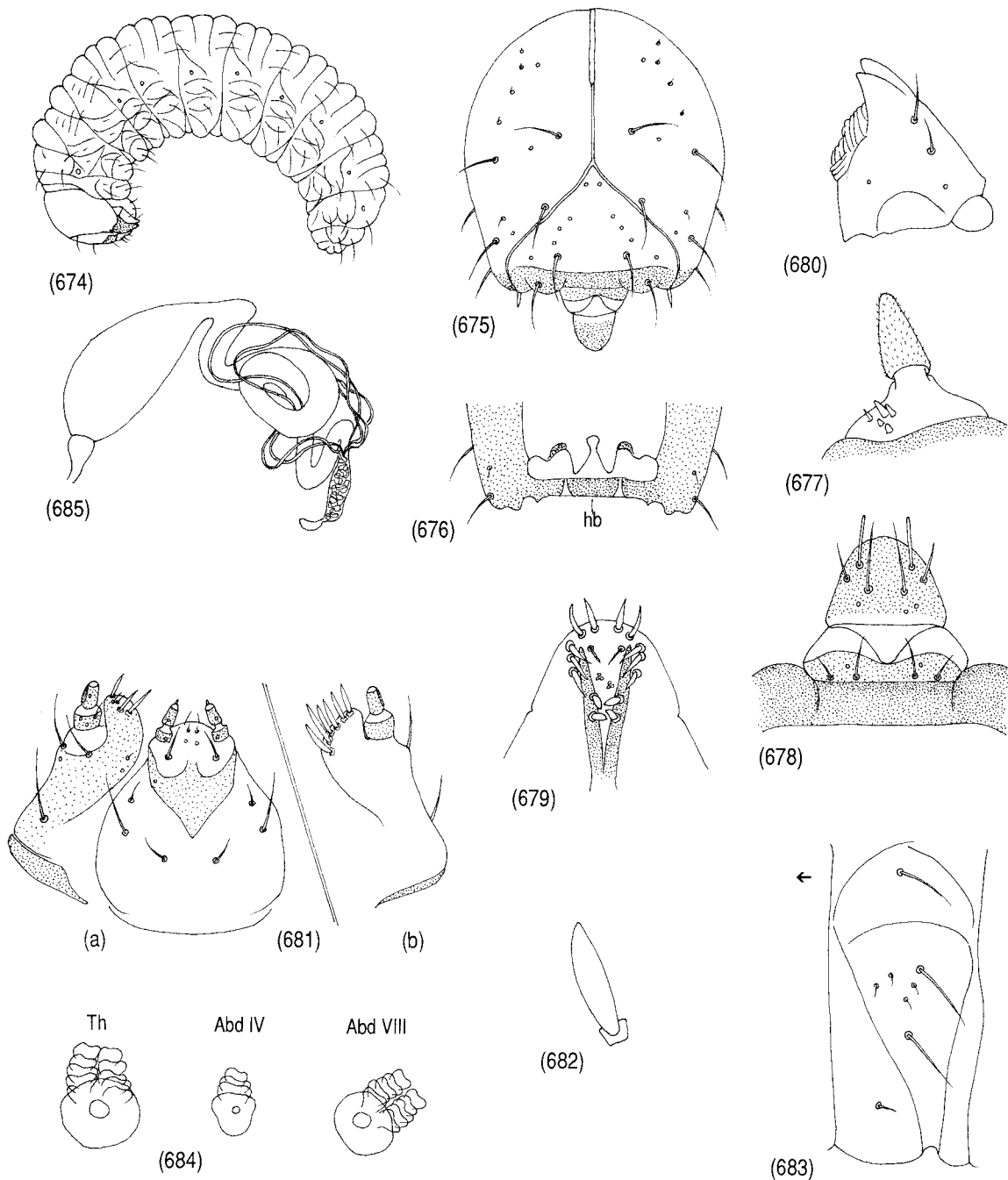


Curculionidae: Curculioninae: Cryptorhynchini
Fig. 654–663 *Crisius variegatus*: (654) habitus, lateral, x6; (655) head, dorsal, x20; (656) antenna, x265; (657) labrum, clypeus, and epistoma, x45; (658) epipharyngeal lining, x65; (659) mandible, x35; (660) maxilla and labium, x45 (a, ventral; b, dorsal maxilla); (661) Th II, ventropleural, pedal, and mediosternal lobes, x30; (662) spiracles, x130; (663) alimentary canal, x7.



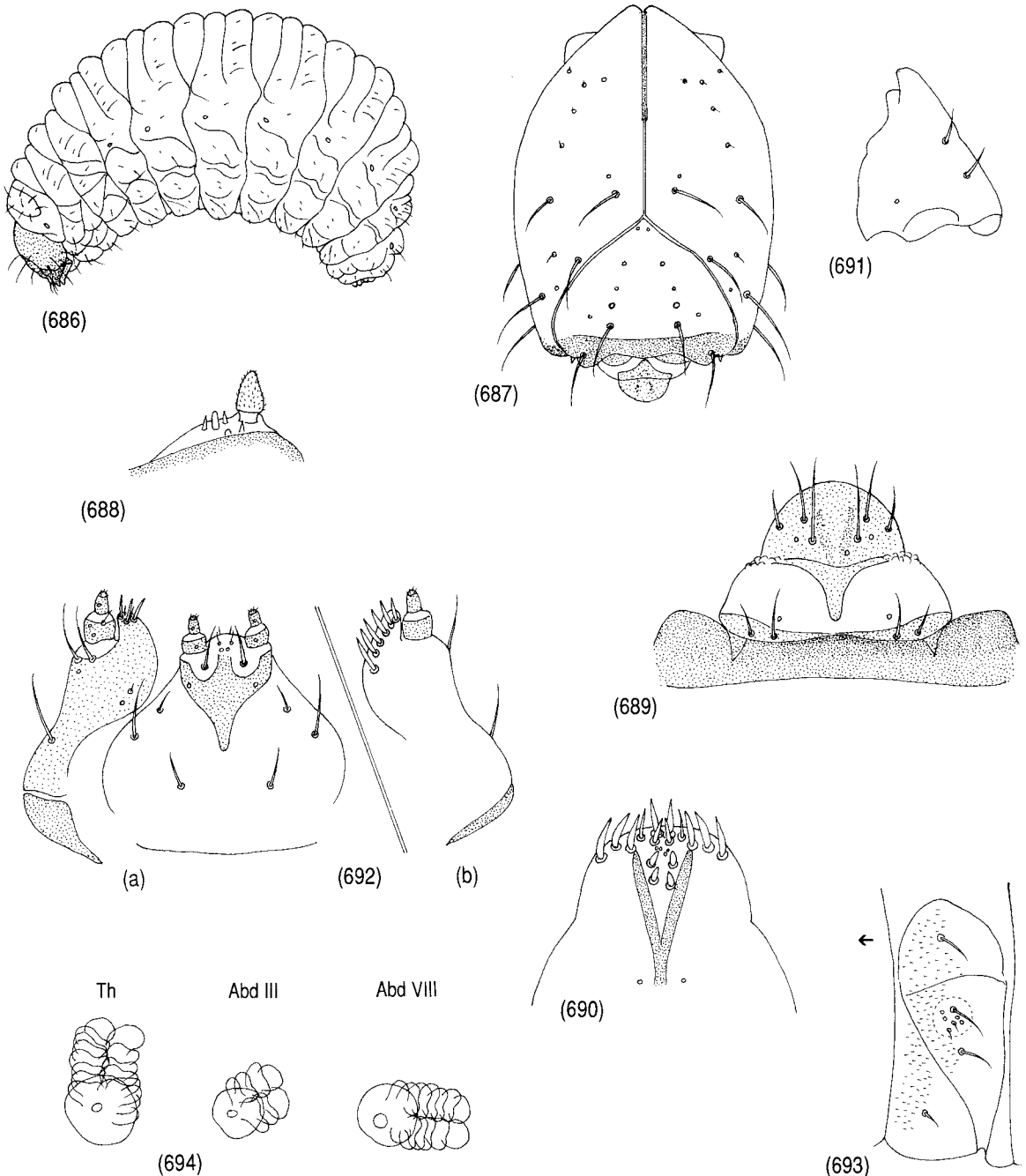
Curculionidae: Curculioninae: Cryptorhynchini

Fig. 664–673 *Sympedius testudo*: (664) habitus, lateral, x10; (665) head, dorsal, x20; (666) antenna, x65; (667) labrum, clypeus, and epistoma, x55; (668) epipharyngeal lining, x65; (669) mandible, x130; (670) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (671) Th II ventropleural, pedal, and mediosternal lobes, x65; (672) spiracles, x265; (673) alimentary canal, x10.



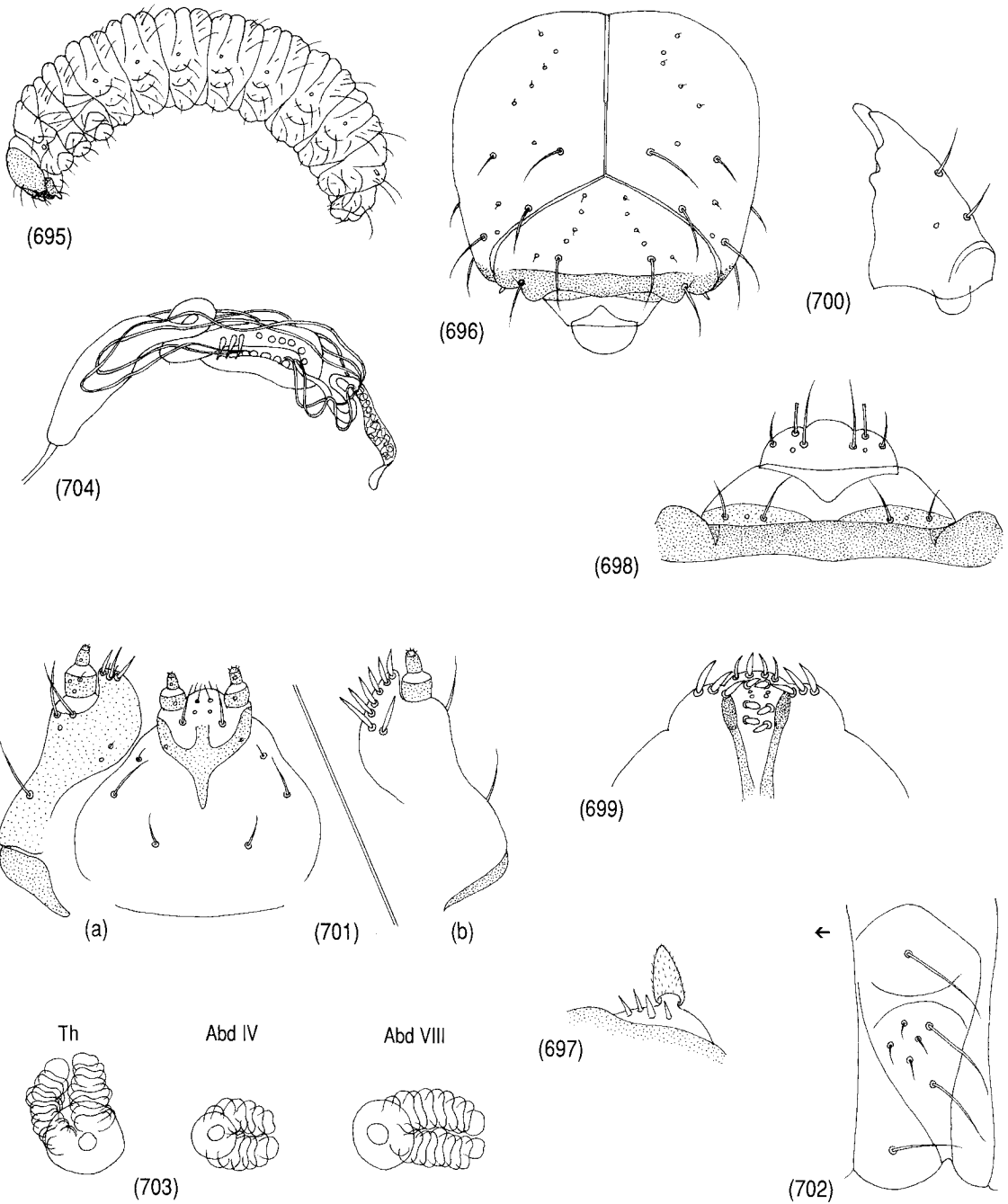
Curculionidae: Curculioninae: Eugnomini

Fig. 674–685 *Ancistropterus quadrispinosus*: (674) habitus, lateral, x10; (675, 676) head, dorsal, and ventral showing hypopharyngeal bracon, x40; (677) antenna, x265; (678) labrum, clypeus, and epistoma, x110; (679) epipharyngeal lining, x135; (680) mandible, x95; (681) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (682) dorsal seta of mala, showing rectangular base, x265; (683) Th III, ventropleural, pedal, and mediosternal lobes, x55; (684) spiracles, x265; (685) alimentary canal, x10.



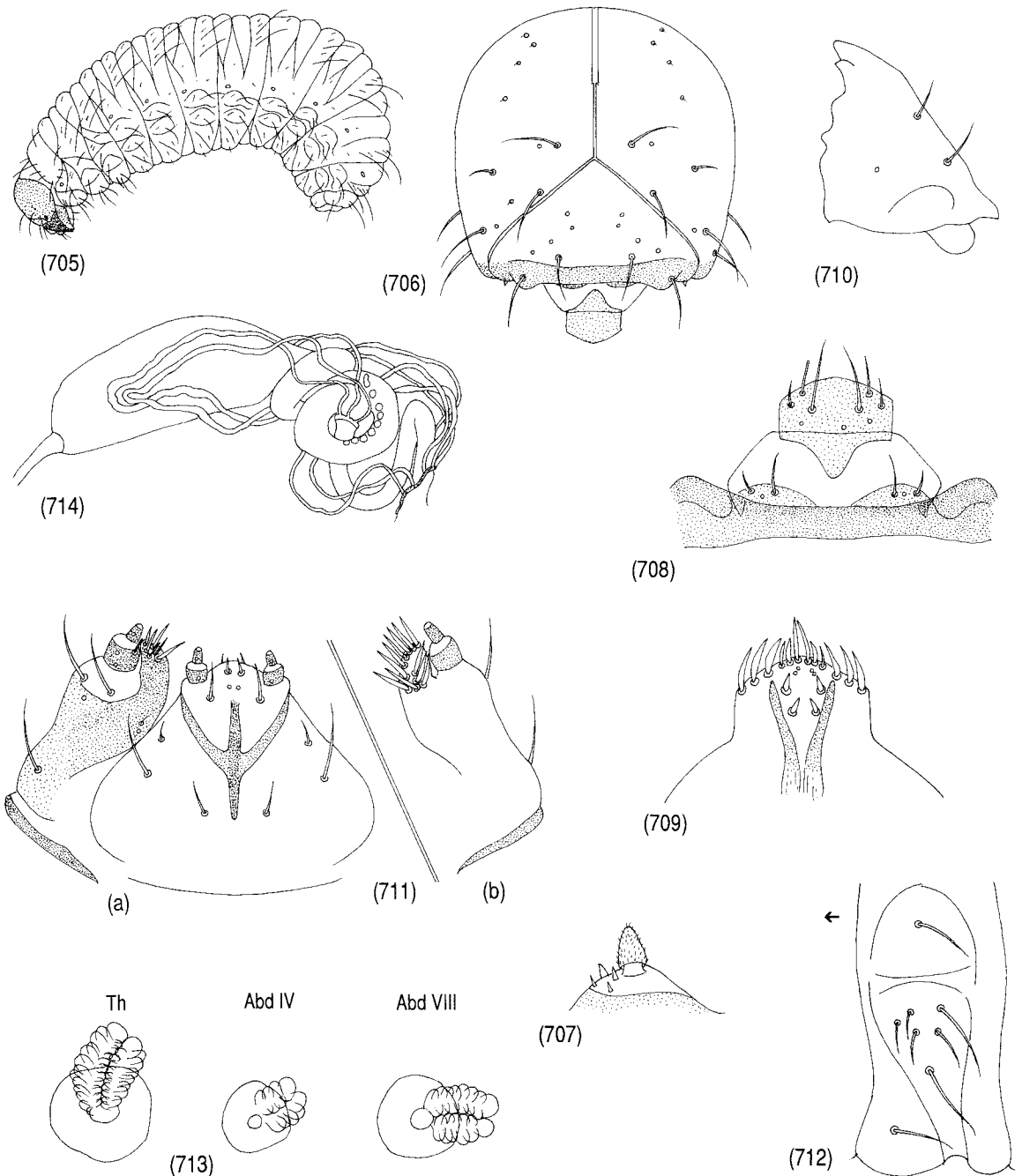
Curculionidae: Curculioninae: Eugnomini

Fig. 686–694 *Gonoroapterus spinicollis*: (686) habitus, lateral, x10; (687) head, dorsal, x50; (688) antenna, x265; (689) labrum, clypeus, and epistoma, x135; (690) epipharyngeal lining, x190; (691) mandible, x95; (692) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (693) Th II, ventropleural, pedal, and mediosternal lobes, x30; (694) spiracles, x265.



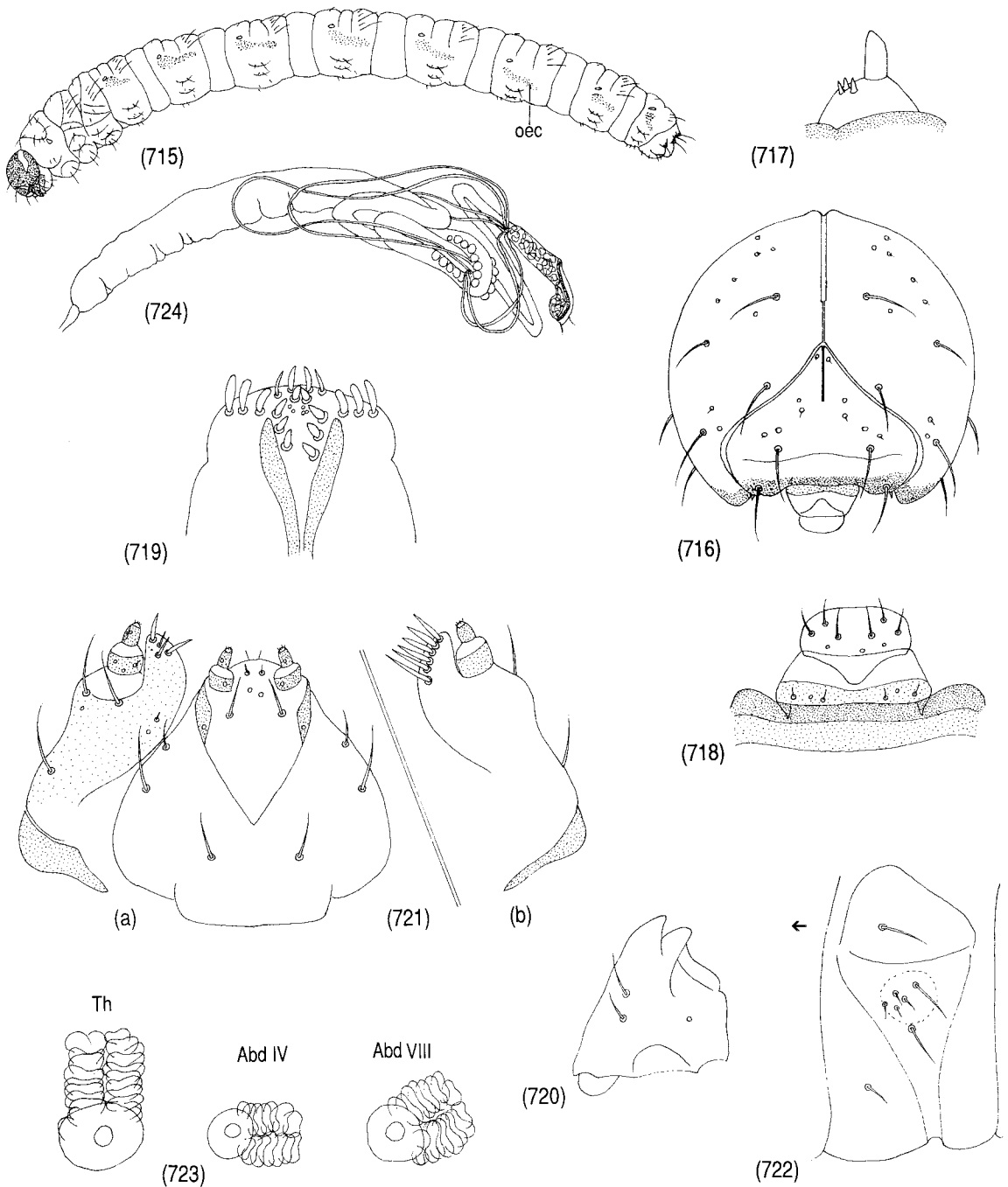
Curculionidae: Curculioninae: Eugnomini

Fig. 695–704 *Hoplocneme inaequale*: (695) habitus, lateral, x10; (696) head, dorsal, x50; (697) antenna, x265; (698) labrum, clypeus, and epistoma, x95; (699) epipharyngeal lining, x135; (700) mandible, x95; (701) maxilla and labium, x110 (a, ventral; b, dorsal maxilla); (702) Th II, ventropleural, pedal, and mediosternal lobes, x55; (703) spiracles, x265; (704) alimentary canal, x10.



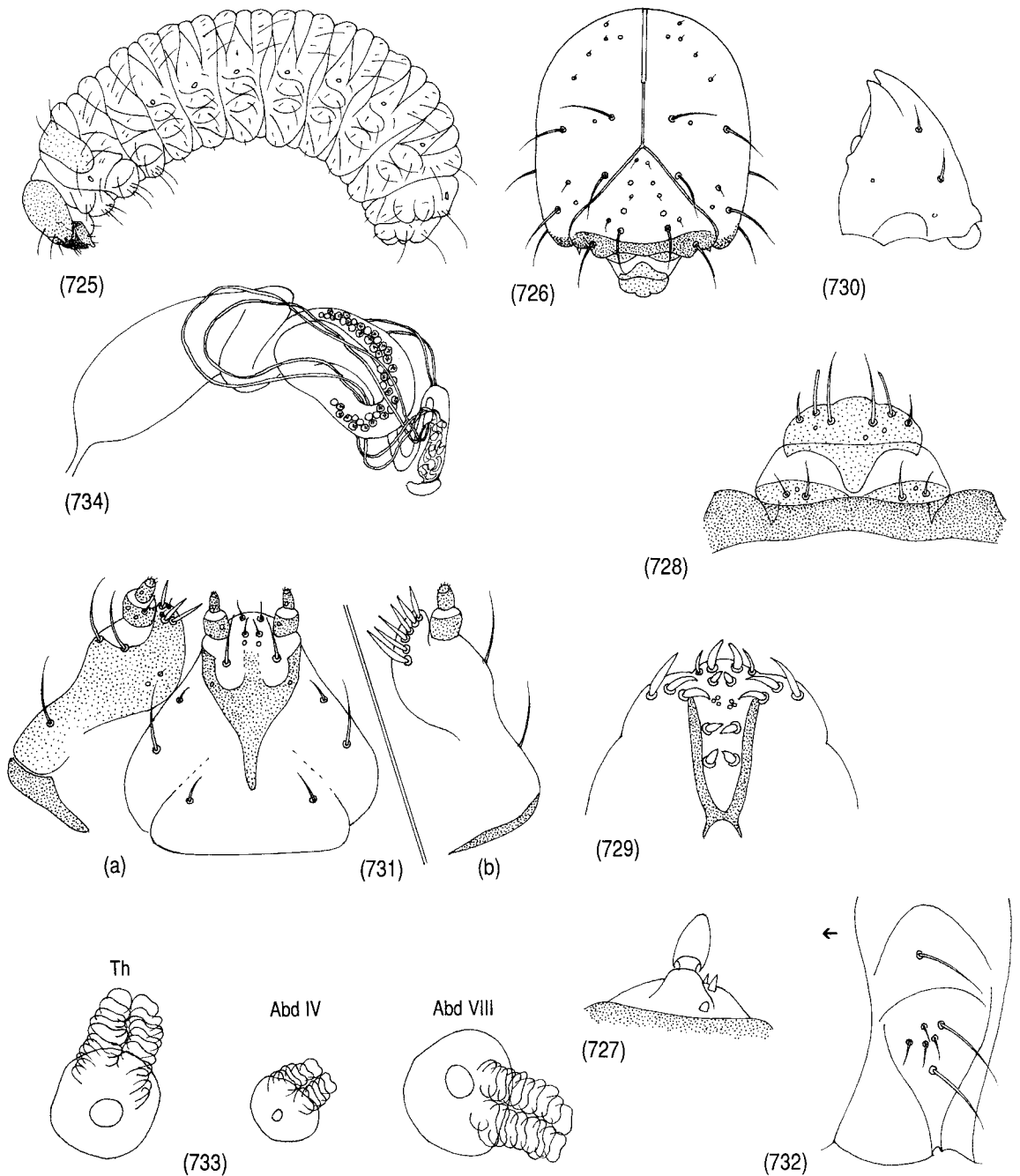
Curculionidae: Curculioninae: Eugnomini

Fig. 705–714 *Nyxetes bidens*: (705) habitus, lateral, x10; (706) head, dorsal, x40; (707) antenna, x265; (708) labrum, clypeus, and epistoma, x65; (709) epipharyngeal lining, x135; (710) mandible, x65; (711) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (712) Th II, ventropleural, pedal, and mediosternal lobes, x40; (713) spiracles, x265; (714) alimentary canal, x10.



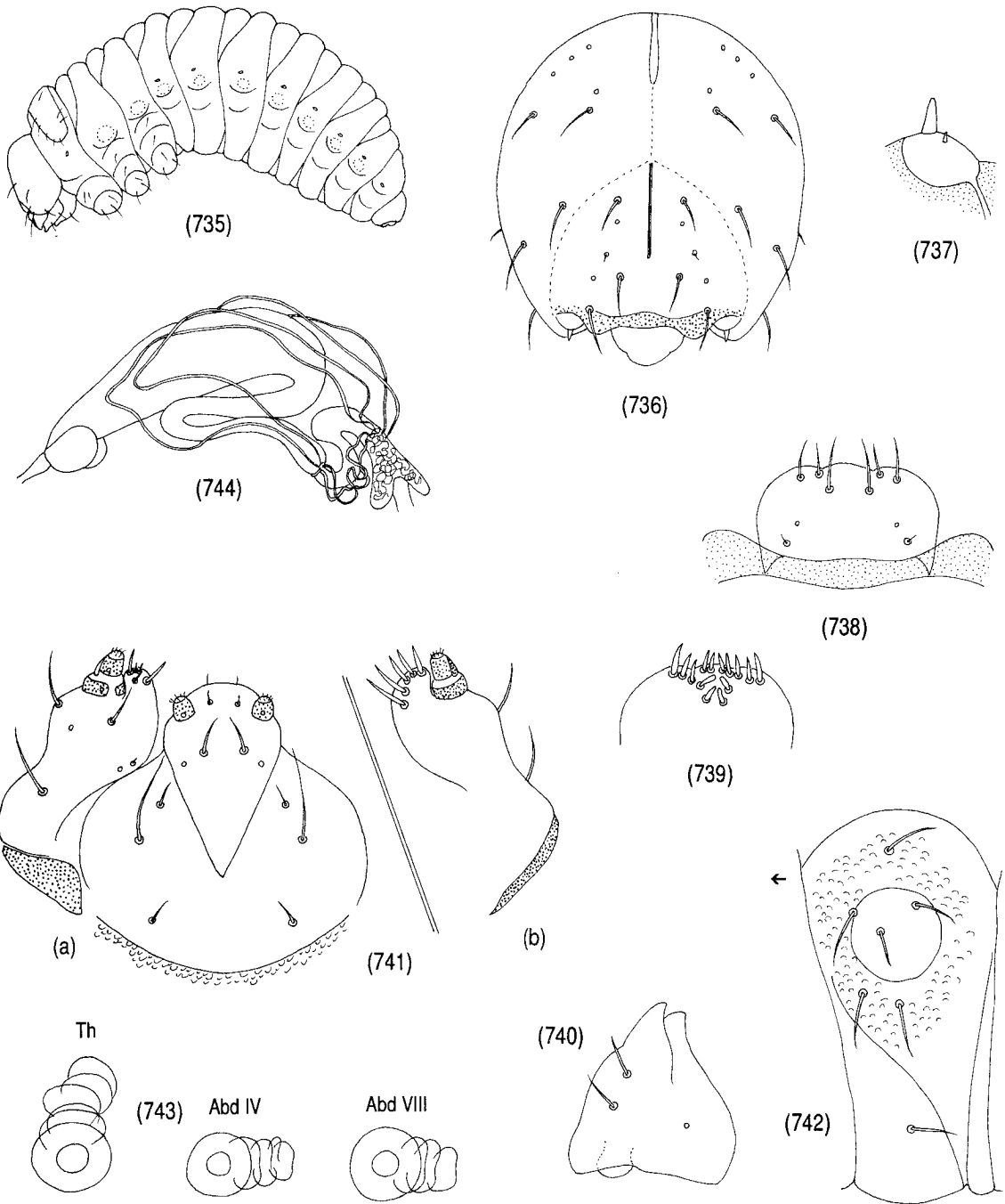
Curculionidae: Curculioninae: Eugnomini

Fig. 715–724 *Oreocalus albosparsus*: (715) habitus, lateral, x10; (716) head, dorsal, x65; (717) antenna, x270; (718) labrum, clypeus, and epistoma, x135; (719) epipharyngeal lining, x265; (720) mandible, x135; (721) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (722) Th II, ventropleural, pedal, and mediosternal lobes, x55; (723) spiracles, x265; (724) alimentary canal, x10.



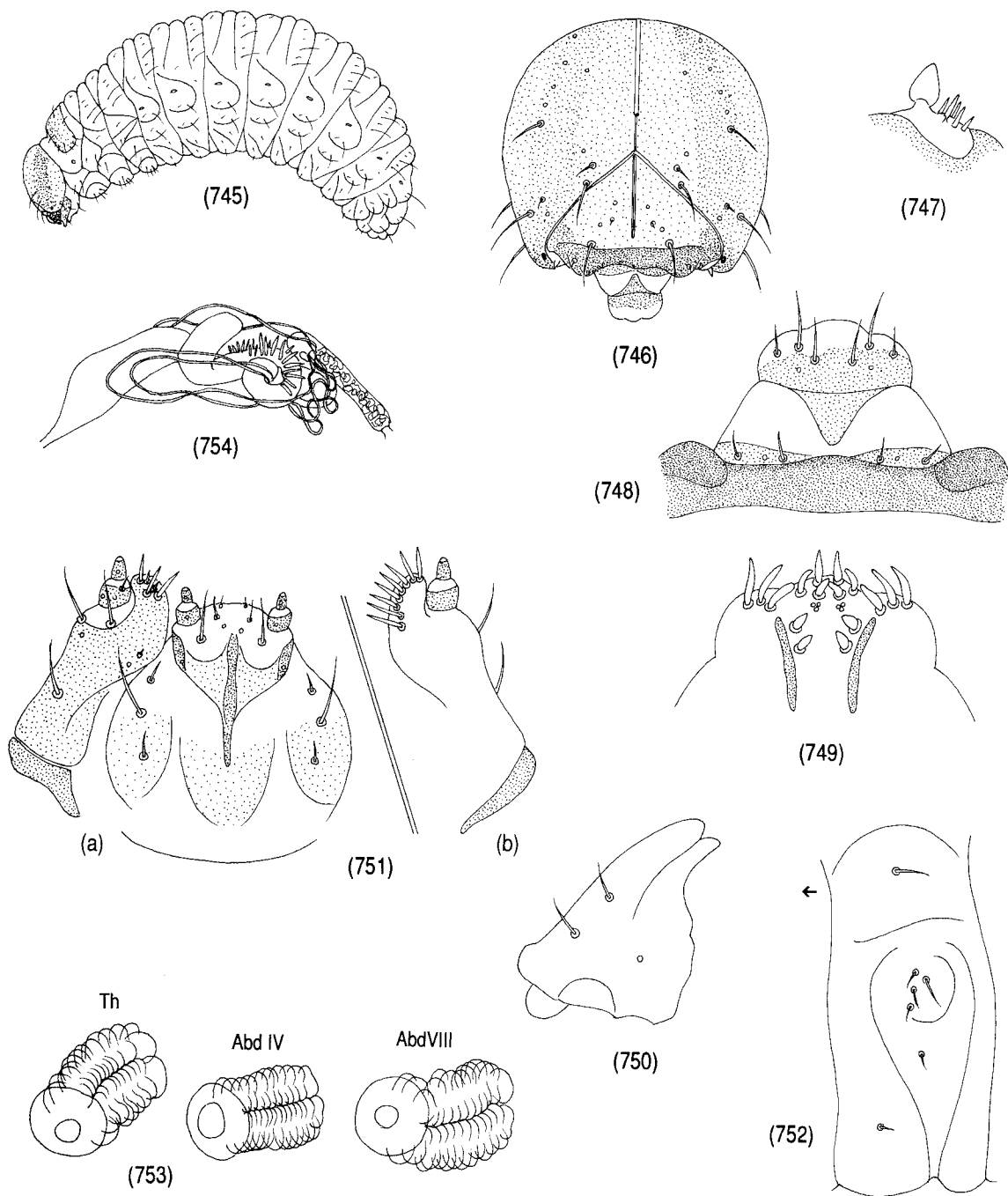
Curculionidae: Curculioninae: Eugnomini

Fig. 725–734 *Scolopterus aequus*: (725) habitus, lateral, x7; (726) head, dorsal, x20; (727) antenna, x265; (728) labrum, clypeus, and epistoma, x65; (729) epipharyngeal lining, x110; (730) mandible, x50; (731) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (732) Th II, ventropleural, pedal, and mediosternal lobes, x30; (733) spiracles, x265; (734) alimentary canal, x7.



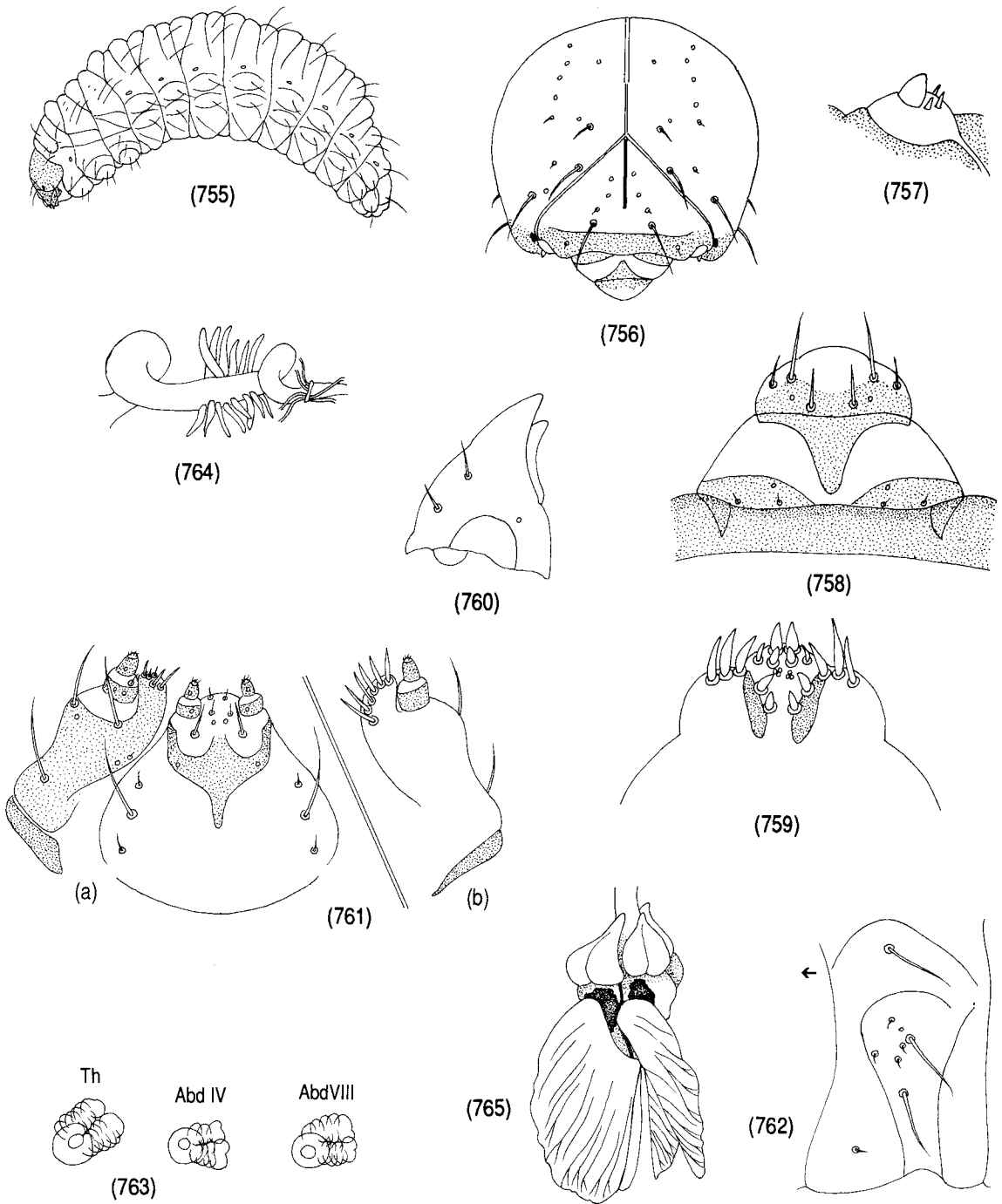
Curculionidae: Curculioninae: Gymnetrini

Fig. 735–744 *Gymnetron pascuorum*: (735) habitus, lateral, x25; (736) head, dorsal, x100; (737) antenna, x265; (738) labrum, clypeus, and epistoma, x265; (739) epipharyngeal lining, x265; (740) mandible, x135; (741) maxilla and labium, x200 (a, ventral; b, dorsal maxilla); (742) Th II, ventropleural, pedal, and mediosternal lobes, x100; (743) spiracles, x530; (744) alimentary canal, x25.



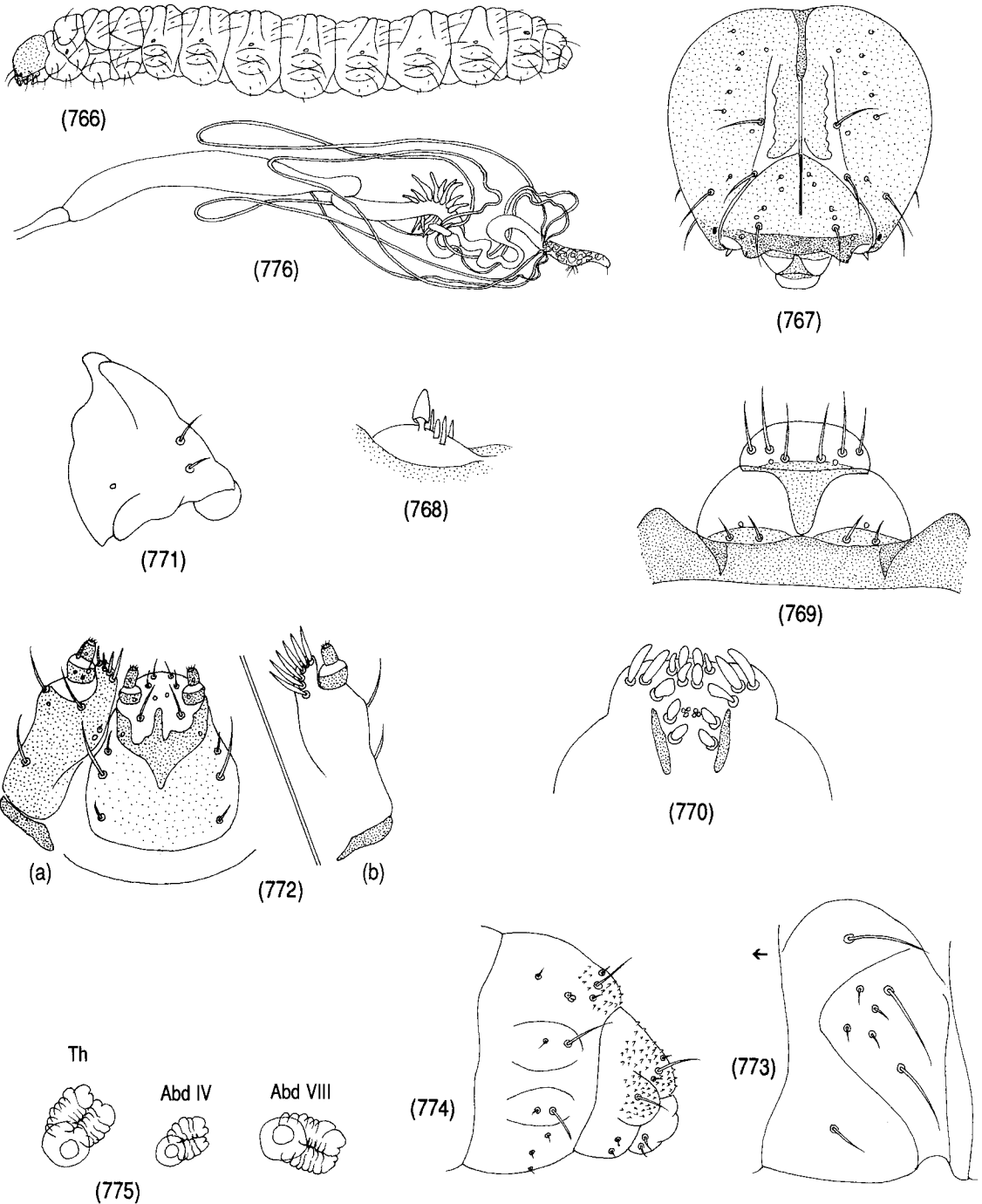
Curculionidae: Curculioninae: Curculionini

Fig. 745–754 *Peristoreus grossus*: (745) habitus, lateral, x7; (746) head, dorsal, x55; (747) antenna, x265; (748) labrum, clypeus, and epistoma, x135; (749) epipharyngeal lining, x200; (750) mandible, x100; (751) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (752) Th II, ventropleural, pedal, and mediosternal lobes, x55; (753) spiracles, x200; (754) alimentary canal, x7.



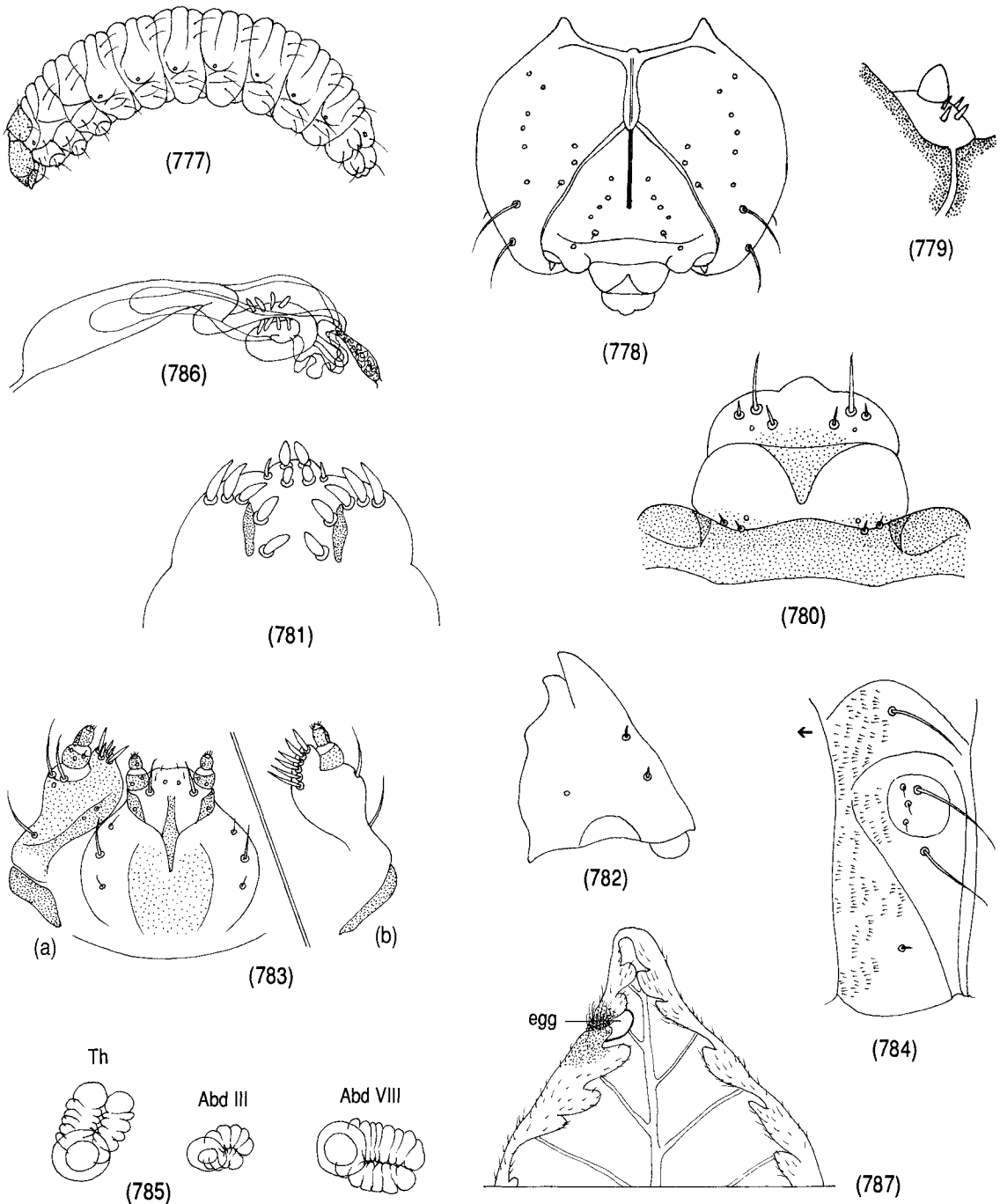
Curculionidae: Curculioninae: Curculionini

Fig. 755–765 *Aneuma compta*: (755) habitus, lateral, x20; (756) head, dorsal, x55; (757) antenna, x265; (758) labrum, clypeus, and epistoma, x200; (759) epipharyngeal lining, x265; (760) mandible, x135; (761) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (762) Th II, ventropleural, pedal, and mediosternal lobes, x30; (763) spiracles, x265; (764) alimentary canal, posterior ventriculus, x30; (765) larval exit holes in fruits of *Hoheria populnea*, x3.



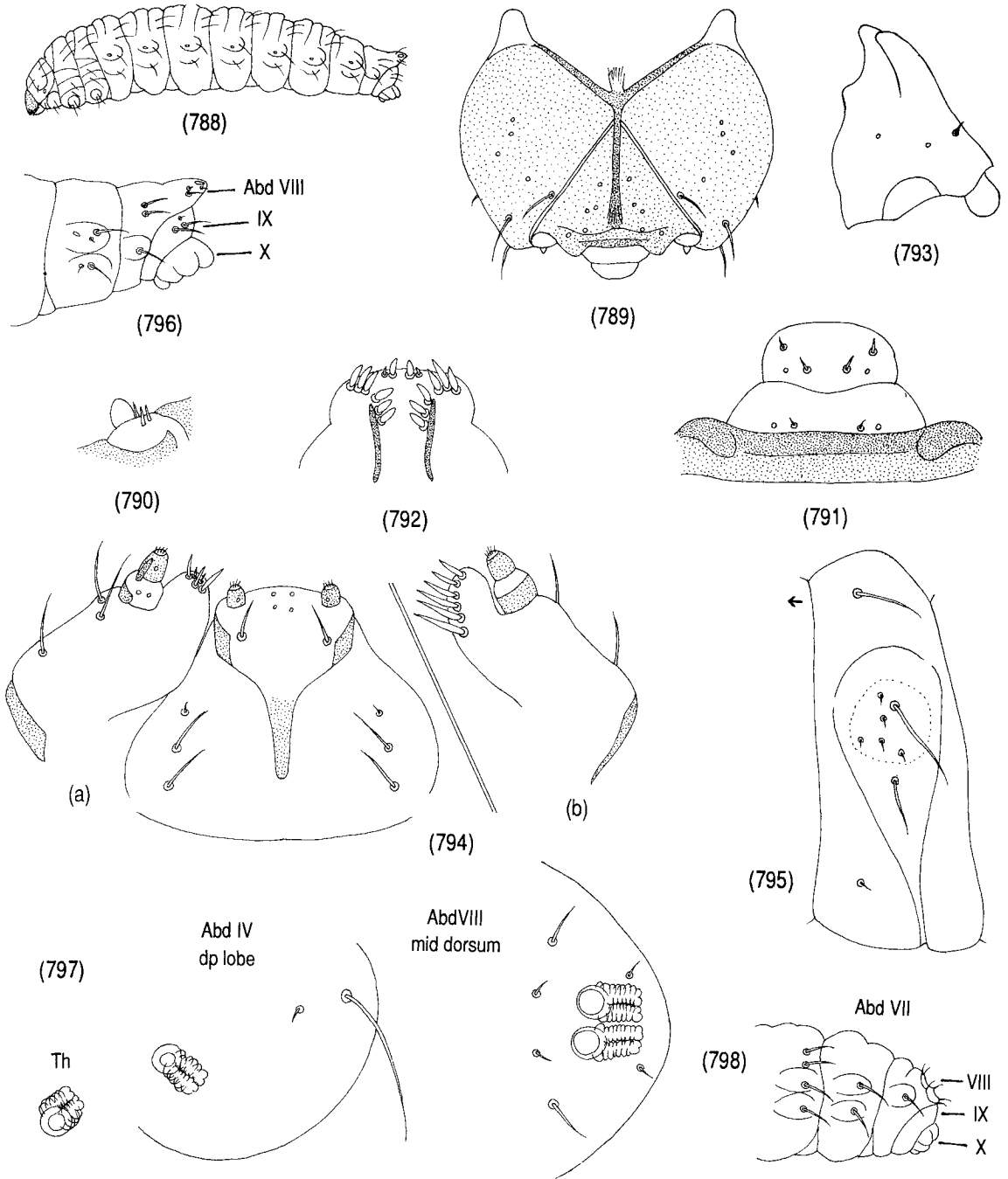
Curculionidae: Curculioninae: Curculionini

Fig. 766–776 *Phorostichus linearis*: (766) habitus, lateral, x15; (767) head, dorsal, x65; (768) antenna, x265; (769) labrum, clypeus, and epistoma, x200; (770) epipharyngeal lining, x265; (771) mandible, x200; (772) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (773) Th II, ventropleural, pedal, and mediosternal lobes, x100; (774) abdominal segments VIII–X, x40; (775) spiracles, x265; (776) alimentary canal, x15.



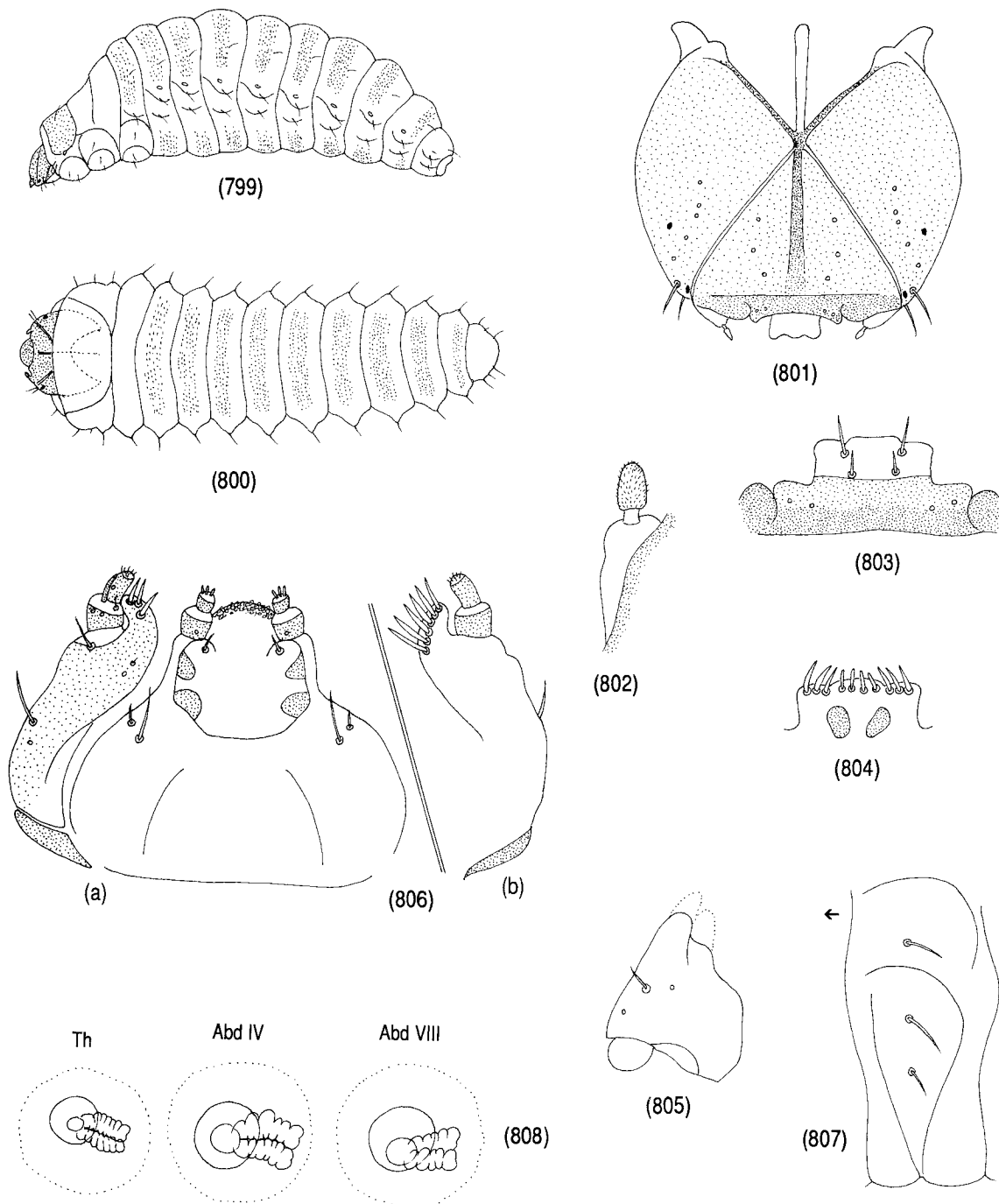
Curculionidae: Curculioninae: Curculionini

Fig. 777–787 *Hypotagea concolor*: (777) habitus, lateral, x15; (778) head, dorsal, x100; (779) antenna, x330; (780) labrum, clypeus, and epistoma, x265; (781) epipharyngeal lining, x330; (782) mandible, x265; (783) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (784) Th II, ventropleural, pedal, and mediosternal lobes, x100; (785) spiracles, x330; (786) alimentary canal, x15; (787) egg in leaf-curl of *Nothofagus truncata*.



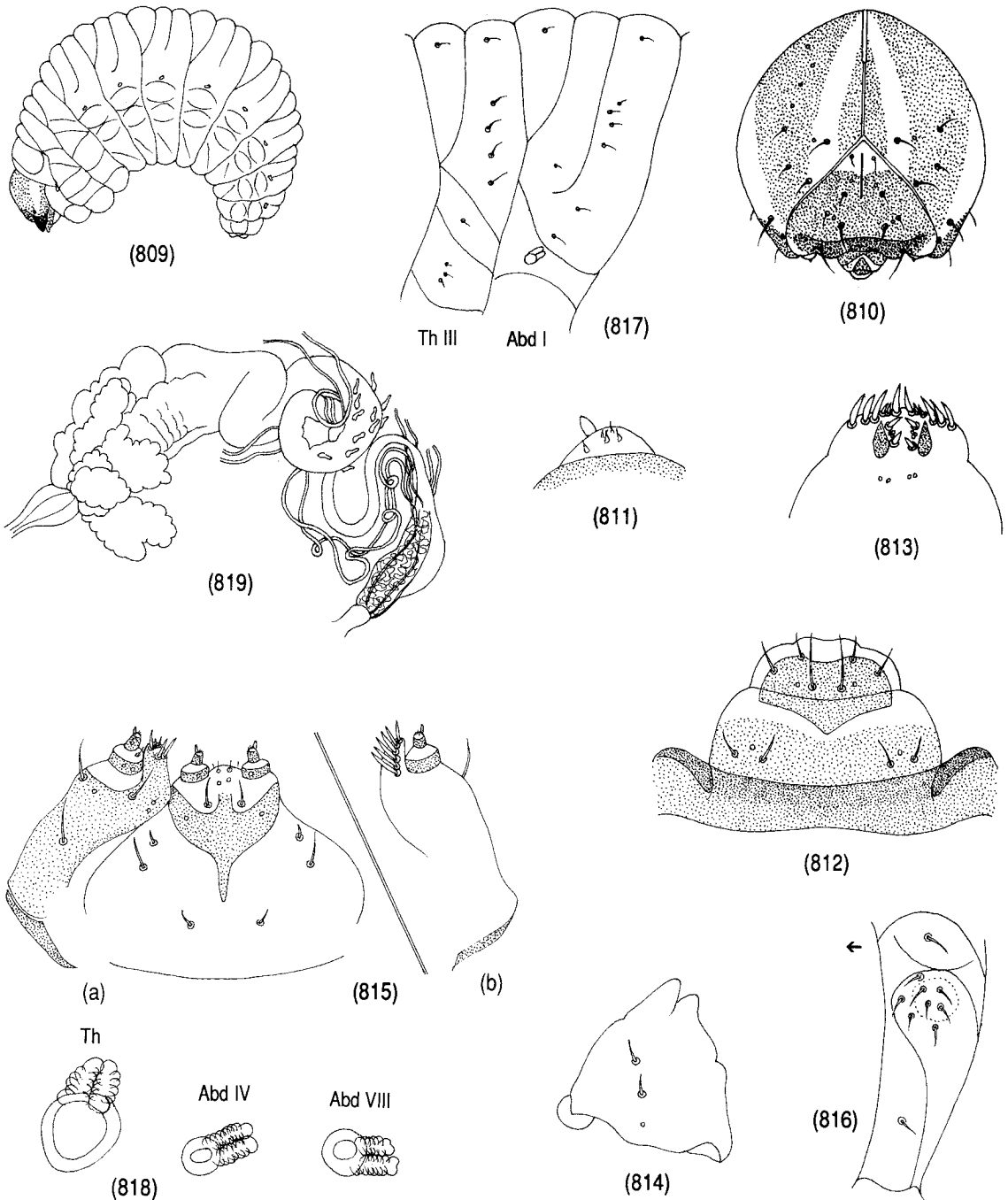
Curculionidae: Curculioninae: Curculionini

Fig. 788–797 *Neomycta rubida*: (788) habitus, lateral, x15; (789) head, dorsal, x100; (790) antenna, x265; (791) labrum, clypeus, and epistoma, x265; (792) epipharyngeal lining, x265; (793) mandible, x265; (794) maxilla and labium, x265 (a, ventral; b, dorsal maxilla); (795) Th II, ventropleural, pedal, and mediosternal lobes, x135; (796) terminal abdominal segments, lateral, x30; (797) spiracles, x265. **798 *N. pulicaris*,** terminal abdominal segments, lateral, x30.



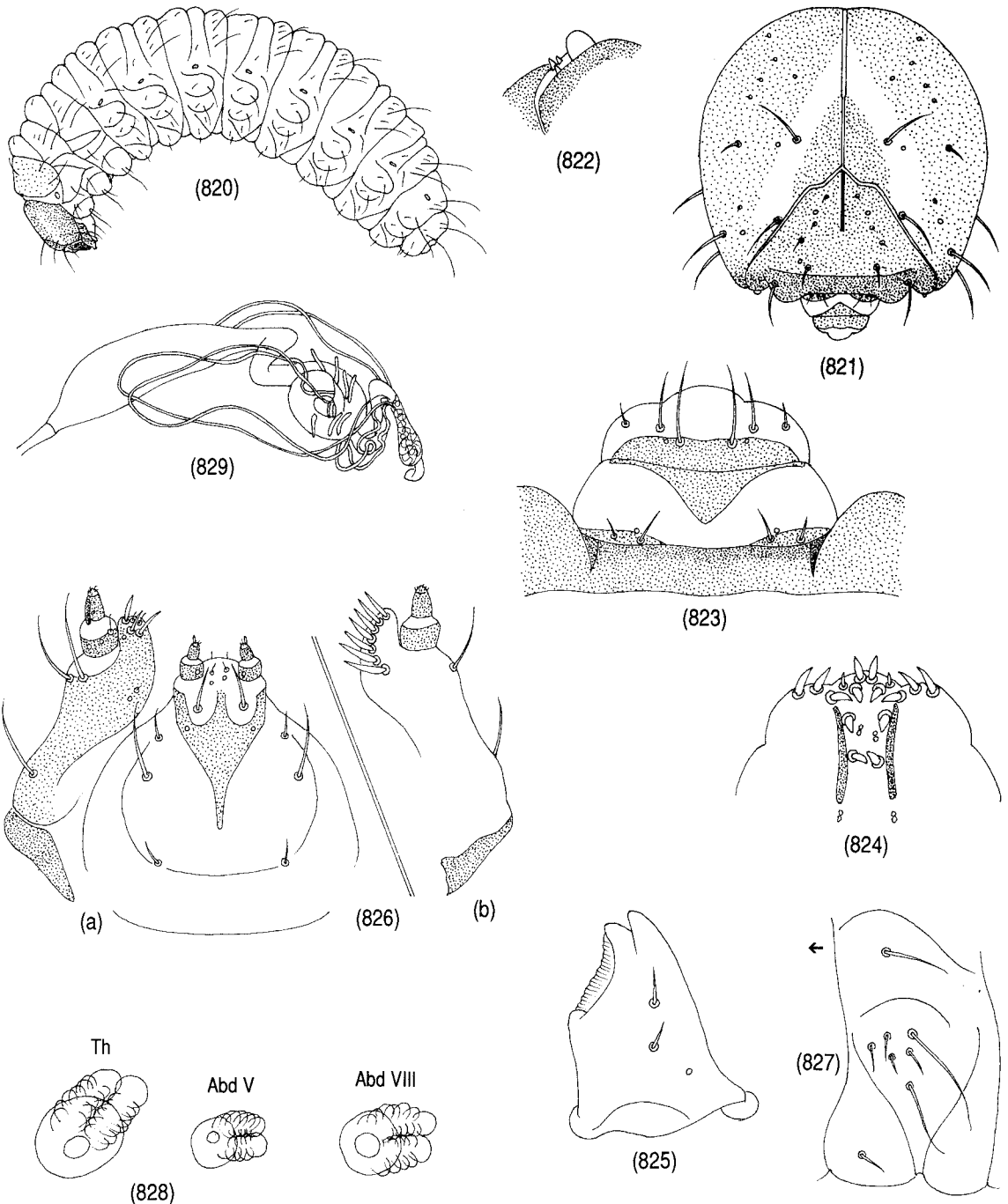
Curculionidae: Curculioninae: Curculionini

Fig. 799–808 *Geochustibialis*: (799) prepupal larva, habitus, lateral, x30; (800) feeding larva, habitus, dorsal, x30; (801) head, dorsal, x110; (802) antenna, x405; (803) labrum and frontoclypeus, x265; (804) epipharyngeal lining, x265; (805) mandible, x265; (806) maxilla and labium, x265 (a, ventral; b, dorsal maxilla); (807) Th II, ventropleural, pedal, and mediosternal lobes, x55; (808) spiracles, x530.



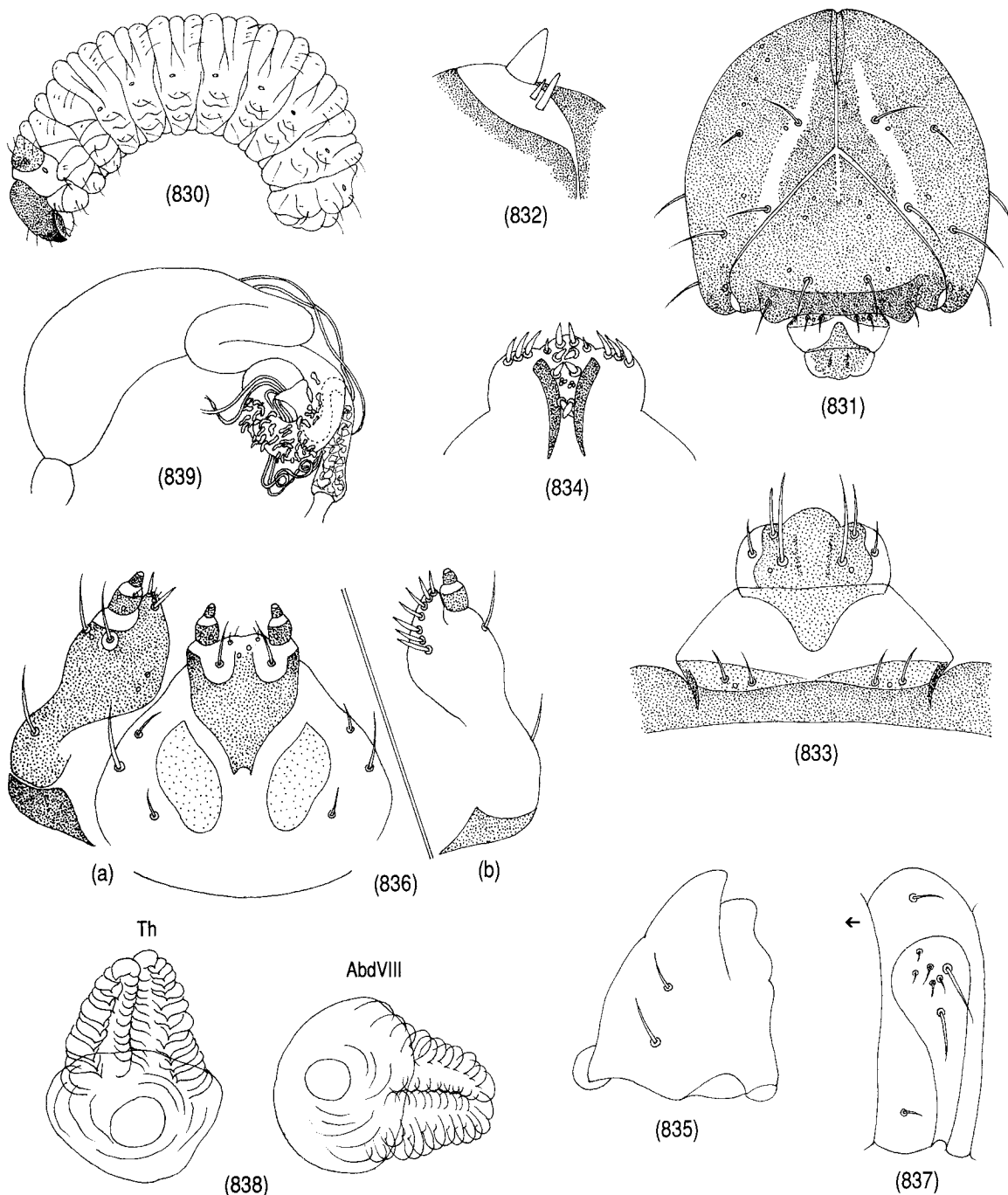
Curculionidae: Curculioninae: Cleonini

Fig. 809–819 *Rhinocyllus conicus*: (809) habitus, lateral, x7; (810) head, dorsal, x30; (811) antenna, x265; (812) labrum, clypeus, and epistoma, x135; (813) epipharyngeal lining, x135; (814) mandible, x65; (815) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (816) Th II, ventropleural, pedal, and mediosternal lobes, x30; (817) Th III and Abd I, dorsal and spiracular setae (x30); (818) spiracles, x265; (819) alimentary canal, x15.



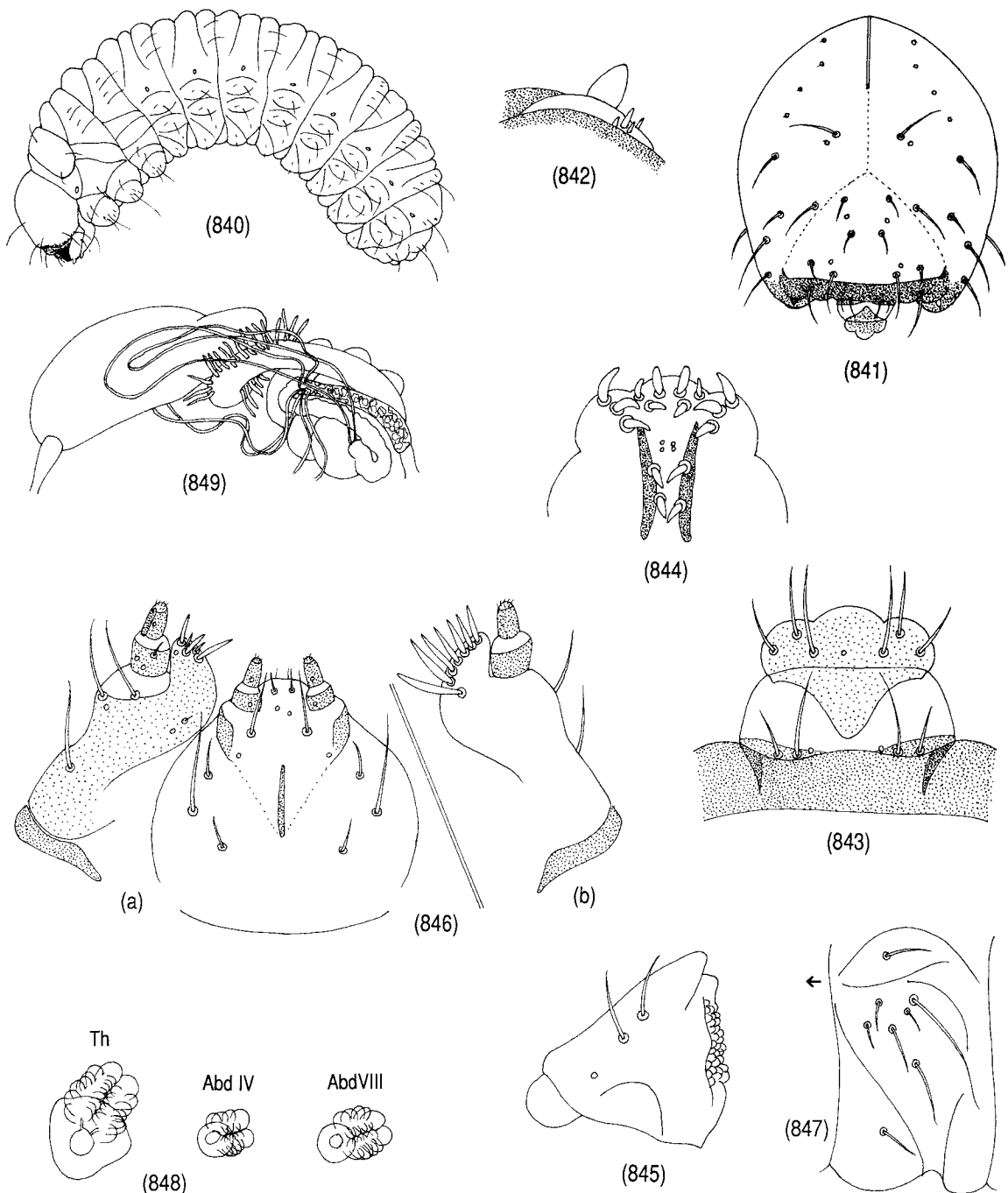
Curculionidae: Curculioninae: Molytini

Fig. 820–829 *Arecofaga varia*: (820) habitus, lateral, x15; (821) head, dorsal, x45; (822) antenna, x265; (823) labrum, clypeus, and epistoma, x185; (824) epipharyngeal lining, x185; (825) mandible, x135; (826) maxilla and labium, x110 (a, ventral; b, dorsal maxilla); (827) Th II, ventropleural, pedal, and mediosternal lobes, x65; (828) spiracles, x270; (829) alimentary canal, x15.



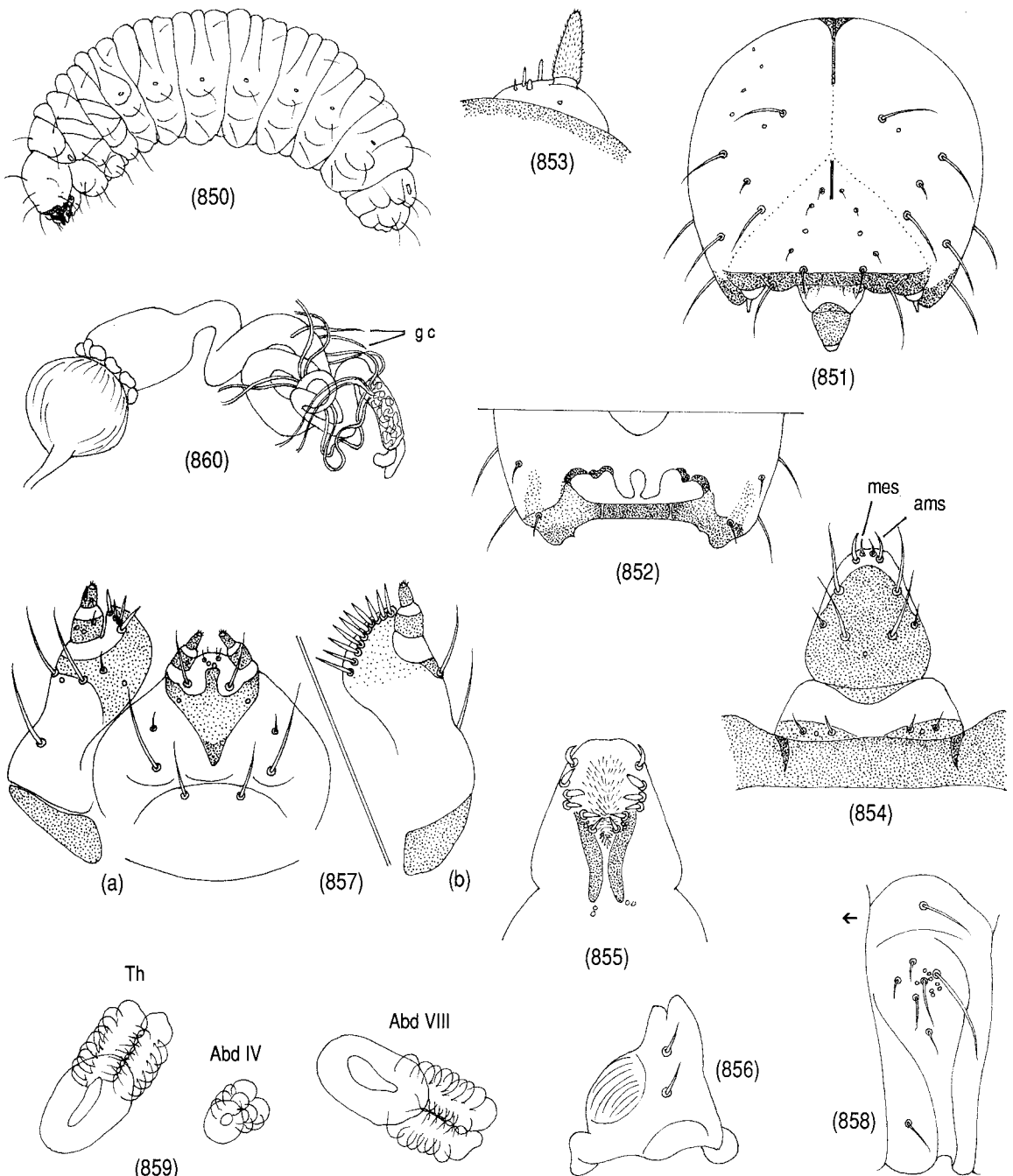
Curculionidae: Curculioninae: Molytini

Fig. 830–839 *Lyperobius* spp. (830–838, Mt Arthur; 839, Mt Murchison): (830) habitus, lateral, x3; (831) head, dorsal, x15; (832) antenna, x110; (833) labrum, clypeus, and epistoma, x30; (834) epipharyngeal lining, x30; (835) mandible, x30; (836) maxilla and labium, x20 (a, ventral; b, dorsal maxilla); (837) Th II, ventropleural, pedal, and mediosternal lobes, x7; (838) spiracles, x55; (839) alimentary canal, x3.



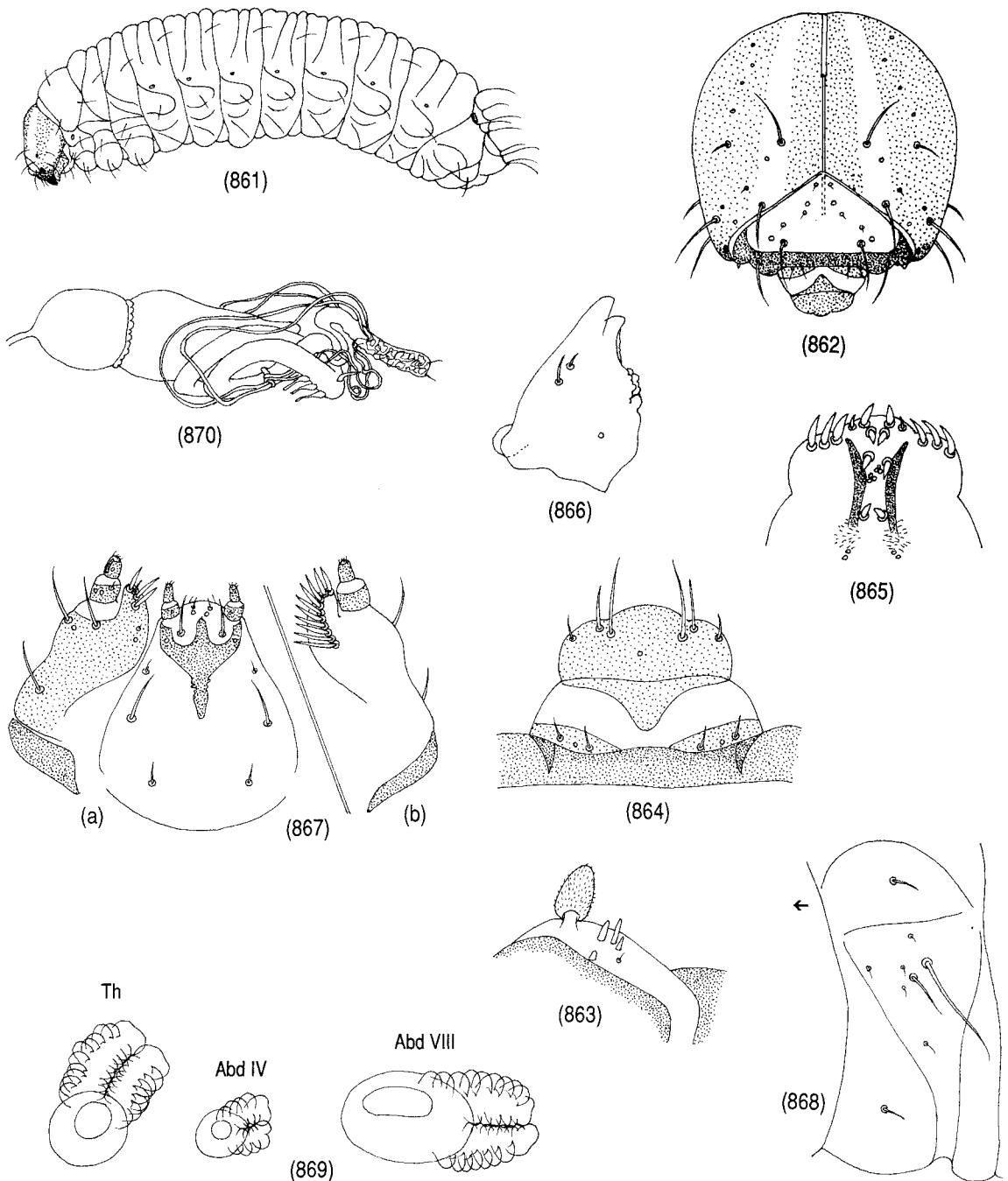
Curculionidae: Curculioninae: Molytini

Fig. 840–849 *Paedaretus hispidus*: (840) habitus, lateral, x15; (841) head, dorsal, x40; (842) antenna, x265; (843) labrum, clypeus, and epistoma, x185; (844) epipharyngeal lining, x185; (845) mandible, x135; (846) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (847) Th II, ventropleural, pedal, and mediosternal lobes, x45; (848) spiracles, x265; (849) alimentary canal, x15.



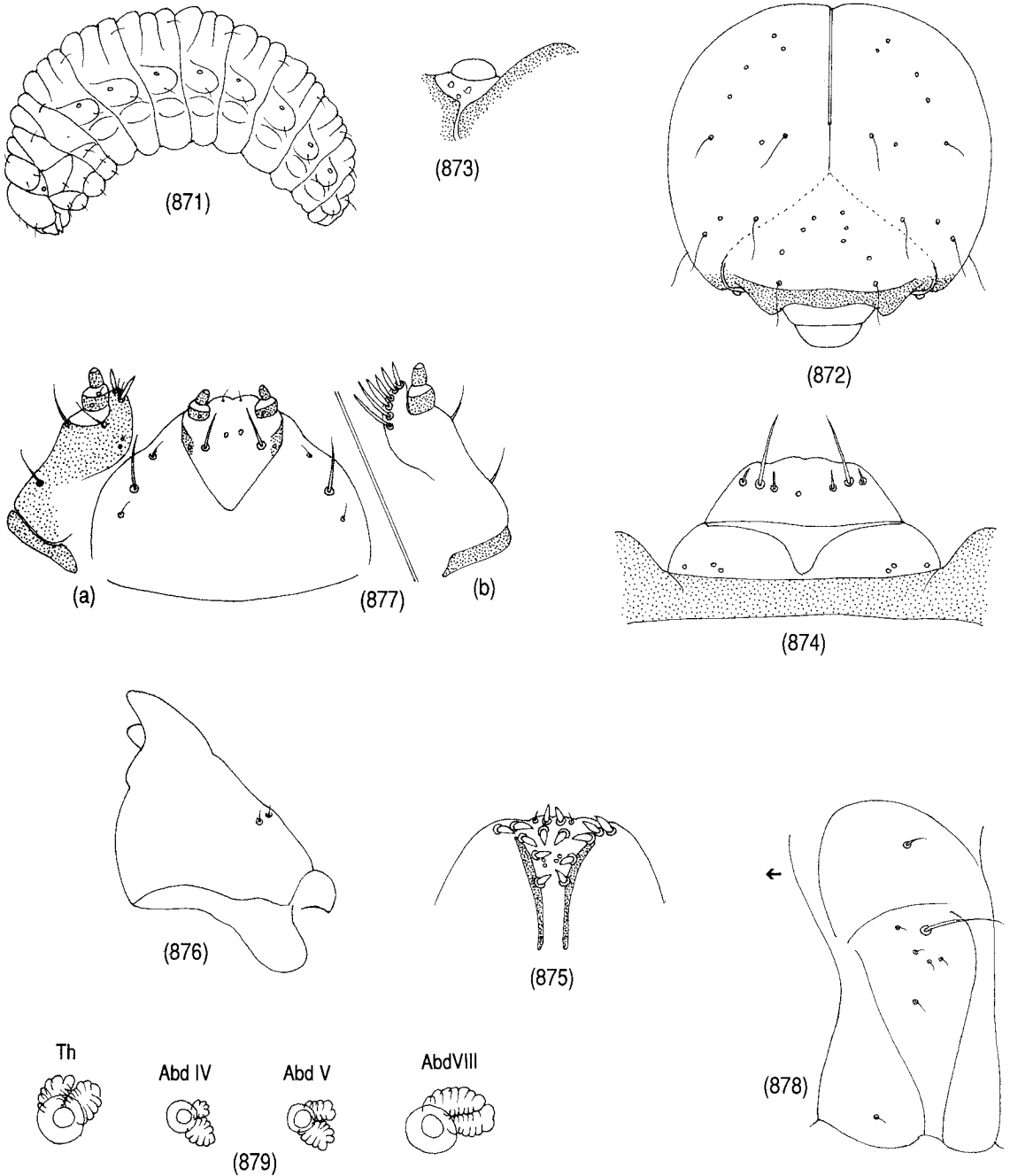
Curculionidae: Curculioninae: Molytini

Fig. 850–860 *Phrynixus astutus*: (850) habitus, lateral, x15; (851) head, dorsal, and ventral, anterior portion, x45; (853) antenna, x220; (854) labrum, clypeus, and epistoma, x95; (855) epipharyngeal lining, x95; (856) mandible, x65; (857) maxilla and labium, x75 (a, ventral; b, dorsal maxilla); (858) Th II, ventropleural, pedal, and mediosternal lobes, x65; (859) spiracles, x185; (860) alimentary canal, x15.



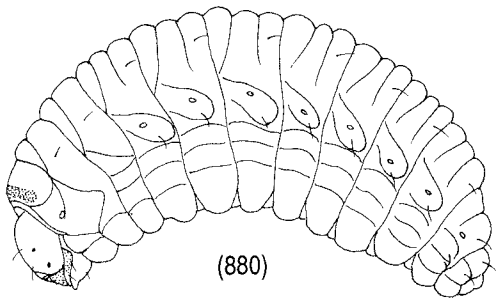
Curculionidae: Curculioninae: Molytini

Fig. 861–870 *Rystheus notabilis*: (861) habitus, lateral, x10; (862) head, dorsal, x35; (863) antenna, x265; (864) labrum, clypeus, and epistoma, x65; (865) epipharyngeal lining, x185; (866) mandible, x65; (867) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (868) Th II, ventropleural, pedal, and mediosternal lobes, x55; (869) spiracles, x220; (870) alimentary canal, x10.

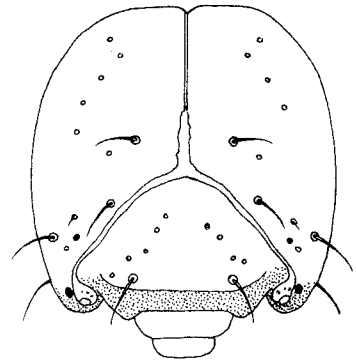


Curculionidae: Curculioninae: Ceutorhynchini

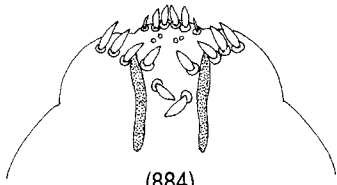
Fig. 871–879 *Rhinoncus australis*: (871) habitus, lateral, x20; (872) head, dorsal, x95; (873) antenna, x265; (874) labrum, clypeus, and epistoma, x265; (875) epipharyngeal lining, x265; (876) mandible, x185; (877) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (878) Th II, ventropleural, pedal, and mediosternal lobes, x135; (879) spiracles, x265.



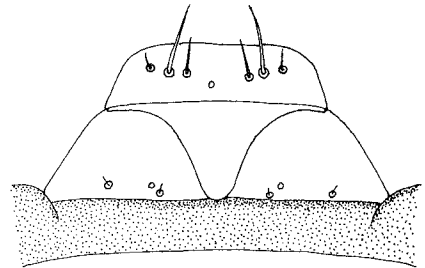
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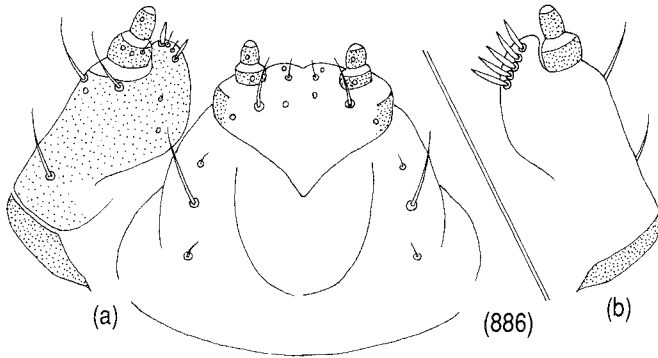
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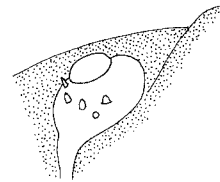
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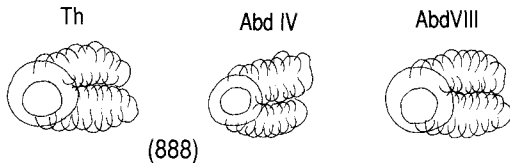
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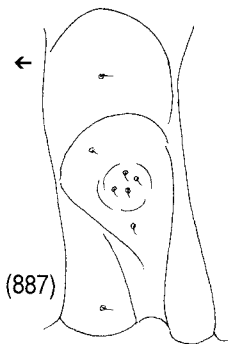
Abd IV

Abd VIII

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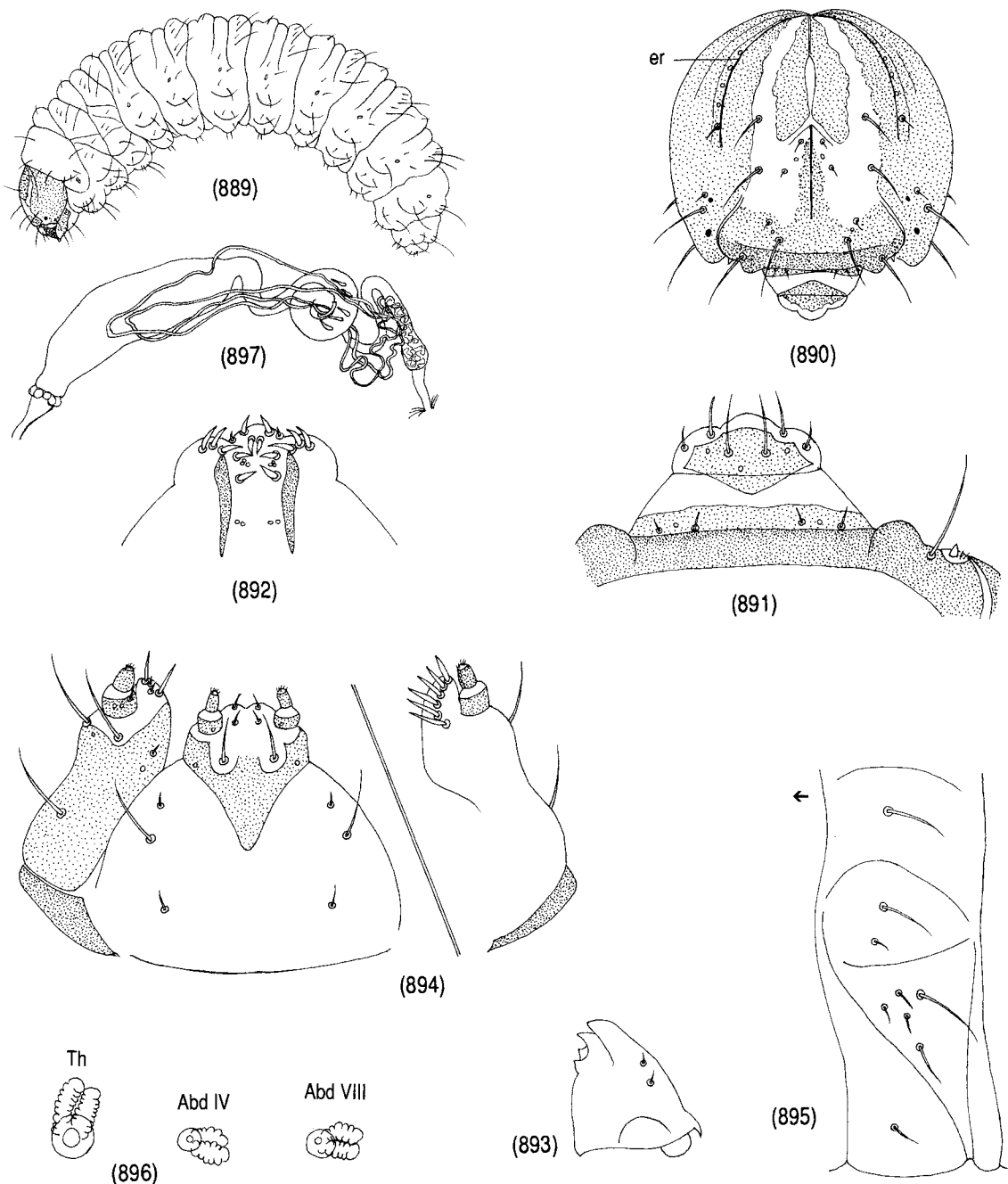
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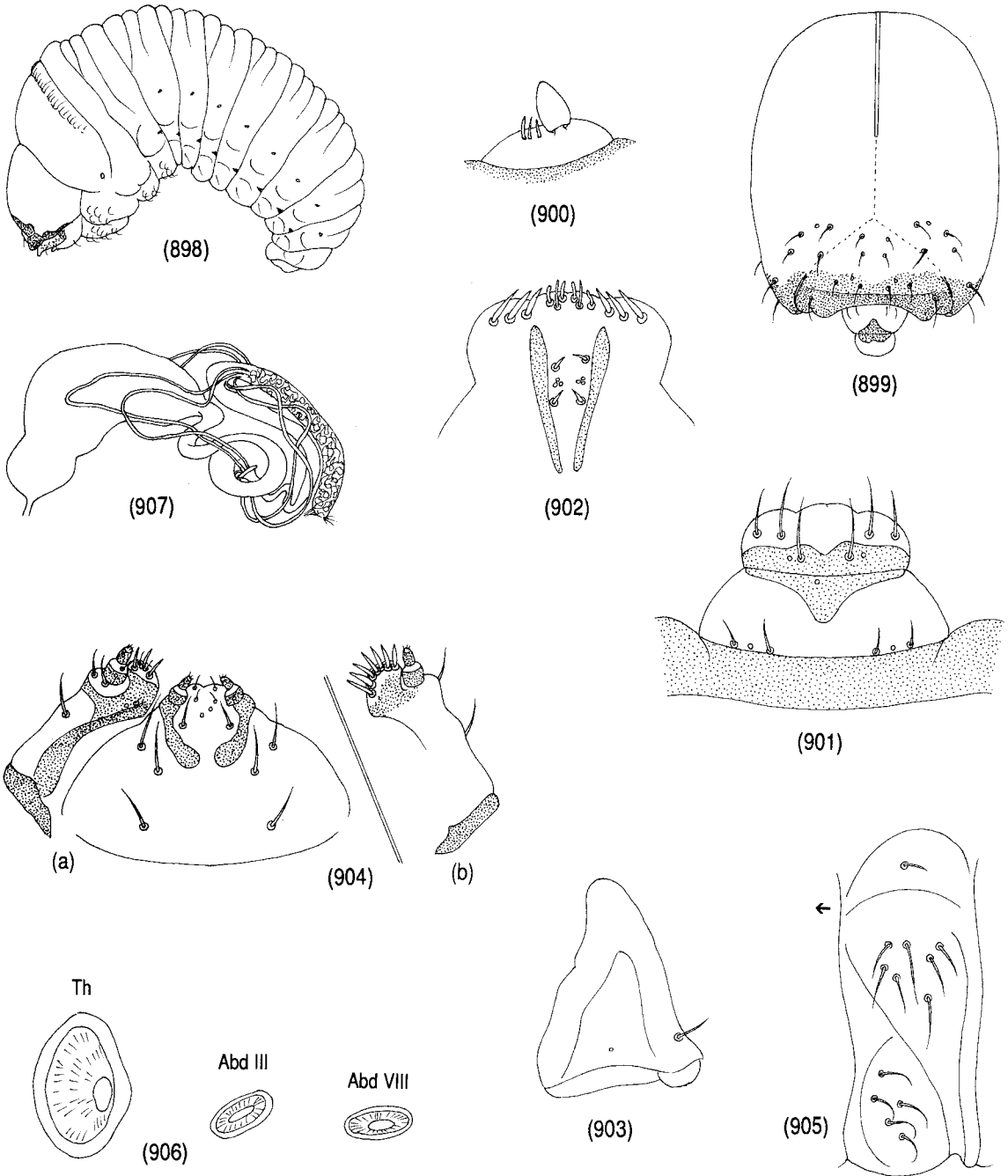
Curculionidae: Curculioninae: Ceutorhynchini

Fig. 880–888 *Trichosirocalus horridus*: (880) habitus, lateral, x15; (881) head, dorsal, x65; (882) antenna, x265; (883) labrum, clypeus, and epistoma, x185; (884) epipharyngeal lining, x185; (885) mandible, x135; (886) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (887) Th II, ventropleural, pedal, and mediosternal lobes, x65; (888) spiracles, x265.



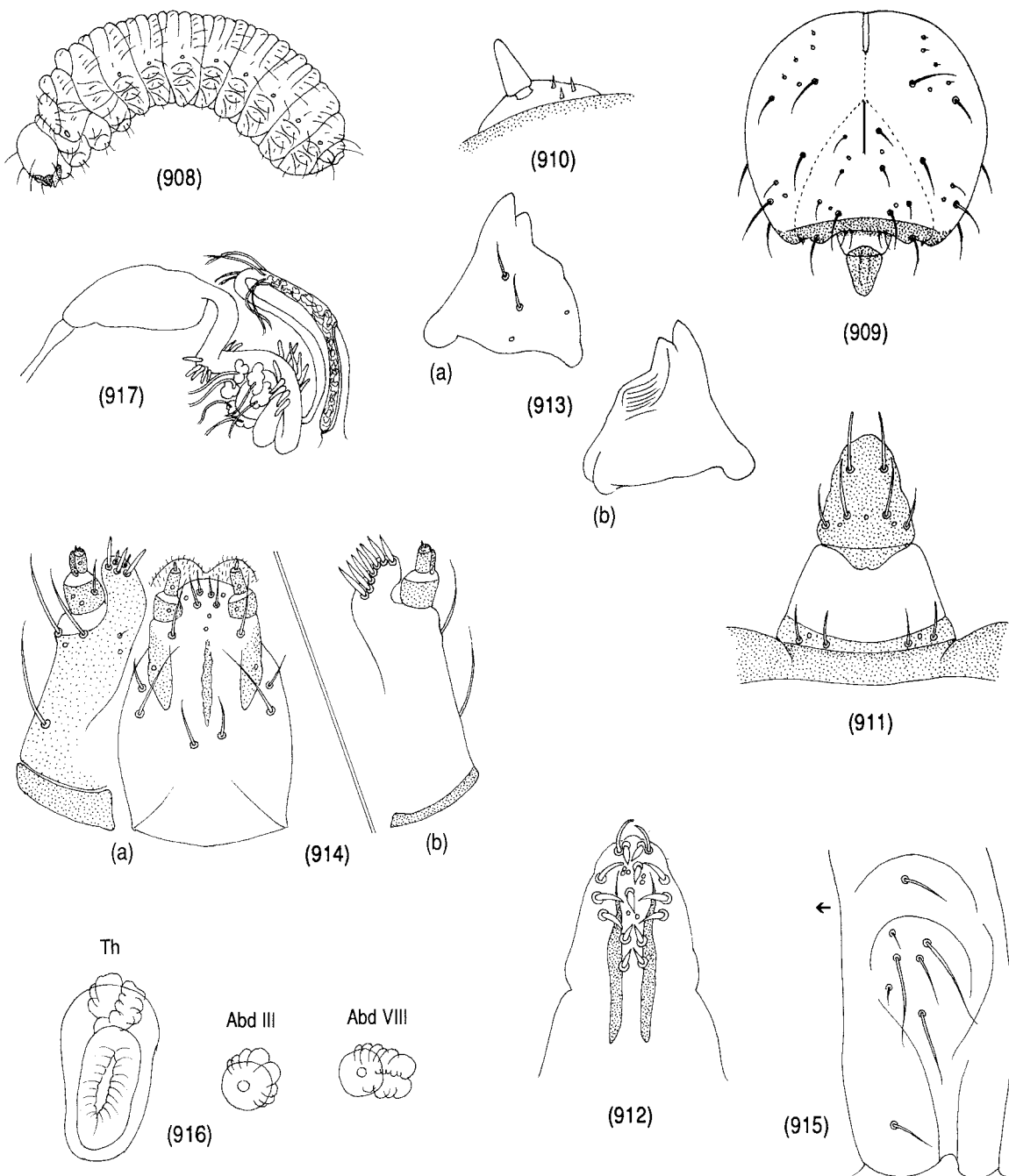
Curculionidae: Curculioninae: Baridini

Fig. 889–897 *Linogeraeus urbanus*: (889) habitus, lateral, x11; (890) head, dorsal, x22; (891) labrum, clypeus, epistoma, and antenna, x110; (892) epipharyngeal lining, x110; (893) mandible, x55; (894) maxilla and labium (a, ventral; b, dorsal maxilla), x95; (895) dorsopleural, ventropleural, pedal, and mediosternal areas, Th II, x55; (896) spiracles, x265; (897) alimentary canal, x11.



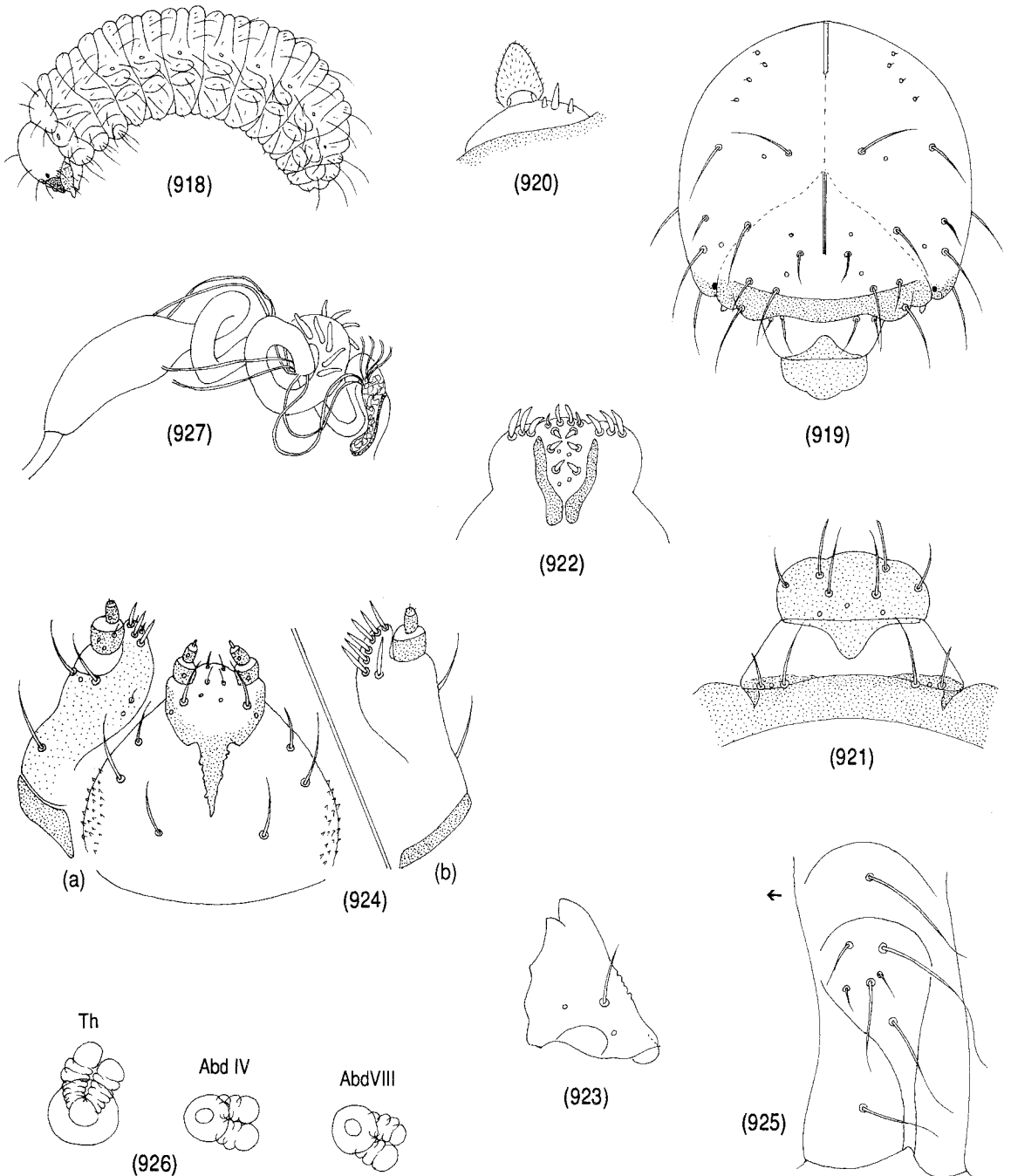
Curculionidae: Curculioninae: Magdalinini

Fig. 898–907 *Neosaccolaemus narinus*: (898) habitus, lateral, x10; (899) head, dorsal, x30; (900) antenna, x265; (901) labrum, clypeus, and epistoma, x110; (902) epipharyngeal lining, x135; (903) mandible, x95; (904) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (905) Th II, ventropleural, pedal, and mediosternal lobes, x40; (906) spiracles, x200; (907) alimentary canal, x10.



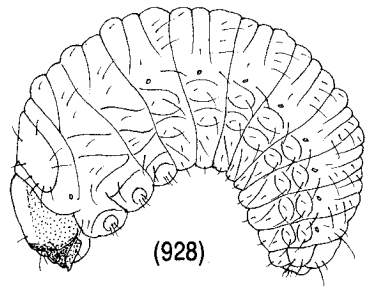
Curculionidae: Cossoninae: Cossonini

Fig. 908–917 *Mesites pallidipennis*: (908) habitus, lateral, x7; (909) head, dorsal, x30; (910) antenna, x265; (911) labrum, clypeus, and epistoma, x95; (912) epipharyngeal lining, x135; (913) mandible, x65 (a, outer surface; b, inner surface); (914) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (915) Th II, ventropleural, pedal, and mediosternal lobes, x55; (916) spiracles, x265; (917) alimentary canal, x10.

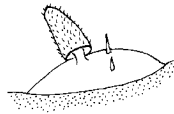


Curculionidae: Cossoninae: Cotasterini

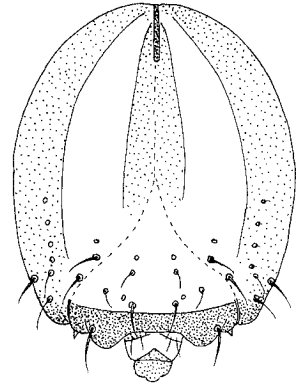
Fig. 918–927 *Eiratus suavis*: (918) habitus, lateral, x15; (919) head, dorsal, x65; (920) antenna, x330; (921) labrum, clypeus, and epistoma, x135; (922) epipharyngeal lining, x135; (923) mandible, x95; (924) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (925) Th II, ventropleural, pedal, and mediosternal lobes, x95; (926) spiracles, x330; (927) alimentary canal, x15.



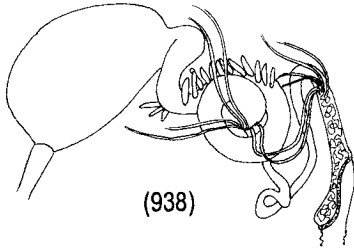
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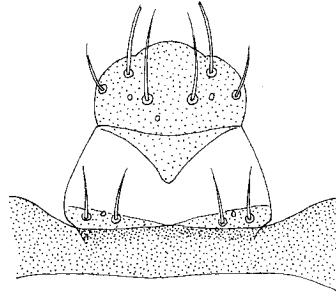
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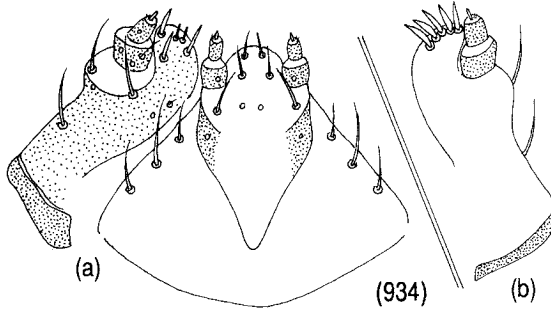
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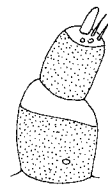
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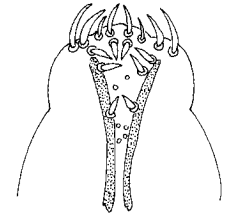
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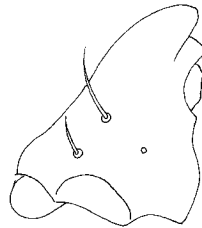
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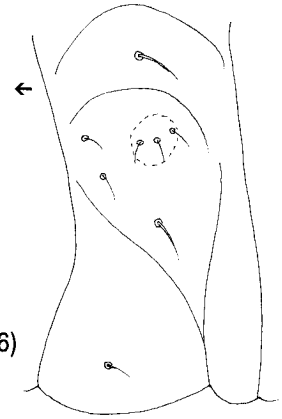
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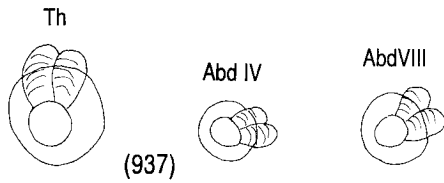
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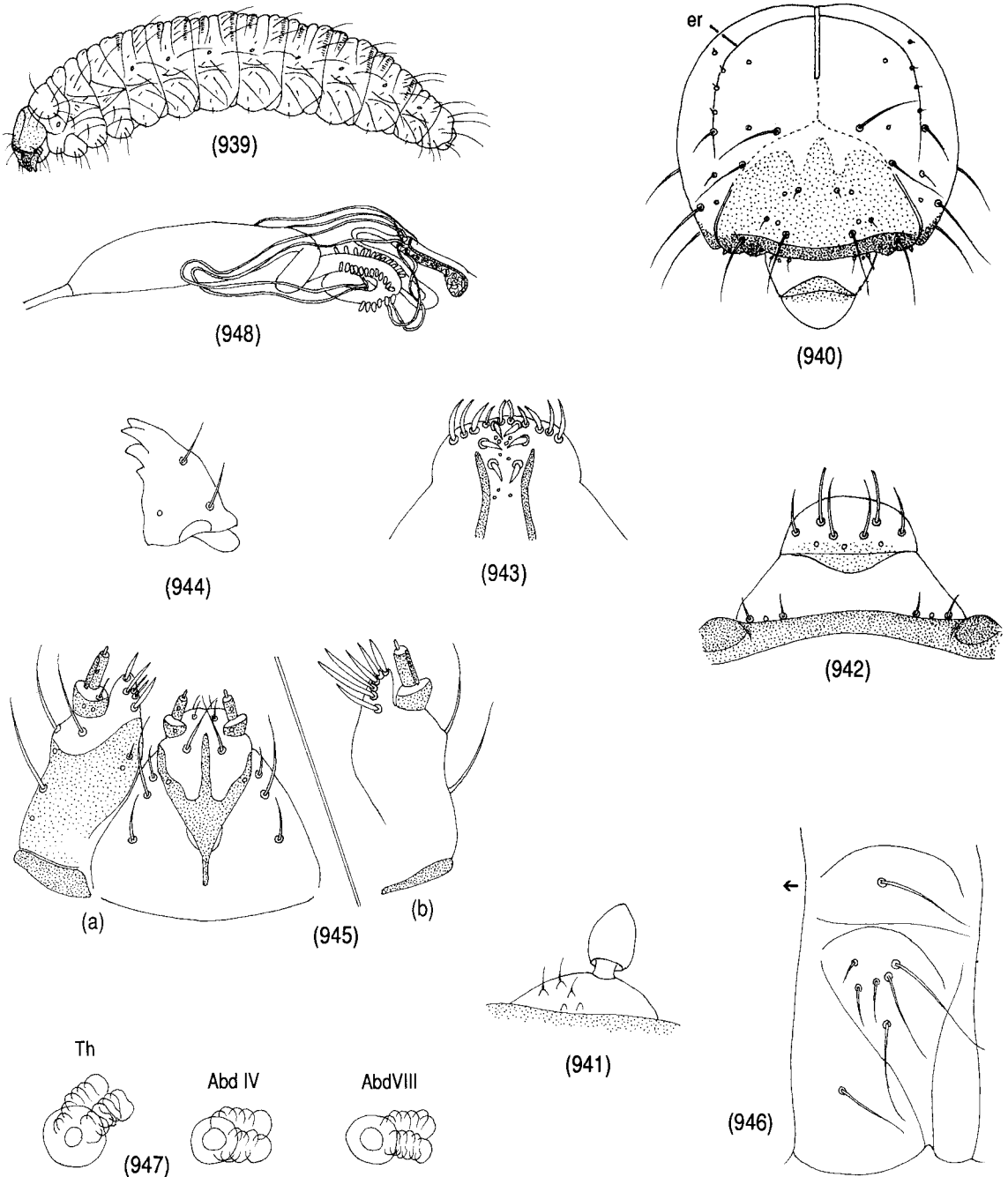
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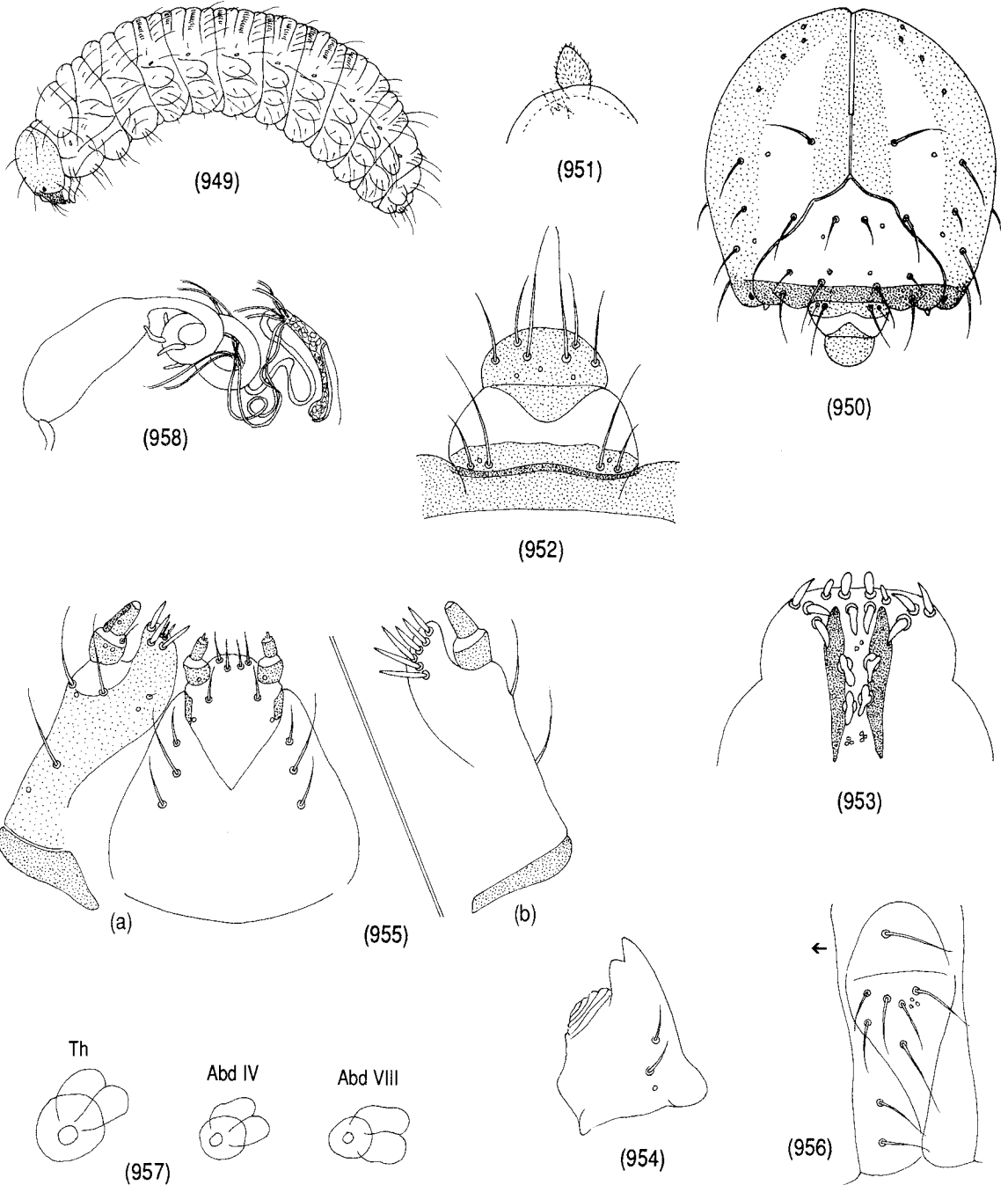
Curculionidae: Cossoninae: Pentarthrini

Fig. 928–938 *Pentarthrum zealandicum*: (928) habitus, lateral, x15; (929) head, dorsal, x45; (930) antenna, x265; (931) labrum, clypeus, and epistoma, x165; (932) epipharyngeal lining, x165; (933) mandible, x135; (934) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (935) labial palp, x330; (936) Th II, ventropleural, pedal, and mediosternal lobes, x55; (937) spiracles, x330; (938) alimentary canal, x15.



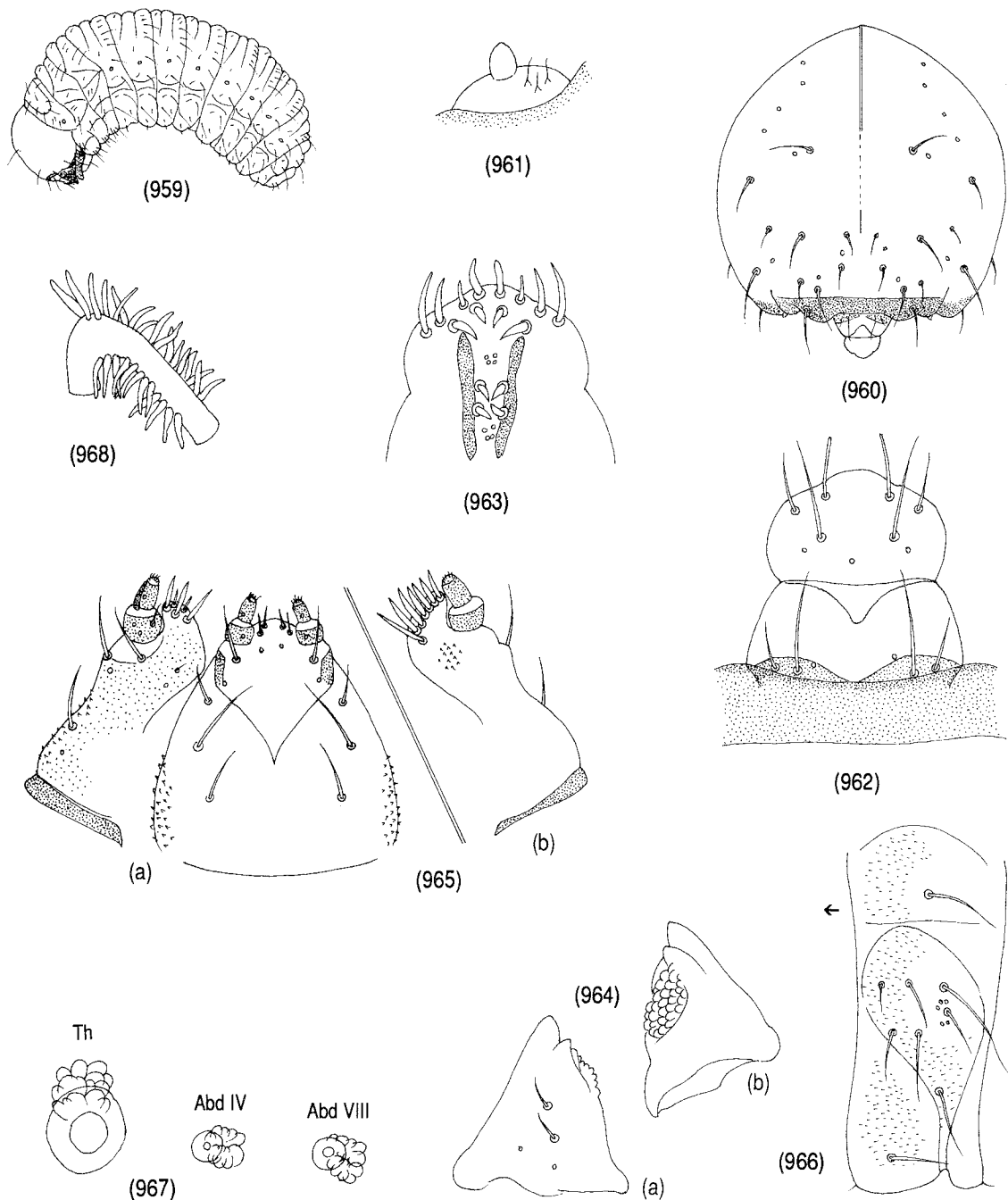
Curculionidae: Cossoninae: Pentarthrini

Fig. 939–948 *Arecocryptus bellus*: (939) habitus, lateral, x15; (940) head, dorsal, x75; (941) antenna, x530; (942) labrum, clypeus, and epistoma, x135; (943) epipharyngeal lining, x135; (944) mandible, x65; (945) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (946) Th II, ventropleural, pedal, and mediosternal lobes, x90; (947) spiracles, x330; (948) alimentary canal, x15.



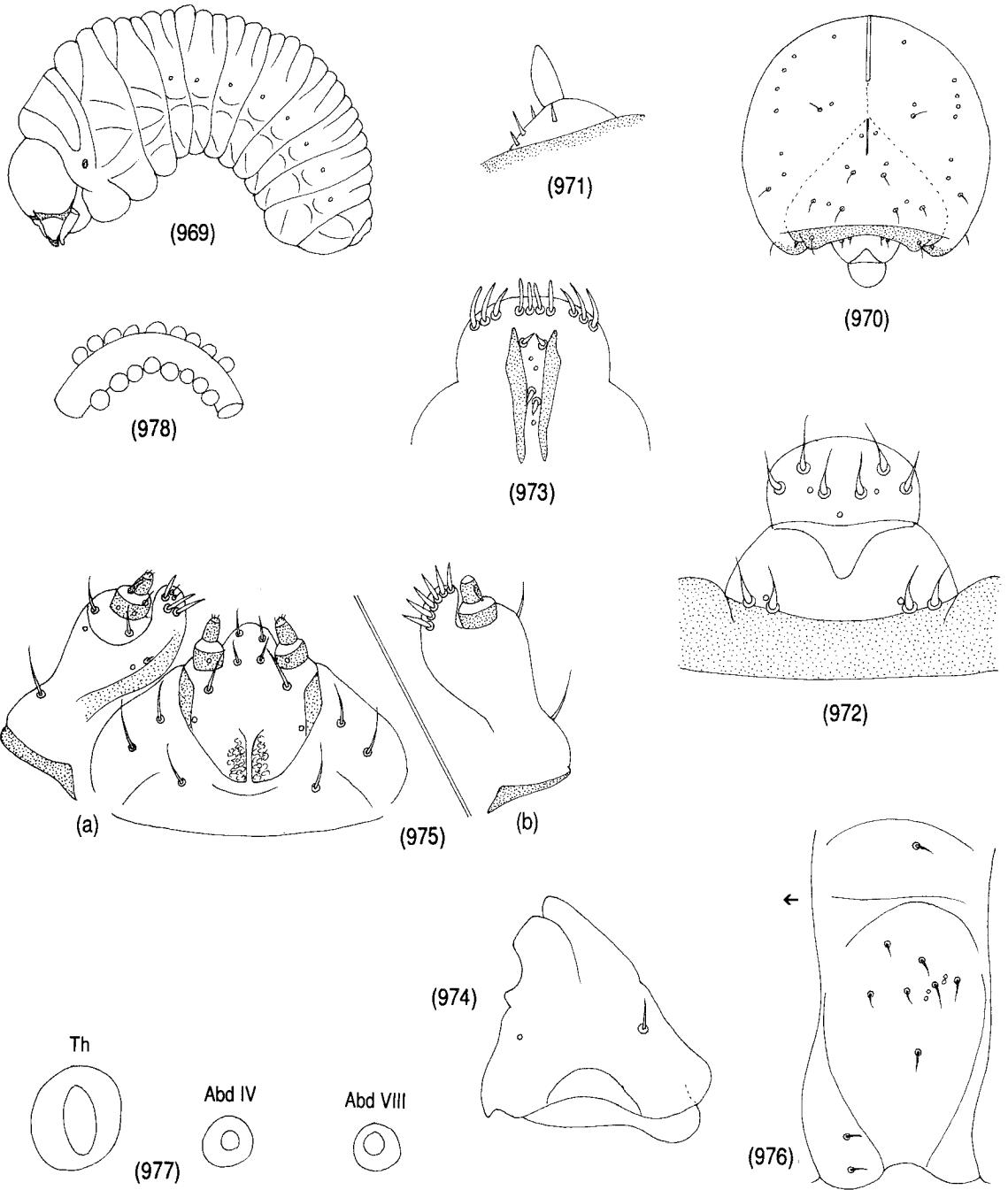
Curculionidae: Cossoninae: Rhyncolini

Fig. 949–958 *Pachyops dubius*: (949) habitus, lateral, x15; (950) head, dorsal, x55; (951) antenna, x265; (952) labrum, clypeus, and epistoma, x135; (953) epipharyngeal lining, x220; (954) mandible, x95; (955) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (956) Th II, ventropleural, pedal, and mediosternal lobes, x65; (957) spiracles, x330; (958) alimentary canal, x15.



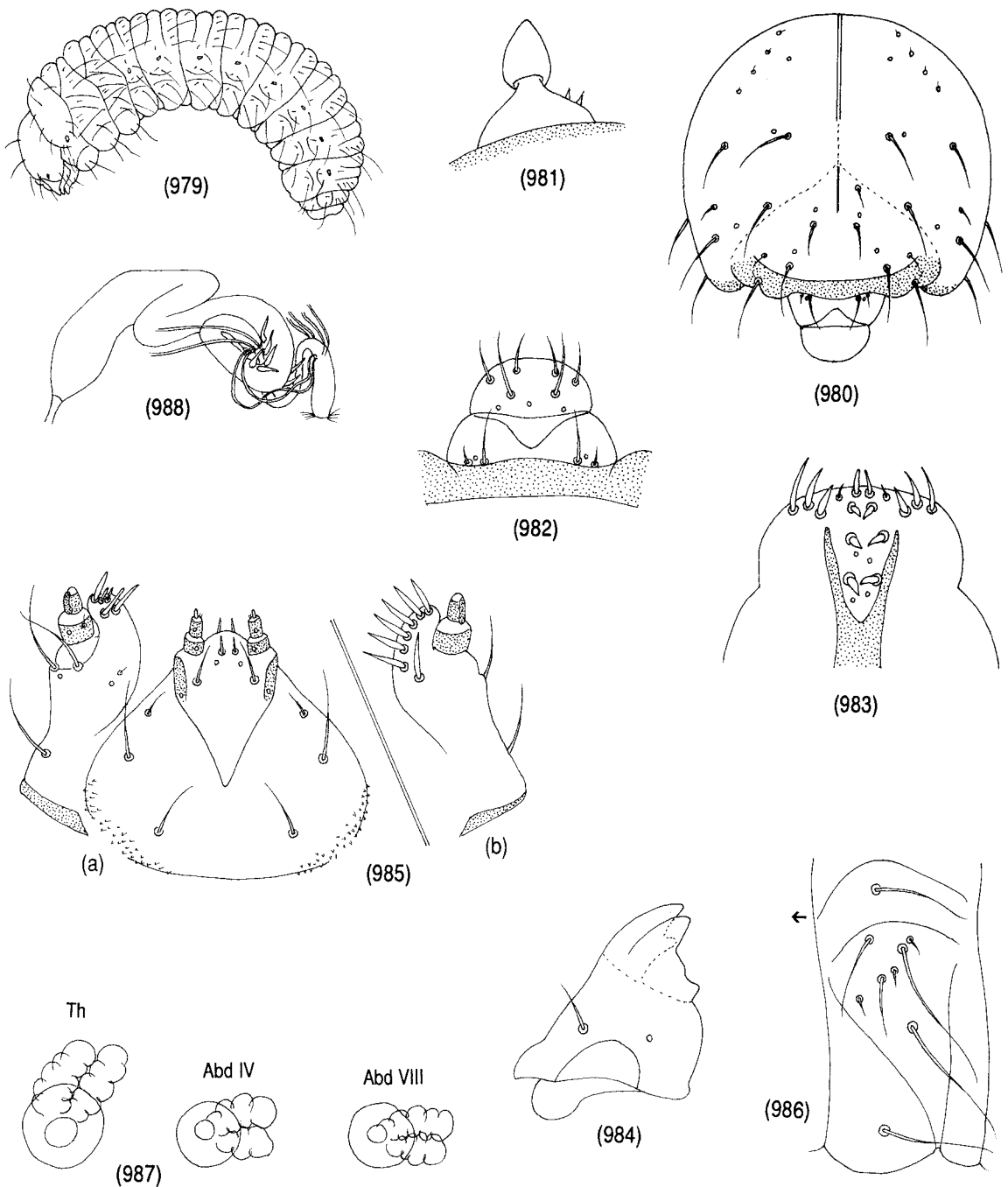
Curculionidae: Cossoninae: Araucariini

Fig. 959–968 *Inosomus rufopiceus*: (959) habitus, lateral, x15; (960) head, dorsal, x15; (961) antenna, x265; (962) labrum, clypeus, and epistoma, x265; (963) epipharyngeal lining, x265; (964) mandible, x110 (a, outer surface; b, inner surface); (965) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (966) Th II, ventropleural, pedal, and mediosternal lobes, x110; (967) spiracles, x265; (968) alimentary canal - gastric caeca on posterior ventriculus, x30.



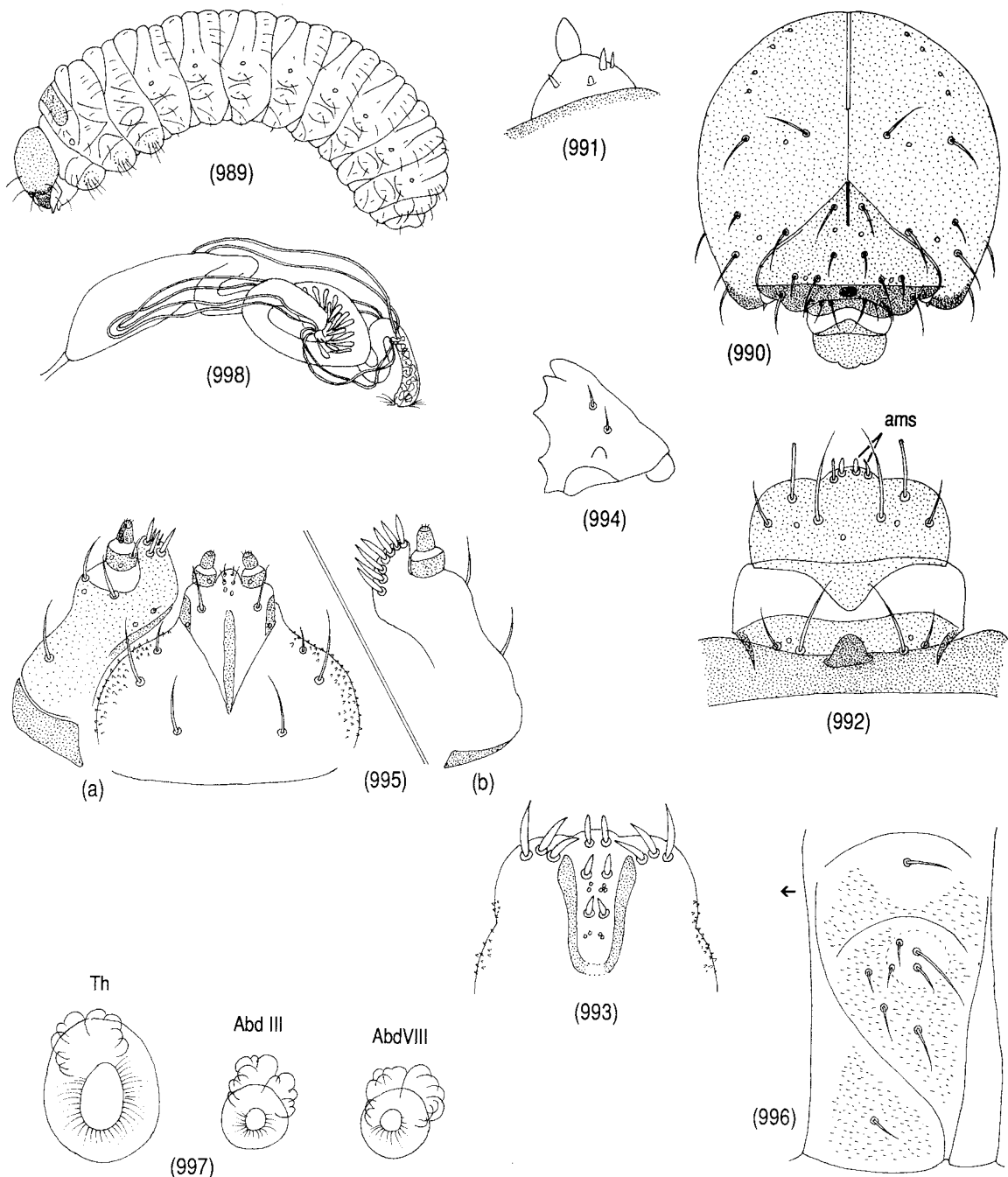
Curculionidae: Scolytinae: Hylesinini

Fig. 969–978 *Chaetoptelius mundulus*: (969) habitus, lateral, x20 (setae omitted); (970) head, dorsal, x65; (971) antenna, x530; (972) labrum, clypeus, and epistoma, x270; (973) epipharyngeal lining, x265; (974) mandible, x220; (975) maxilla and labium, x165 (a, ventral; b, dorsal maxilla); (976) Th II, ventropleural, pedal, and mediosternal lobes, x135; (977) spiracles, x330; (978) alimentary canal - gastric caeca on posterior ventriculus, x30.



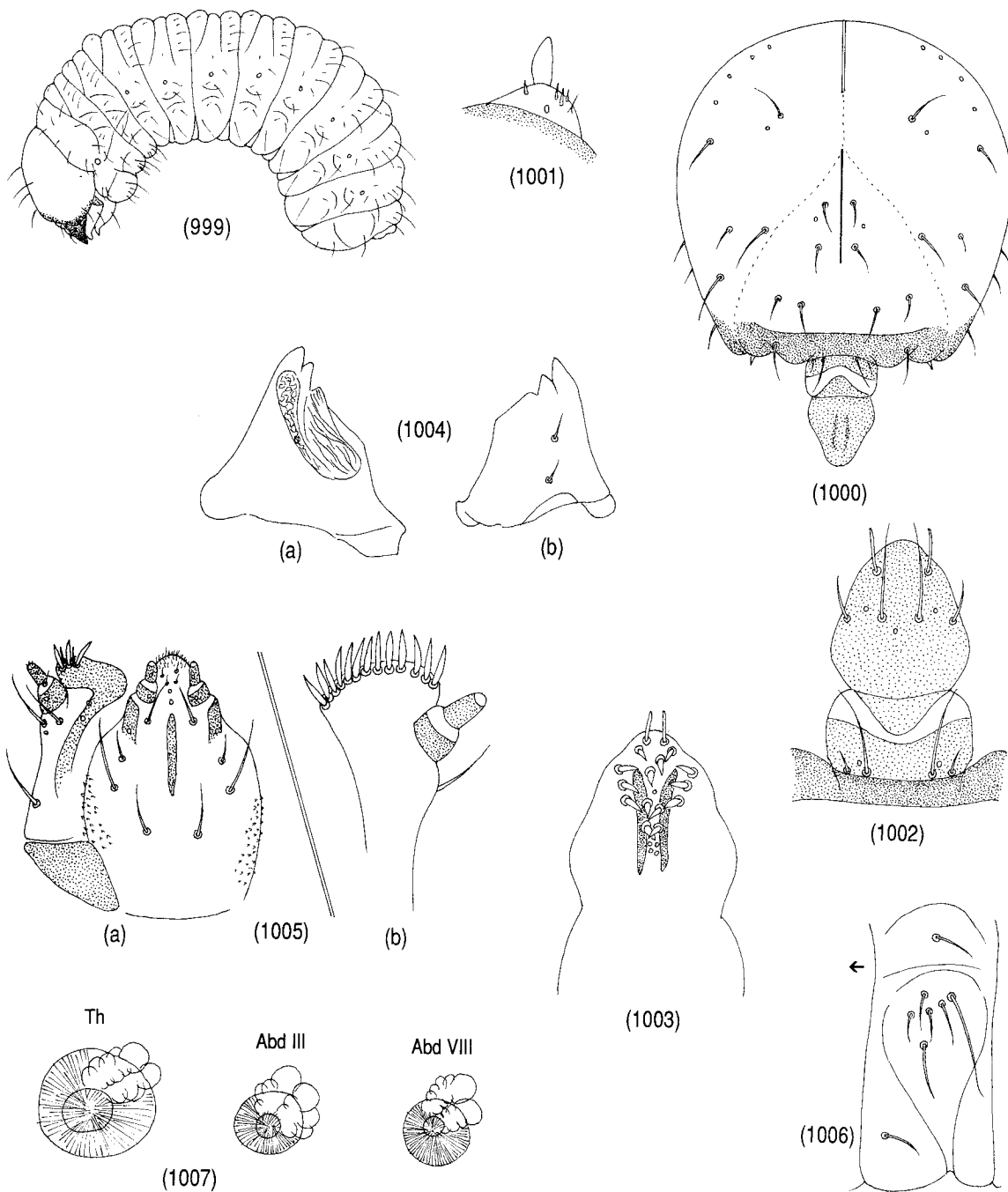
Curculionidae: Scolytinae: Hylesinini

Fig. 979–988 *Dendrotrupes costiceps*: (979) habitus, lateral, x20; (980) head, dorsal, x95; (981) antenna, x530; (982) labrum, clypeus, and epistoma, x135; (983) epipharyngeal lining, x265; (984) mandible, x185; (985) maxilla and labium, x185 (a, ventral; b, dorsal maxilla); (986) Th II, ventropleural, pedal, and mediosternal lobes, x135; (987) spiracles, x530; (988) alimentary canal, x20.



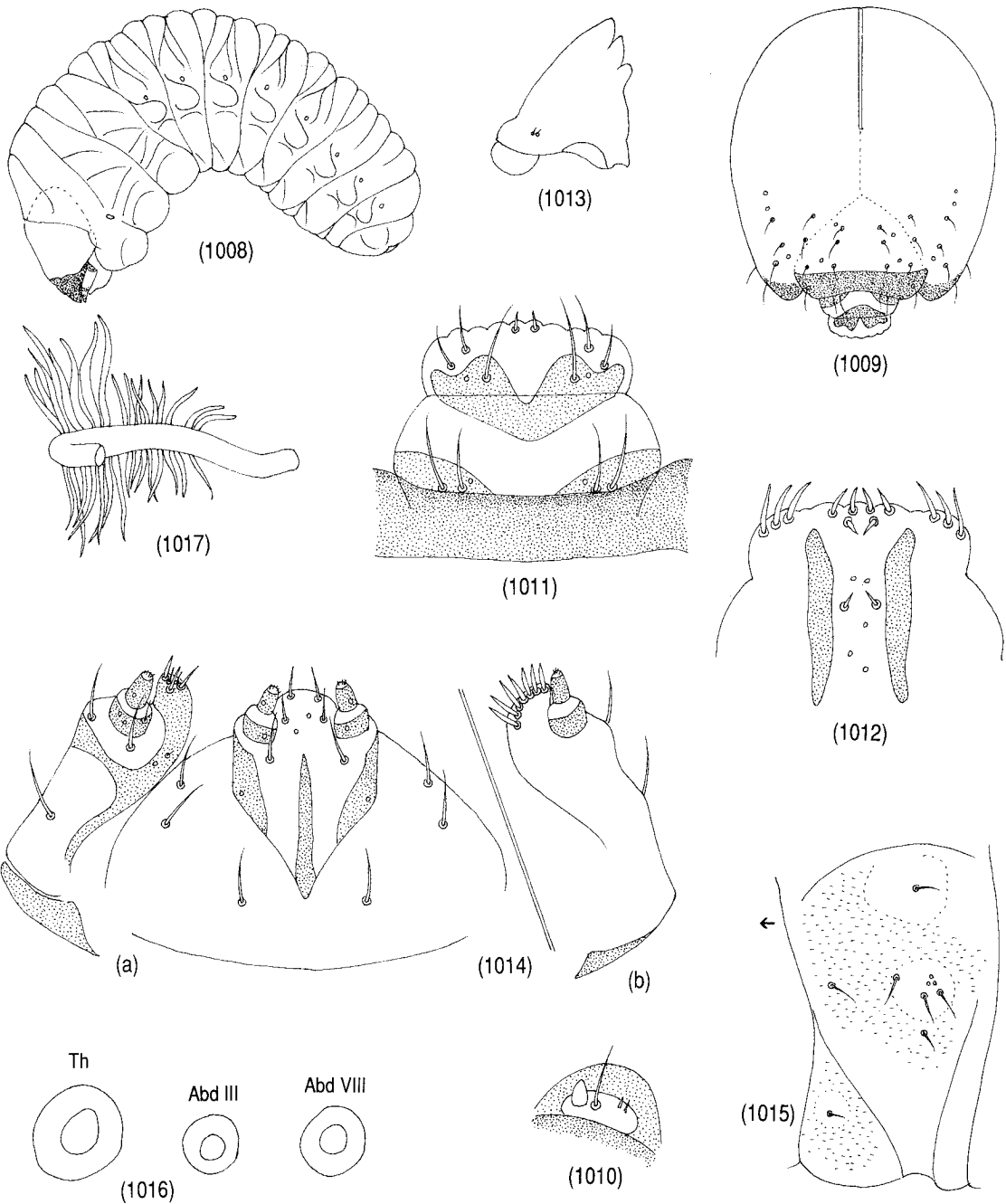
Curculionidae: Scolytinae: Hylesinini

Fig. 989–998 *Hylastes ater*: (989) habitus, lateral, x15; (990) head, dorsal, x45; (991) antenna, x265; (992) labrum, clypeus, and epistoma, x135; (993) epipharyngeal lining, x135; (994) mandible, x65; (995) maxilla and labium, x95 (a, ventral; b, dorsal maxilla); (996) Th II, ventropleural, pedal, and mediosternal lobes, x55; (997) spiracles, x265; (998) alimentary canal, x15.



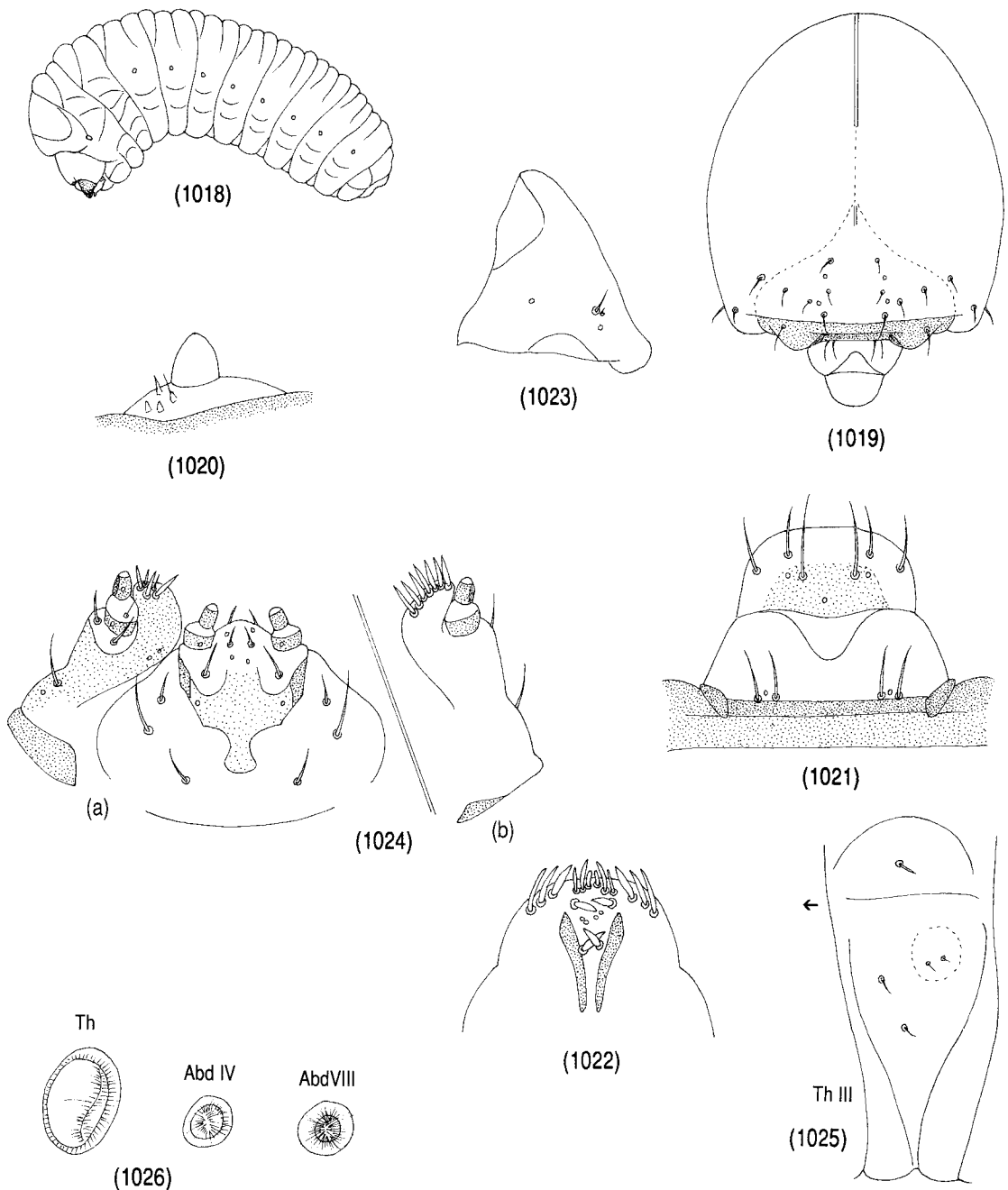
Curculionidae: Scolytinae: Hylesinini

Fig. 999–1007 *Pachycotes peregrinus*: (999) habitus, lateral, x15; (1000) head, dorsal, x45; (1001) antenna, x265; (1002) labrum, clypeus, and epistoma, x110; (1003) epipharyngeal lining, x135; (1004) mandible, x65 (a, inner surface; b, outer surface); (1005) maxilla and labium (a, ventral, x55; b, dorsal maxilla, x135); (1006) Th II, ventropleural, pedal, and mediosternal lobes, x45; (1007) spiracles, x330.



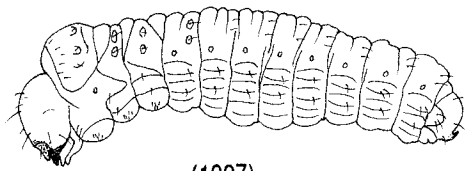
Curculionidae: Scolytinae: Hylesinini

Fig. 1008–1017 *Phloeosinus cupressi*: (1008) habitus, lateral, x30; (1009) head, dorsal, x45; (1010) antenna, x265; (1011) labrum, clypeus, and epistoma, x265; (1012) epipharyngeal lining, x265; (1013) mandible, x40; (1014) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (1015) Th II, ventropleural, pedal, and medio-sternal lobes, x65; (1016) spiracles, x200; (1017) alimentary canal - gastric caeca on posterior ventriculus, x40.

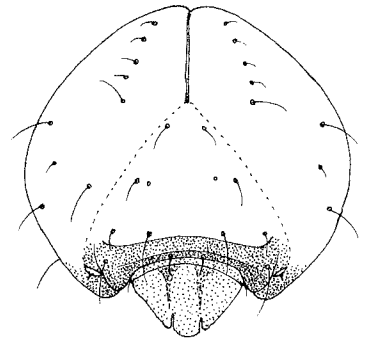


Curculionidae: Scolytinae: Hylesinini

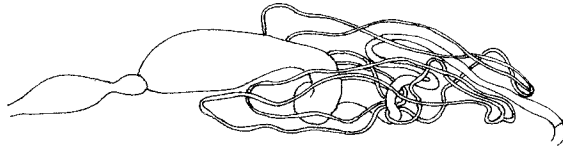
Fig. 1018–1026 *Scolytus multistriatus*: (1018) habitus, lateral, x15 (setae omitted); (1019) head, dorsal, x65; (1020) antenna, x530; (1021) labrum, clypeus, and epistoma, x185; (1022) epipharyngeal lining, x185; (1023) mandible, x135; (1024) maxilla and labium, x135 (a, ventral; b, dorsal maxilla); (1025) Th III, ventropleural, pedal, and mediosternal lobes, x135; (1026) spiracles, x265.



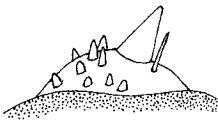
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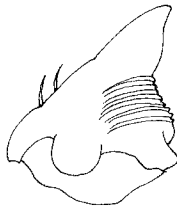
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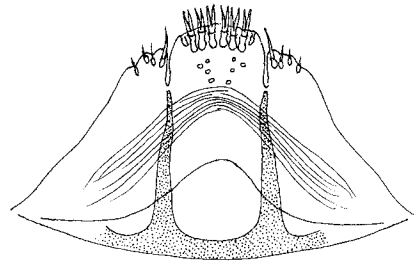
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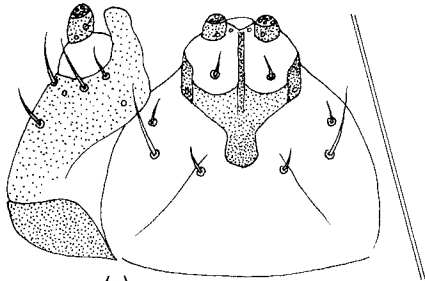
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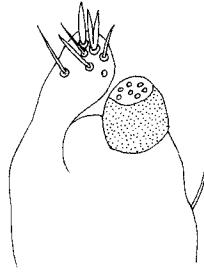


(1031)

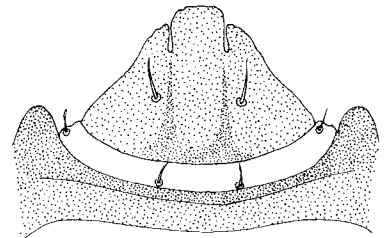


(a)

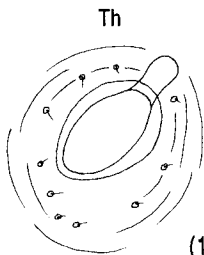
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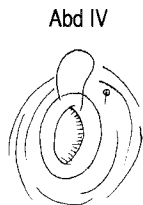
(b)



(1030)



(1035)



Abd IV



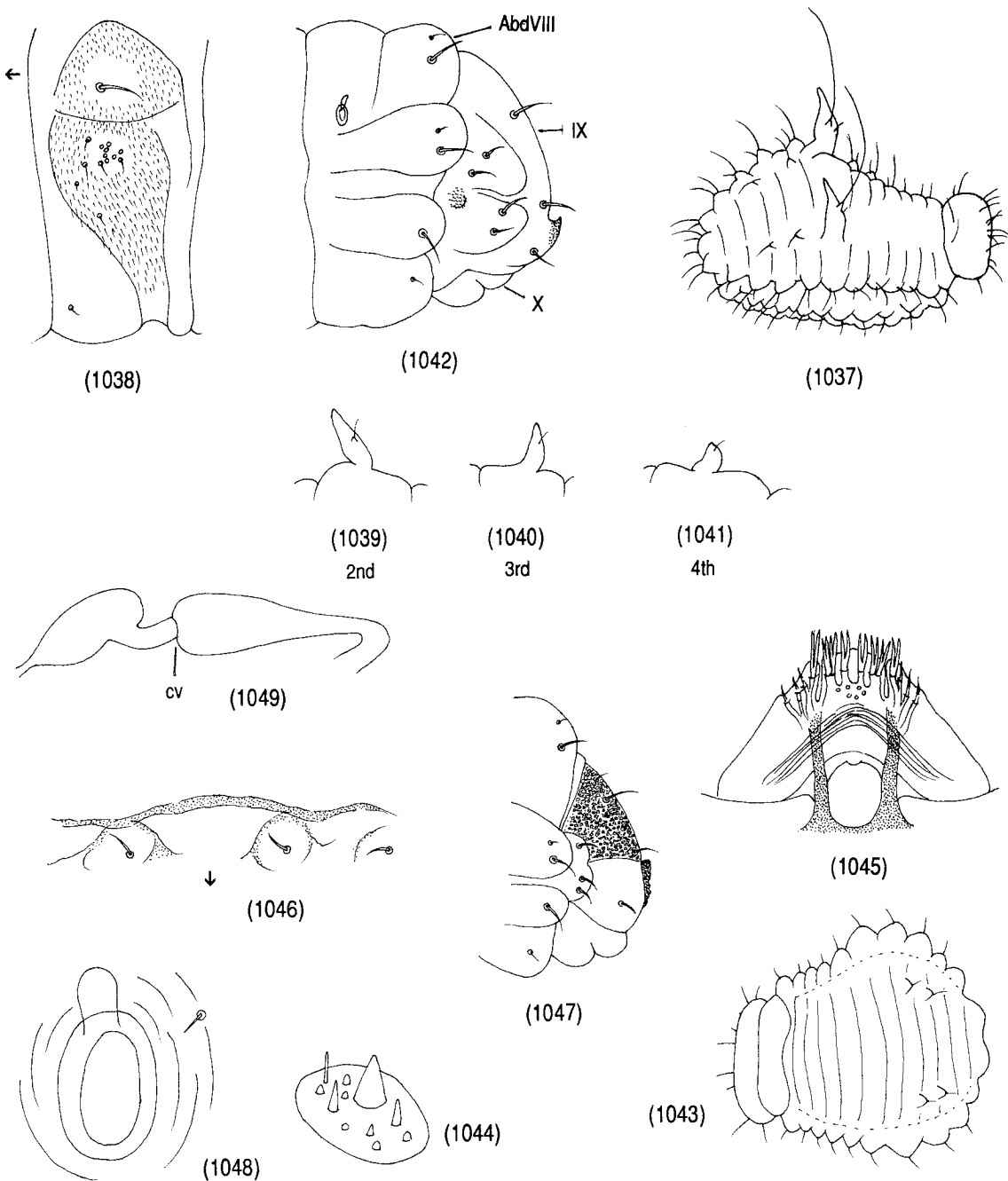
Abd VIII



(1034)

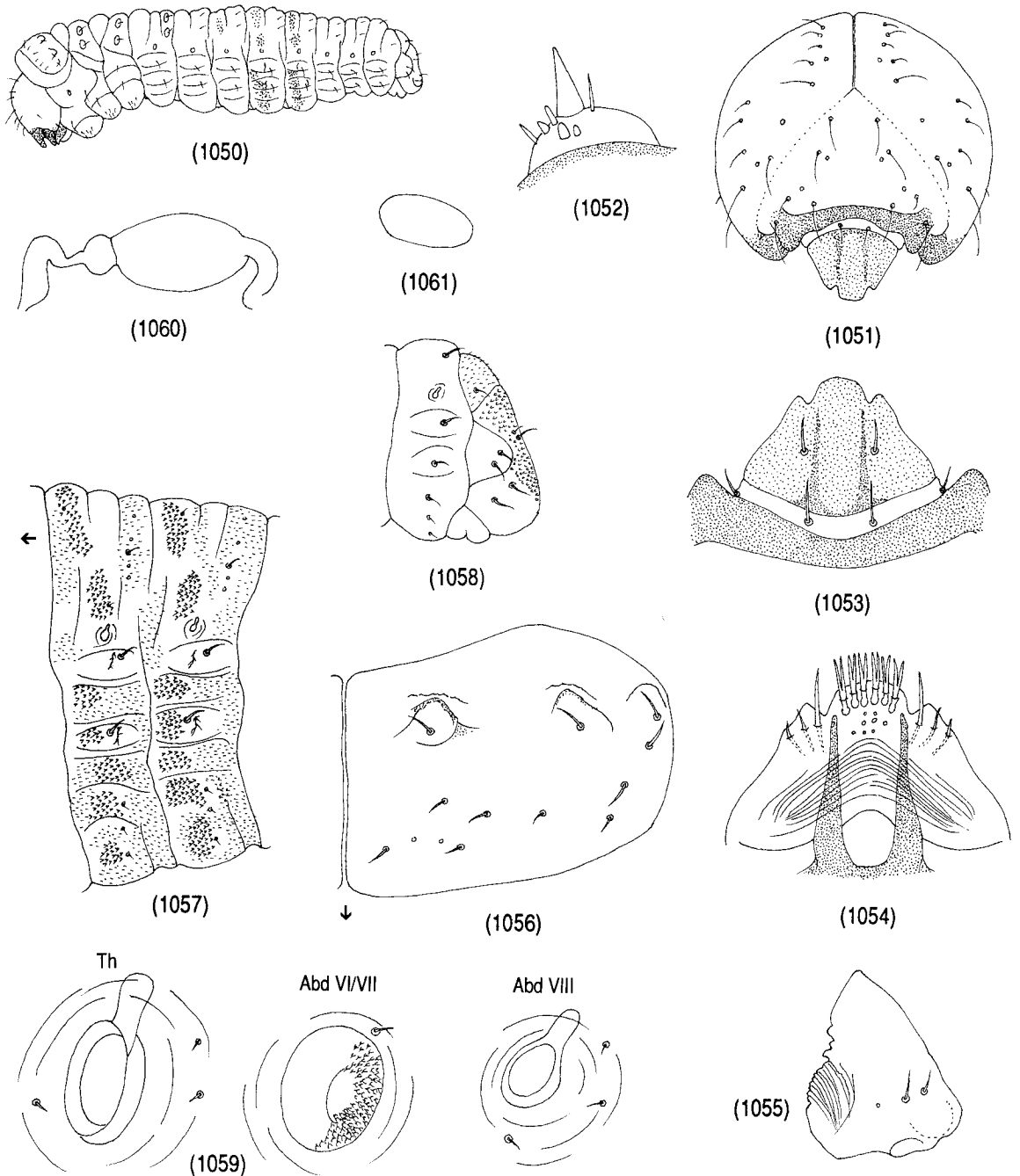
Curculionidae: Platypodinae

Fig. 1027–1036 *Platypus apicalis*: (1027) habitus, lateral, x7; (1028) head, dorsal, x30; (1029) antenna, x265; (1030) labrum, clypeus, and epistoma, x65; (1031) epipharyngeal lining, x95; (1032) mandible, inner surface, x65; (1033) maxilla and labium (a, ventral, x65; b, dorsal maxilla, x135); (1034) pronotal pattern, x45; (1035) spiracles, x265; (1036) alimentary canal, x10.



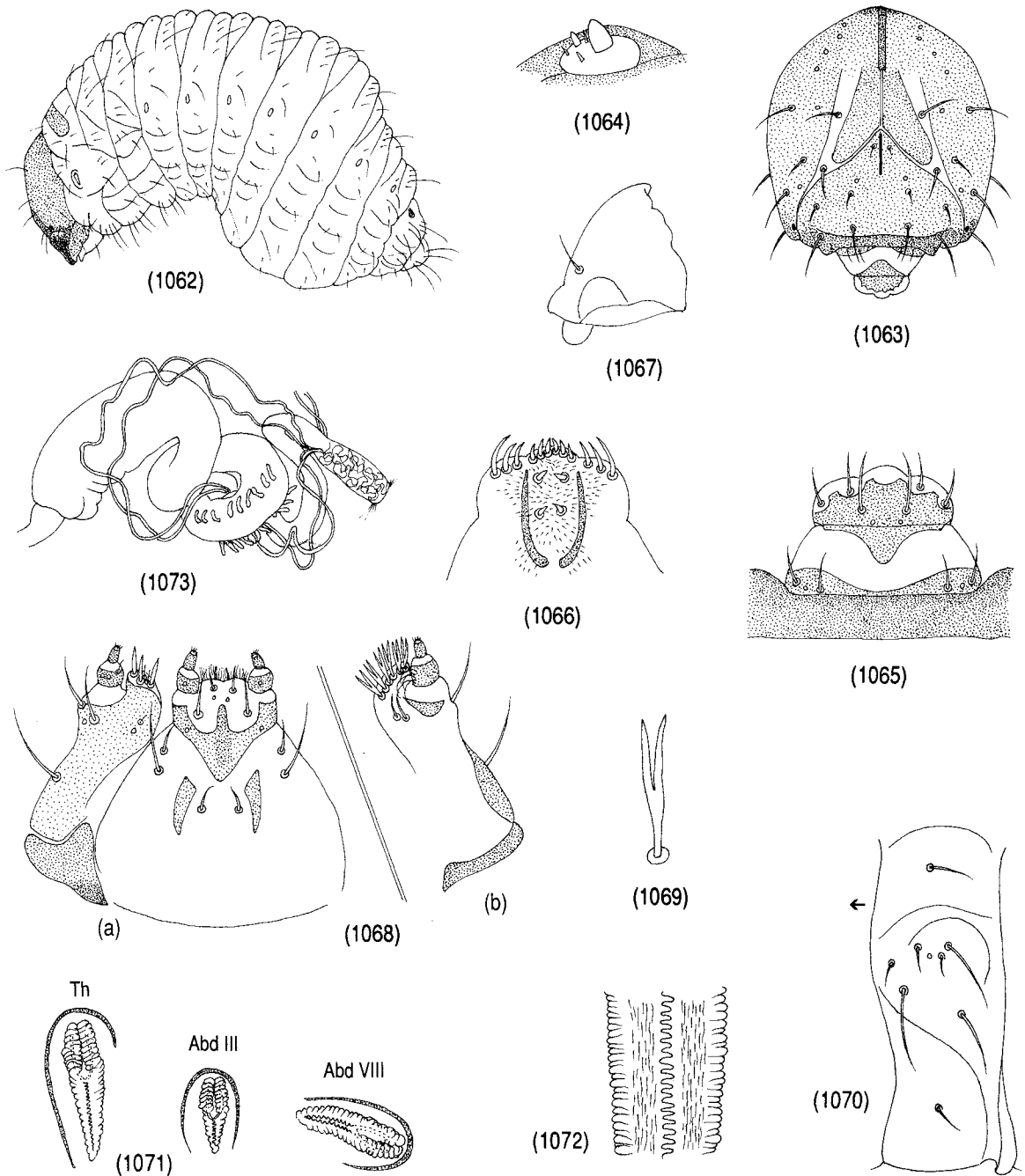
Curculionidae: Platypodinae

Fig. 1037–1042 *Platypus apicalis*: (1037) 1st instar larva, x30; (1038) Th II, ventropleural, pedal, and mediosternal lobes, x45; (1039–1041) mid-dorsal tubercle, 2nd–4th instar larvae, x30; (1042) abdominal segments VIII–X, lateral, x30. **Fig. 1043–1049 *P. caviceps*:** (1043) 1st instar larva, x30; (1044) antenna, x265; (1045) epipharyngeal lining, x95; (1046) pronotal pattern, x45; (1047) abdominal segments VIII–X, lateral, x30; (1048) spiracle, x265 (similar on all segments); (1049) proventriculus and anterior ventriculus, x10.



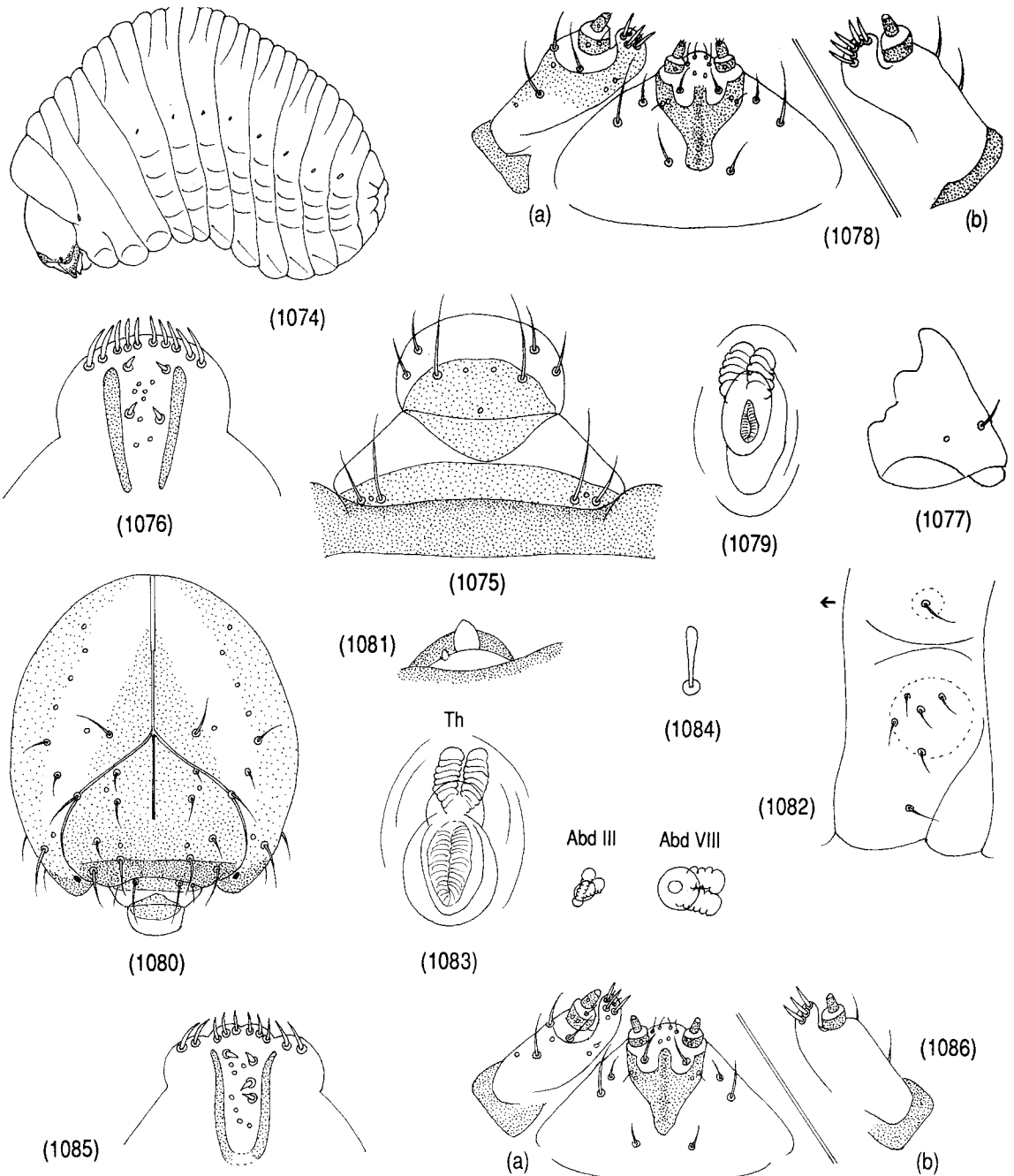
Curculionidae: Platypodinae

Fig. 1050–1061 *Platypus gracilis*: (1050) habitus, lateral, x10; (1051) head, dorsal, x45; (1052) antenna, x265; (1053) labrum, clypeus, and epistoma, x95; (1054) epipharyngeal lining, x110; (1055) mandible, x95; (1056) pronotum, dorsolateral, x65; (1057) abdominal segments IV and V, lateral, x20; (1058) abdominal segments VIII–X, lateral, x30; (1059) spiracles, x265; (1060) proventriculus and anterior ventriculus, x15; (1061) egg, x15.



Curculionidae: Rhynchophorinae

Fig. 1062–1073 *Sphenophorus brunnipennis*: (1062) habitus, lateral, x7; (1063) head, dorsal, x15; (1064) antenna, ventral, x135; (1065) labrum, clypeus, and epistoma, x40; (1066) epipharyngeal lining, x45; (1067) mandible, x30; (1068) maxilla and labium, x40 (a, ventral; b, dorsal maxilla); (1069) malar seta, x110; (1070) Th III, ventropleural, pedal, and mediosternal lobes, x30; (1071) spiracles, x55; (1072) spiracular atrium in closed position, x265; (1073) alimentary canal, x7.



Curculionidae: Rhynchophorinae

Fig. 1074–1079 *Sitophilus oryzae*: (1074) habitus, lateral, x20; (1075) labrum, clypeus, and epistoma, x265; (1076) epipharyngeal lining, x265; (1077) mandible, x135; (1078) maxilla and labium, x65 (a, ventral; b, dorsal maxilla); (1079) thoracic spiracle, x265. **Fig. 1080–1084 *S. granarius*:** (1080) head, dorsal, x65; (1081) antenna, ventral, x265; (1082) Th II, ventropleural, pedal, and mediosternal lobes, x65; (1083) spiracles, x265; (1084) spiracular seta, x265. **Fig. 1085, 1086 *S. zeamais*:** (1085) epipharyngeal lining, x190; (1086) maxilla and labium, x95 (a, ventral; b, dorsal maxilla).

APPENDIX 2

List of host-plant / weevil larva associations, in alphabetical sequence of (a) plant families,
(b) plant genera, (c) weevil genera. Fungi are listed separately at the end

Actinidiaceae		<i>Celmisia</i> spp.	<i>Anagotus</i> sp.
<i>Actinidia deliciosa</i>	<i>Gymnetron pascuorum</i>	<i>Cirsium arvense</i>	<i>Rhinocyllus conicus</i>
Apiaceae		<i>Cirsium palustre</i>	<i>Rhinocyllus conicus</i>
<i>Aciphylla ferox</i>	<i>Lyperobius</i> sp. indet.	<i>Cirsium vulgare</i>	<i>Trichosirocalus horridus</i>
Apocynaceae		<i>Crepis</i> sp.	<i>Trichosirocalus horridus</i>
<i>Parsonsia heterophylla</i>	<i>Pachyops dubius</i>	<i>Helianthus tuberosus</i>	<i>Listroderes difficilis</i>
Araliaceae		<i>Olearia furfuracea</i>	<i>Hypera punctata</i>
<i>Meryta sinclairii</i>	<i>Dysnocryptus inflatus</i>		<i>Dasyanthribus purpureus</i>
<i>Pseudopanax arboreus</i>	<i>Dendrotrupes costiceps</i>	<i>Olearia rani</i>	<i>Sharpus brouni</i>
	<i>Eiratus suavis</i>		<i>Tychanus gibbus</i>
	<i>Scolopterus</i> sp.		<i>Lasiorrhynchus barbicornis</i>
	<i>Stephanorrhynchus</i> sp.		<i>Platypus apicalis</i>
<i>Pseudopanax crassifolius</i>	<i>Dendrotrupes costiceps</i>	Betulaceae	
<i>Pseudopanax lessonii</i>	<i>Aralius wollastoni</i>	<i>Carpinus</i> sp.	<i>Deporaus betulae</i>
	<i>Dendrotrupes costiceps</i>	Blechnaceae	
	<i>Eiratus parvulus</i>	<i>Blechnum</i> sp.	<i>Gromilus thoracicus</i>
	<i>Pactola variabilis</i>		<i>Rystheus notabilis</i>
	<i>Phymatus hetaera</i>		<i>Megacolabus decipiens</i>
<i>Pseudopanax simplex</i>	<i>Eiratus suavis</i>	Brassicaceae	
	<i>Dendrotrupes costiceps</i>	<i>Coronopus didymus</i>	<i>Listroderes difficilis</i>
<i>Pseudopanax</i> spp.	<i>Mecistostylus douei</i>	Bryophyta	
	<i>Scolopterus penicillatus</i>	<i>Polytrichadelphus magellanicus</i>	<i>Bryocatus amplus</i>
	<i>Stephanorrhynchus curvipes</i>		
<i>Schefflera digitata</i>	<i>Phymatus hetaera</i>	Caryophyllaceae	
Araucariaceae		<i>Stellaria</i> sp.	<i>Listroderes difficilis</i>
<i>Agathis australis</i>	<i>Helmoresus sharpi</i>	Convolvulaceae	
	<i>Cacephatus inornatus</i>	<i>Ipomoea batatas</i>	<i>Cylas formicarius</i>
	<i>Inosomus rufopiceus</i>	<i>Ipomoea brasiliensis</i>	<i>Cylas formicarius</i>
	<i>Mitrastethus baridioides</i>	Cornaceae	
	<i>Platypus apicalis</i>	<i>Corokia buddleioides</i>	<i>Agathinus tridens</i>
	<i>Phymatus hetaera</i>	<i>Griselinia littoralis</i>	<i>Peristoreus discoideus</i>
	<i>Torostoma apicale</i>	<i>Griselinia lucida</i>	<i>Peristoreus discoideus</i>
<i>Araucaria araucana</i>	<i>Mecomacer scambus</i>	Corylaceae	
	<i>Rhynchitomacerinus kuscheli</i>	<i>Corylus</i> sp.	<i>Byctiscus betulae</i>
Aspidiaceae		Corynocarpaceae	
<i>Polystichum vestitum</i>	<i>Rystheus notabilis</i>	<i>Corynocarpus laevigatus</i>	<i>Lasiorrhynchus barbicornis</i>
Asteraceae			<i>Pentarthrum zealandicum</i>
<i>Carduus acanthoides</i>	<i>Trichosirocalus horridus</i>	Cunoniaceae	
<i>Carduus nutans</i>	<i>Rhinocyllus conicus</i>	<i>Weinmannia racemosa</i>	<i>Psepholax tibialis</i>
	<i>Trichosirocalus horridus</i>		<i>Geochus politus</i>
<i>Carduus pycnocephalus</i>	<i>Rhinocyllus conicus</i>		<i>Geochus tibialis</i>
	<i>Trichosirocalus horridus</i>	<i>Weinmannia sylvicola</i>	<i>Psepholax tibialis</i>
<i>Carduus tenuiflorus</i>	<i>Rhinocyllus conicus</i>		
	<i>Trichosirocalus horridus</i>		

Cupressaceae

- Cupressus macrocarpa* *Dryophthorus* sp.
Phloeosinus cupressi
Libocedrus bidwillii *Neocyba* sp. B

Cyatheaceae

- Cyathea dealbata* *Scolopterus aequus*

Cycadaceae

- Dioon* sp. *Parallocorynus* sp.
Encephalartos altensteini *Anliarhis zamiae*
Zamia furfuracea *Rhopalotria mollis*

Cyperaceae

- Cyperus esculentus* *Phlyctinus callosus*

Epacridaceae

- Dracophyllum latifolium* *Peristoreus* sp. indet.
Dracophyllum matthewsii *Peristoreus* sp. indet.
Dracophyllum traversii *Agathinus tridens*
Peristoreus grossus
Rhynchodes ursus
Peristoreus sp. indet.

Fabaceae

- Albizia julibrissin* *Neosaccolaemus narinus*
Lupinus arboreus *Phymatus hetaera*
Crisius variegatus
Medicago polymorpha *Sitona discoidea*
Medicago sativa *Hypera punctata*
Naupactina
Sitona discoidea
Racosperma decurrens *Neosaccolaemus narinus*
Racosperma sp. *Araecerus palmaris*
 (carrying *Uromycladium* galls)
Sophora microphylla *Crisius variegatus*
Trifolium incarnatum *Hypera punctata*
Trifolium pratense *Hypera punctata*
Trifolium repens *Mandalotus miricollis*
Floresianus sordidus
Trifolium spp. *Sitona discoidea*
Ulex europaeus *Exapion ulicis*

Fagaceae

- Fagus* spp. *Deporaus betulae*
Nothofagus cliffortioides *Pachyurinus sticticus*
Rhynchodes ursus
Nothofagus dombeyi *Rhynchitomacer rufus*
Nothofagus fusca *Ancistropterus quadrispinosus*
Platypus caviceps
Platypus gracilis
Nothofagus menziesii *Neocyba* sp. A*
 (*in galls on live stems) *Platypus caviceps*

Nothofagus solandri**Nothofagus** sp.**Nothofagus truncata**

- Quercus alba*
Quercus macrocarpa

Grossulariaceae

- Ribes nigrum* *Otiorhynchus sulcatus*

Haloragaceae

- Haloragis erecta* *Rhadinosomus acuminatus*

Hydnoraceae

- Prosopanche* sp. *Hydnorobius* sp.
 (a parasitic plant on roots)

Iridaceae

- Watsonia* sp. *Bruchela lili*

Liliaceae

- Aloe davyana* *Brachycerus monachus*
Astelia fragrans *Phorostichus linearis*
Peristoreus trilobus
Astelia solandri *Phorostichus linearis*
Astelia spp. *Anagotus* spp.
Astelia trinervia *Phorostichus linearis*
Collospermum hastatum *Phorostichus linearis*
Peristoreus trilobus
Phormium spp. *Anagotus* spp.

Loganiaceae

- Geniostoma ligustrifolium* *Sympedius testudo*

Malvaceae

- Hoheria glabrata* *Hoherius meinertzhageni*
Hoheria populnea *Aneuma compta*
Plagianthus betulinus *Hoherius meinertzhageni*
Plagianthus divaricatus *Hoherius meinertzhageni*

Meliaceae

- Dysoxylum spectabile* *Platypus apicalis*
Metrosideros umbellata *Neomycta rubida*

Monimiaceae

- Hedycarya arborea* *Lasiorrhynchus barbicornis*
Pentarthrum zealandicum

Myoporaceae

- Myoporum laetum* *Sympedius testudo*

Myrsinaceae*Myrsine australis* *Psepholax tibialis***Myrtaceae***Eucalyptus globulus* *Gonipterus scutellatus**Leptospermum scoparium* *Psepholax tibialis**Metrosideros excelsa* *Neocyba metrosideros**Neomycta rubida**Metrosideros fulgens* *Neomycta rubida**Metrosideros kermadecensis* *Neomycta rubida**Metrosideros robusta* *Neomycta rubida**Phrynixus astutus***Oleaceae***Nestegis cunninghamii* *Gonopteris spinicollis**Peristoreus rufirostris**Nestegis lanceolata* *Gonopteris spinicollis***Onagraceae***Fuchsia excorticata* *Tychanus gibbus***Osmundaceae***Leptopteris hymenophylloides* *Rystheus notabilis***Palmae***Rhopalostylis sapida* *Arecocryptus bellus*
Arecopais spectabilis
Arecophaga varia
Eucossonus comptus
Stenotrupis debilis
*Stenotrupis wollastonianus***Papilionaceae***Carmichaelia aligera* *Notochoragus crassus*
(carrying *Rosellinia* fungus)**Passifloraceae***Tetrapathaea tetrandra* *Phymatus hetaera*
*Crisius variegatus***Pinaceae***Pinus banksiana* *Cimberis pilosus*
*Cimberis elongatus**Pinus ponderosa* *Anagotus helmsi**Pinus radiata* *Anagotus helmsi**Dryophthorus* sp.*Helmoreus sharpi**Hylastes ater**Hylurgus ligniperda**Pachycotes peregrinus**Pinus sabiniana* *Cimberis comptus**Pinus sylvestris* *Cimberis attelaboides**Doydirhynchus austriacus**Pinus virginiana* *Cimberis pilosus**Pseudotsuga menziesii* *Anagotus helmsi**Saxegothaea conspicua* *Nannomacer wittmeri***Piperaceae***Macropiper excelsum* *Pentarthrum zealandicum***Pittosporaceae***Pittosporum crassifolium* *Chaetoptelius mundulus**Pittosporum eugeniooides* *Chaetoptelius mundulus**Pittosporum tenuifolium* *Sharpius brouni***Chaetoptelius mundulus*(*carrying fungus galls of *Endothia* sp.)**Plantaginaceae***Plantago lanceolatum* *Gymnetron pascuorum***Poaceae***Chionochloa rubra* *Catoptes cuspidatus**Nicaeana cervina**Chionochloa* spp. *Anagotus* sp.*Dactylis glomerata* *Listronotus bonariensis**Festuca novae-zelandiae* *Catoptes cuspidatus**Nicaeana cervina**Lolium perenne* *Floresianus sordidus**Listronotus bonariensis**Oryza sativa* *Lissorhopterus oryzophilus**Paspalum paspaloides* *Linogeraeus urbanus**Pennisetum clandestinum* *Sphenophorus brunnipennis**Poa annua* *Listronotus bonariensis**Poa* spp. *Listronotus bonariensis**Zea mays* *Listronotus bonariensis***Podocarpaceae***Dacrycarpus dacrydioides* *Inosomus rufopiceus**Rhinorhynchus rufulus**Dacrydium cupressinum* *Pachycotes peregrinus**Rhinorhynchus rufulus**Rhynchodes ursus**Phyllocladus alpinus* *Rhinorhynchus* sp. indet.*Phyllocladus trichomanoides* *Rhinorhynchus* sp. indet.*Podocarpus totara* *Rhinorhynchus rufulus**Prumnopitys taxifolia* *Lasiiorhynchus barbicornis**Mitrastethus baridioides***Polygonaceae***Muehlenbeckia australis* *Pachyops dubius**Polygonum persicaria* *Rhinoncus australis***Primulaceae***Cyclamen* sp. cult. *Otiorhynchus sulcatus**Primula polyantha* *Otiorhynchus sulcatus***Proteaceae***Protea caffra* *Tanaos interstitialis**Toronia toru* *Pachyurinus rubicundus**Proconus asperirostris*

Ranunculaceae

<i>Clematis paniculata</i>	<i>Nyxetes bidens</i>
<i>Clematis</i> sp.	<i>Crisius variegatus</i>
	<i>Phymatus hetaera</i>
<i>Consolida regalis</i>	<i>Nemonyx lepturoides</i>
(larkspur, previously in genus <i>Delphinium</i>)	
<i>Delphinium consolida</i>	<i>Nemonyx lepturoides</i>

Rosaceae

<i>Crataegus monogyna</i>	<i>Garyus altus</i>
	<i>Pleosporius bullatus</i>
<i>Eriobotrya japonica</i>	<i>Araecerus palmaris</i>
(mummified loquat fruits, <i>Botryosphaeria</i> sp. fungus)	
<i>Prunus</i> sp. (yellow plums)	<i>Rhynchites auratus</i>
<i>Prunus spinosa</i>	<i>Rhynchites auratus</i>

Rubiaceae

<i>Coprosma arborea</i>	<i>Tychanus gibbus</i>
<i>Coprosma australis</i>	<i>Tychanus gibbus</i>
<i>Coprosma lucida</i>	<i>Sympedius testudo</i>
<i>Coprosma robusta</i>	<i>Sympedius testudo</i>
<i>Coprosma serrulata</i>	<i>Hoplocneme inaequale</i>
<i>Coprosma</i> sp.	<i>Agathinus tridens</i>

Rutaceae

<i>Citrus limon</i>	<i>Araecerus palmaris</i>
(mummified fruit, <i>Botryosphaeria</i> sp. fungus)	
<i>Phebalium nudum</i>	<i>Tychanus gibbus</i>

Salicaceae

<i>Populus tremula</i>	<i>Byctiscus populi</i>
<i>Salix</i> spp.	<i>Helmoneus sharpi</i>

Sapindaceae

<i>Alectryon excelsa</i>	<i>Sharpius brouni</i>
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Scrophulariaceae

<i>Hebe macrocarpa</i>	<i>Oreocalus albosparsus</i>
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Smilacaceae

<i>Ripogonum scandens</i>	<i>Pachyops dubius</i>
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Ulmaceae

<i>Ulmus</i> sp.	<i>Scolytus multistriatus</i>
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Violaceae

<i>Melicytus</i> sp.	<i>Pentarthrum zealandicum</i>
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FUNGI

<i>Botryosphaeria</i> sp.	<i>Araecerus palmaris</i>
<i>Ceratocystis ulmi</i>	<i>Scolytus multistriatus</i>
<i>Endothia</i> sp.	<i>Sharpius brouni</i>
<i>Monochaetia</i> sp.	<i>Lasiorrhynchus barbicornis</i>
<i>Rosellinia</i> (Ascomycetes)	<i>Notochoragus crassus</i>
	<i>Pleosporius bullatus</i>
<i>Seimatosporium</i> sp.	<i>Lasiorrhynchus barbicornis</i>
<i>Uromycladium</i> sp.	<i>Araecerus palmaris</i>
Galls on live stems of	
<i>Nothofagus menziesii</i>	<i>Neocyba</i> sp. A
Galls in <i>Clematis paniculata</i> vines	<i>Nyxetes bidens</i>
Gall in live trunk of	
<i>Hoheria populnea</i>	<i>Nyxetes bidens</i>
Galls in live branches of	
<i>Nestegis lanceolata</i>	<i>Nyxetes bidens</i>

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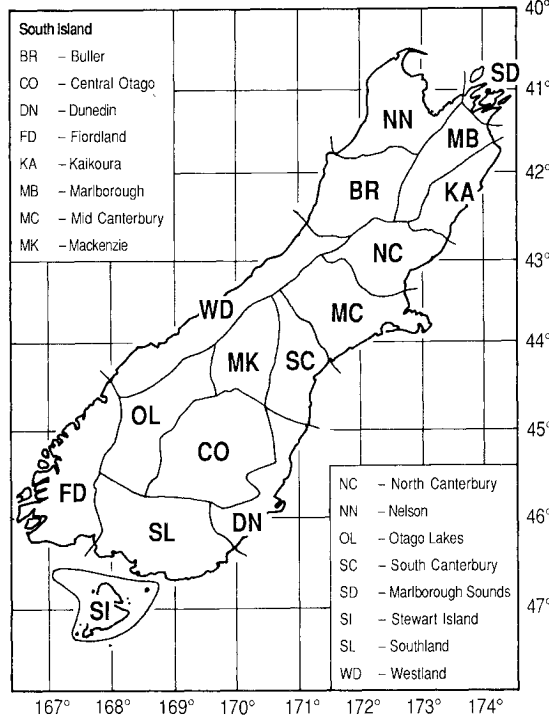
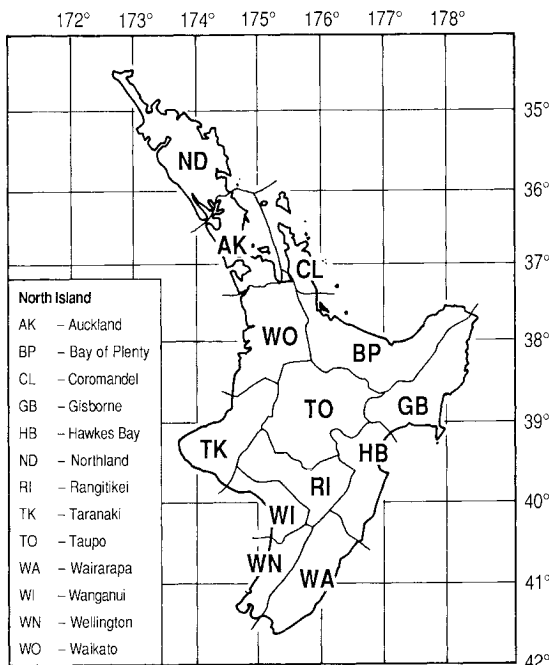
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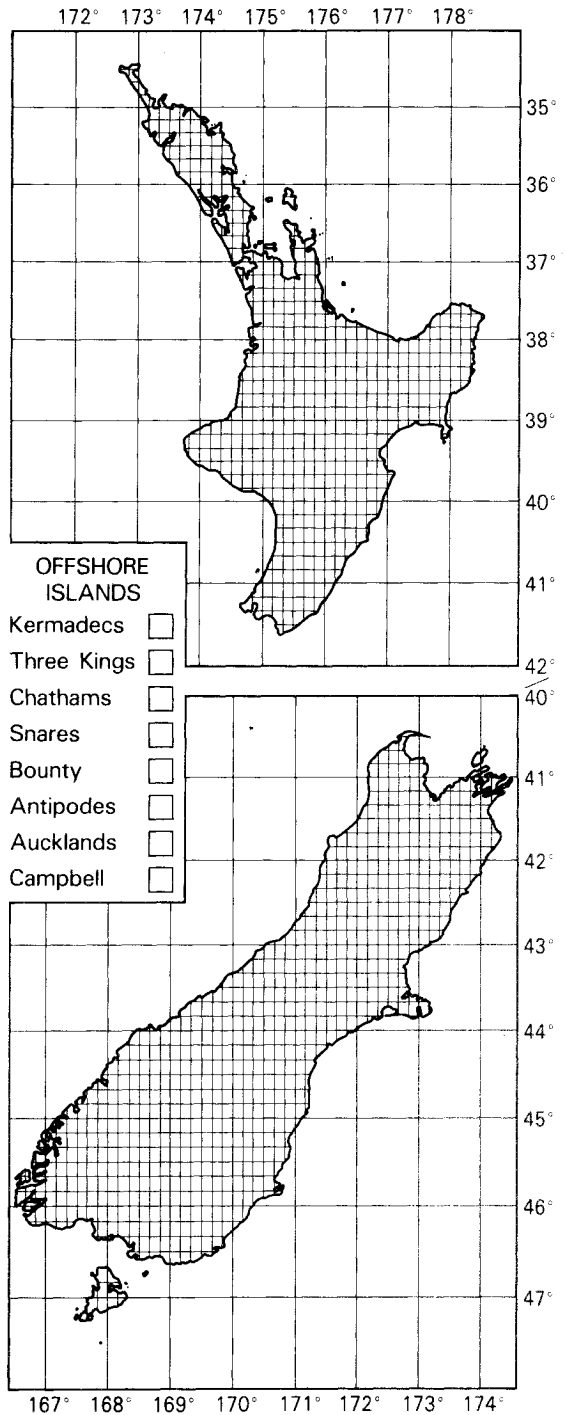
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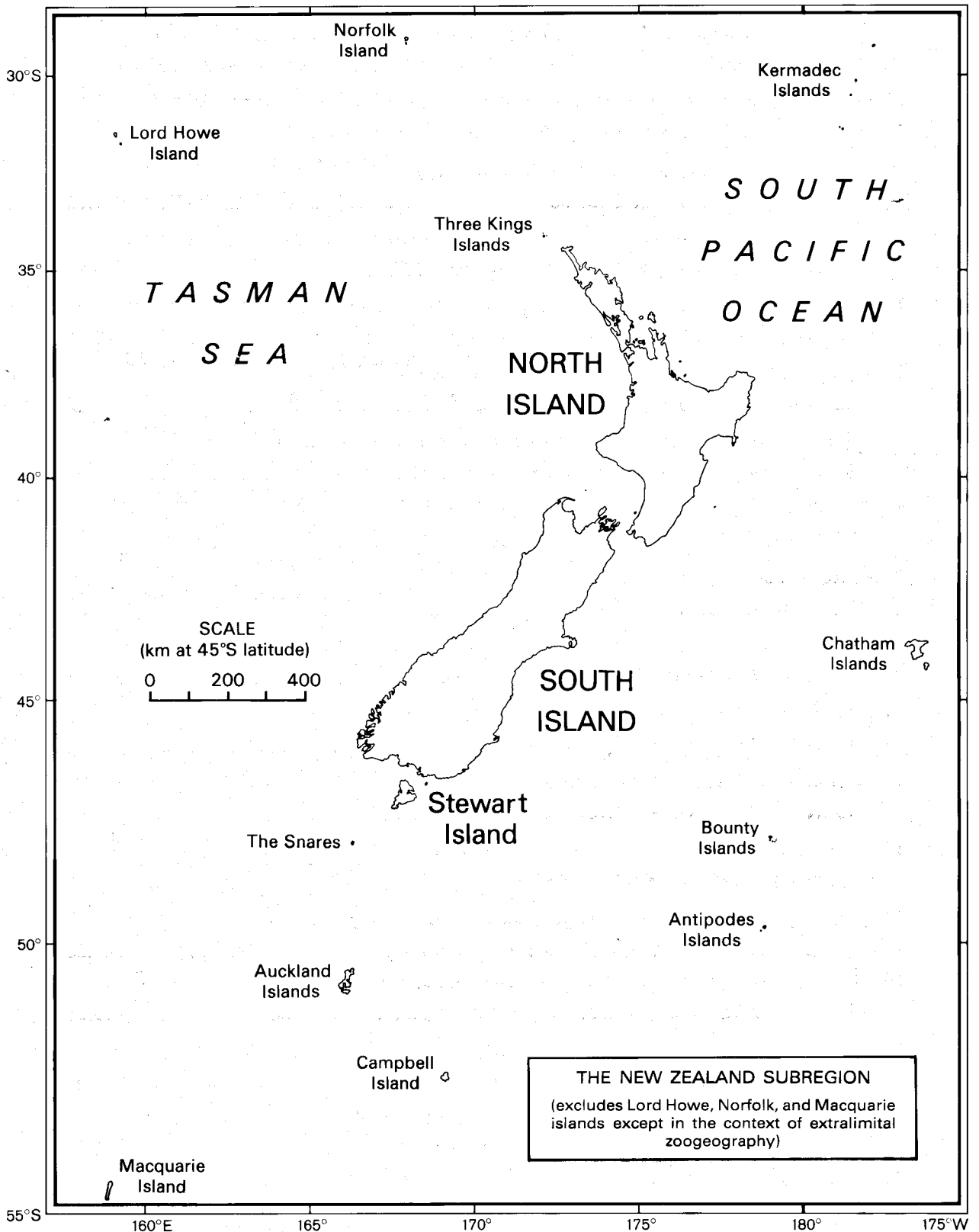
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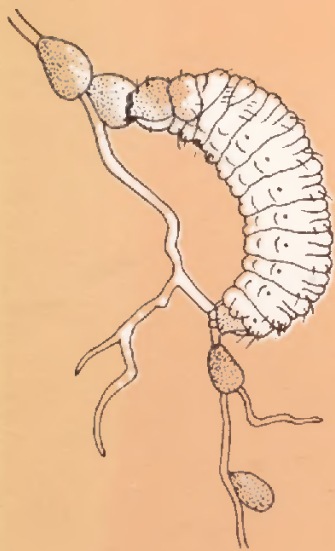
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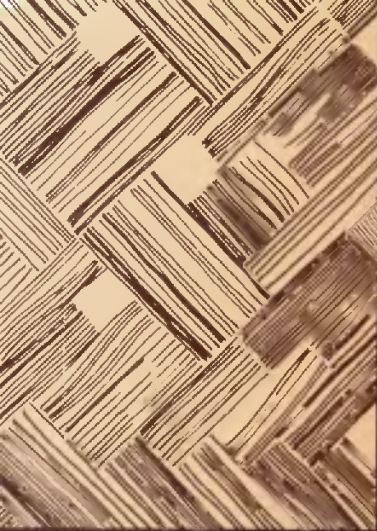
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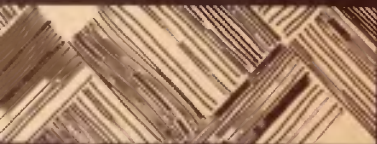
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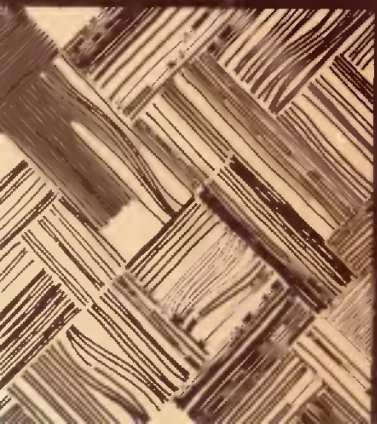
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