

## The Coleoptera Families of British Columbia

G.G.E. Scudder and R.A. Cannings  
March 31, 2005

**Table of Contents**

Introduction.....	<u>1</u>	Deleted: 1
Keys and Descriptions to the Families of Coleoptera of British Columbia.....	<u>3</u>	Deleted: 3
Order COLEOPTERA (Beetles).....	<u>3</u>	Deleted: 3
DESCRIPTION OF FAMILIES .....	<u>28</u>	Deleted: 28
Suborder ARCHOSTEMATA .....	<u>28</u>	Deleted: 28
Family CUPEDIDAE (Reticulated Beetles) [Fig. 1].....	<u>28</u>	Deleted: 28
Family MICROMALTHIDAE (Telephone-pole Beetles) [Fig. 2].....	<u>28</u>	Deleted: 29
Suborder ADEPHAGA.....	<u>29</u>	Deleted: 29
Family RHYSODIDAE (Wrinkled Bark Beetles) [Fig. 3].....	<u>29</u>	Deleted: 29
Family CARABIDAE (Ground Beetles) [Fig. 4] .....	<u>29</u>	Deleted: 30
Family GYRINIDAE (Whirligig Beetles) [Fig. 5].....	<u>30</u>	Deleted: 31
Family HALIPLIDAE (Crawling Water Beetles) [Fig. 6] .....	<u>31</u>	Deleted: 32
Family TRACHYPACHIDAE (False Ground Beetles) [Fig. 7] .....	<u>32</u>	Deleted: 32
Family AMPHIZOIDAE (Trout-stream Beetles) [Fig. 8].....	<u>32</u>	Deleted: 33
Family DYTISCIDAE (Predaceous Diving Beetles) [Fig. 9] .....	<u>33</u>	Deleted: 34
Suborder POLYPHAGA.....	<u>34</u>	Deleted: 34
Series STAPHYLINIFORMIA.....	<u>34</u>	Deleted: 34
Superfamily HYDROPHILOIDEA .....	<u>34</u>	Deleted: 34
Family HYDROPHILIDAE (Water Scavenger Beetles) [Fig. 10].....	<u>34</u>	Deleted: 35
Family SPHAERITIDAE (False Clown Beetles) [Fig. 11].....	<u>35</u>	Deleted: 35
Family HISTERIDAE (Hister Beetles) [Fig. 12] .....	<u>35</u>	Deleted: 36
Superfamily STAPHYLINOIDEA .....	<u>36</u>	Deleted: 36
Family HYDRAENIDAE (Minute Moss Beetles) [Fig. 13] .....	<u>36</u>	Deleted: 37
Family PTILIIDAE (Feather-winged Beetles) [Fig. 14] .....	<u>37</u>	Deleted: 37
Family AGYRTIDAE (Primitive Carrion Beetles) [Fig. 15] .....	<u>37</u>	Deleted: 38
Family LEIODIDAE (Round Fungus Beetles) [Fig. 16].....	<u>38</u>	Deleted: 39
Family SCYDMAENIDAE (Antlike Stone Beetles) [Fig. 17].....	<u>39</u>	Deleted: 39
Family SILPHIDAE (Carrion Beetles) [Fig. 18].....	<u>39</u>	Deleted: 41
Family STAPHYLINIDAE (Rove Beetles) [Fig. 19].....	<u>41</u>	Deleted: 42
Series SCARABAEIFORMIA.....	<u>42</u>	Deleted: 42
Superfamily SCARABAEOIDEA .....	<u>42</u>	Deleted: 42
Family LUCANIDAE (Stag Beetles) [Fig. 20] .....	<u>42</u>	Deleted: 43
Family GLARESIDAE (Enigmatic Scarab Beetles) [Fig. 21] .....	<u>43</u>	Deleted: 43
Family TROGIDAE (Hide Beetles) [Fig. 22].....	<u>43</u>	Deleted: 44
Family GEOTRUPIDAE (Earth-boring Scarab Beetles) [Fig. 23] .....	<u>44</u>	Deleted: 44
Family OCHODAEIDAE (Sand-loving Scarab Beetles) [Fig. 24] .....	<u>44</u>	Deleted: 45
Family GLAPHYRIDAE (Bumble Bee Scarab Beetles) [Fig. 25].....	<u>45</u>	Deleted: 45
Family SCARABAEIDAE (Scarab Beetles) [Fig. 26].....	<u>45</u>	Deleted: 45
Series ELATERIFORMIA.....	<u>46</u>	Deleted: 46
Superfamily SCIRTOIDEA .....	<u>46</u>	Deleted: 46
Family EUCINETIDAE (Plate-thigh Beetles) [Fig. 27].....	<u>46</u>	Deleted: 46
Family CLAMBIDAE (Minute Beetles) [Fig. 28] .....	<u>47</u>	Deleted: 46
		Deleted: 47

		Deleted: 47
		Deleted: 48
Family SCIRTIDAE (Marsh Beetles) [Fig. 29].....	47	Deleted: 48
Superfamily BUPRESTOIDAE.....	48	Deleted: 49
Family BUPRESTIDAE (Metallic Wood-boring Beetles) [Fig. 30].....	48	Deleted: 49
Superfamily BYRRHOIDEA.....	49	Deleted: 50
Family BYRRHIDAE (Pill or Moss Beetles) [Fig. 31].....	49	Deleted: 50
Family ELMIDAE (Riffle Beetles) [Fig. 32].....	50	Deleted: 50
Family DRYOPIDAE (Long-toed Water Beetles) [Fig. 33].....	50	Deleted: 51
Family LIMNICHIDAE (Minute Marsh-loving Beetles) [Fig. 34].....	50	Deleted: 51
Family HETEROCERIDAE (Variegated Mud-loving Beetles) [Fig. 35].....	51	Deleted: 52
Family PTILODACTYLIDAE (Ptilodactylid Beetles) [Fig. 36].....	51	Deleted: 52
Superfamily ELATEROIDEA.....	52	Deleted: 52
Family ARTEMATOPODIDAE (Artematopodid Beetles) [Fig. 37].....	52	Deleted: 53
Family EUCNEMIDAE (False Click Beetles) [Fig. 38].....	52	Deleted: 53
Family THROSCIDAE (Throscid Beetles) [Fig. 39].....	53	Deleted: 54
Family ELATERIDAE (Click Beetles) [Fig. 40].....	53	Deleted: 55
Family LYCIDAE (Net-winged Beetles) [Fig. 41].....	54	Deleted: 55
Family LAMPYRIDAE (Fireflies) [Fig. 42].....	55	Deleted: 56
Family CANTHARIDAE (Soldier Beetles) [Fig. 43].....	55	Deleted: 56
Series BOSTRICHIFORMIA.....	56	Deleted: 56
Superfamily DERODONTOIDEA.....	56	Deleted: 56
Family DERODONTIDAE (Tooth-necked Fungus Beetles ) [Fig. 44].....	56	Deleted: 57
Superfamily BOSTRICHOIDAE.....	57	Deleted: 57
Family NOSODENDRIDAE (Wounded-tree Beetles) [Fig. 45].....	57	Deleted: 57
Family DERMESTIDAE (Dermestid Beetles) [Fig. 46].....	57	Deleted: 58
Family BOSTRICHIDAE (Bostrichids and Powder-post Beetles) [Fig. 47].....	58	Deleted: 59
Family ANOBIIDAE (Deathwatch, Furniture and Spider Beetles) [Fig. 48].....	59	Deleted: 59
Series CUCUJIFORMIA.....	59	Deleted: 60
Superfamily CLEROIDEA.....	60	Deleted: 60
Family TROGOSSITIDAE (Bark-gnawing Beetles) [Fig. 49].....	60	Deleted: 60
Family CLERIDAE (Checkered Beetles) [Fig. 50].....	60	Deleted: 61
Family MELYRIDAE (Soft-winged Flower Beetles) [Fig. 51].....	61	Deleted: 61
Superfamily CUCUJOIDEA.....	61	Deleted: 61
Family SPHINDIDAE (Cryptic Slime Mold Beetles) [Fig. 52].....	61	Deleted: 62
Family BRACHYPTERIDAE (Short-winged Flower Beetles) [Fig. 53].....	62	Deleted: 62
Family NITIDULIDAE (Sap Beetles) [Fig. 54].....	62	Deleted: 63
Family MONOTOMIDAE (Root-eating Beetles) [Fig. 55].....	63	Deleted: 63
Family SILVANIDAE (Silvanid Flat Bark Beetles) [Fig. 56].....	63	Deleted: 64
Family CUCUJIDAE (Flat Bark Beetles) [Fig. 57].....	64	Deleted: 64
Family LAEMOPHLOEIDAE (Lined Flat Bark Beetles) [Fig. 58].....	64	Deleted: 64
Family PHALACRIDAE (Shining Flower Beetles, Shining Mold Beetles) [Fig. 59].....	65	Deleted: 65
Family CRYPTOPHAGIDAE (Silken Fungus Beetles) [Fig. 60].....	65	Deleted: 65
Family LANGURIIDAE (Lizard Beetles) [Fig. 61].....	66	Deleted: 66
Family EROTYLIDAE (Pleasing Fungus Beetles) [Fig. 62].....	67	Deleted: 67
Family BYTURIDAE (Fruitworm Beetles) [Fig. 63].....	67	Deleted: 67
Family BOTHRIDERIDAE (Bothriderid Beetles) [Fig. 64].....	68	Deleted: 68

Family CERYLONIDAE (Minute Bark Beetles) [Fig. 65] .....	<u>68</u>	Deleted: 68
Family ENDOMYCHIDAE (Handsome Fungus Beetles) [Fig. 66] .....	<u>69</u>	Deleted: 69
Family COCCINELLIDAE (Lady Beetles, Ladybird Beetles) [Fig. 67] .....	<u>69</u>	Deleted: 69
Family CORYLOPHIDAE (Minute Hooded Beetles, Minute Fungus Beetles) [Fig. 68] ...	<u>70</u>	Deleted: 70
Family LATRIDIIDAE (Minute Brown Scavenger Beetles, Mildew Beetles) [Fig. 69] .....	<u>71</u>	Deleted: 71
Superfamily TENEBRIONOIDEA .....	<u>71</u>	Deleted: 71
Family MYCETOPHAGIDAE (Hairy Fungus Beetles) [Fig. 70] .....	<u>71</u>	Deleted: 71
Family CIIDAE (Minute Tree-fungus Beetles) [Fig. 71] .....	<u>72</u>	Deleted: 72
Family TETRATOMIDAE (Polypore Fungus Beetles) [Fig. 72] .....	<u>72</u>	Deleted: 72
Family MELANDRYIDAE (False Darkling Beetles) [Fig. 73] .....	<u>73</u>	Deleted: 73
Family MORDELLIDAE (Tumbling Flower Beetles) [Fig. 74] .....	<u>73</u>	Deleted: 73
Family RIPIPHORIDAE (Ripiphorid Beetles) [Fig. 75] .....	<u>74</u>	Deleted: 74
Family COLYDIIDAE (Colydiid or Cylindrical Bark Beetles) [Fig. 76] .....	<u>75</u>	Deleted: 75
Family ZOPHERIDAE (Zopherid Beetles) [Fig. 77] .....	<u>75</u>	Deleted: 75
Family TENEBRIONIDAE (Darkling Beetles) [Fig. 78] .....	<u>76</u>	Deleted: 76
Family PROSTOMIDAE (Jugular-horned Beetles) [Fig. 79] .....	<u>77</u>	Deleted: 77
Family OEDEMERIDAE (False Blister Beetles) [Fig. 80] .....	<u>77</u>	Deleted: 77
Family STENOTRACHELIDAE (False Longhorn Beetles) [Fig. 81] .....	<u>78</u>	Deleted: 77
Family MELOIDAE (Blister Beetles) [Fig. 82] .....	<u>79</u>	Deleted: 78
Family MYCTERIDAE (Palm and Flower Beetles) [Fig. 83] .....	<u>80</u>	Deleted: 79
Family BORIDAE (Conifer Bark Beetles) [Fig. 84] .....	<u>80</u>	Deleted: 80
Family PYTHIDAE (Dead Log Beetles) [Fig. 85] .....	<u>81</u>	Deleted: 80
Family PYROCHROIDAE (Fire-coloured Beetles) [Fig. 86] .....	<u>81</u>	Deleted: 80
Family SALPINGIDAE (Narrow-waisted Bark Beetles) [Fig. 87] .....	<u>82</u>	Deleted: 81
Family ANTHICIDAE (Ant-like Flower Beetles) [Fig. 88] .....	<u>83</u>	Deleted: 81
Family ADERIDAE (Ant-like Leaf Beetles) [Fig. 89] .....	<u>83</u>	Deleted: 82
Family SCRAPTIIDAE (False Flower Beetles) [Fig. 90] .....	<u>84</u>	Deleted: 83
Superfamily CHRYSOMELOIDEA .....	<u>84</u>	Deleted: 83
Family CERAMBYCIDAE (Longhorn Beetles) [Fig. 91] .....	<u>84</u>	Deleted: 84
Family BRUCHIDAE (Bean Weevils) [Fig. 92] .....	<u>86</u>	Deleted: 84
Family MEGALOPODIDAE (Megalopodid Leaf Beetles) [Fig. 93] .....	<u>87</u>	Deleted: 84
Family ORSODACNIDAE (Orsodacnid Leaf beetles) [Fig. 94] .....	<u>87</u>	Deleted: 86
Family CHRYSOMELIDAE (Leaf Beetles) [Fig. 95] .....	<u>88</u>	Deleted: 87
Superfamily CURCULIONOIDEA .....	<u>90</u>	Deleted: 87
Family NEMONYCHIDAE (Pine Flower Snout Beetles) [Fig. 96] .....	<u>90</u>	Deleted: 88
Family ANTHRIBIDAE (Fungus Weevils) [Fig. 97] .....	<u>91</u>	Deleted: 90
Family ATTELABIDAE (Leaf and Bud Weevils) [Fig. 98] .....	<u>92</u>	Deleted: 90
Family BRENTIDAE (Pear-shaped Weevils) [Fig. 99] .....	<u>92</u>	Deleted: 90
Family CURCULIONIDAE (Weevils or Snout Beetles) [Fig. 100] .....	<u>93</u>	Deleted: 91
Glossary .....	<u>97</u>	Deleted: 92
Alphabetical Index of Coleoptera Families .....	<u>104</u>	Deleted: 92
Table 1. Order COLEOPTERA. List of Figures .....	<u>107</u>	Deleted: 93
		Deleted: 97
		Deleted: 104
		Deleted: 107

## Introduction

In preparing this account of the beetle families of British Columbia, we have been heavily dependent on the descriptions in the recent two-volume work on American Beetles (Arnett et al. 2001, 2002). We have followed the family classification and the order of families given in these volumes.

The key to families is adapted from that presented by M.A. Ivie in Arnett et al. (2002). We have tried to use terms that are user-friendly and more easily understood by non-entomologists. For example, we use fore, middle and hind coxae instead of procoxa, mesocoxa and metacoxa. We also use the term "segment" for the divisions of the antennae, legs and palps, although we realize that this is morphologically incorrect. Nevertheless, in many cases we have accepted standard entomological terms in the keys and descriptions: these are given in the glossary that is appended.

In the key to families we have, with few exceptions, only included the families known to occur in British Columbia. In this and the taxa included in the descriptions, we have been guided by those listed in Hatch (1953-1971) and Bousquet (1991). We realize that both of these publications are quite dated, and no doubt many more taxa actually occur in the province. Hence, it is to be expected that revisions will be needed, as soon as an update to Bousquet (1991) is completed.

Finally, we have included only an outline drawing of one species in each family. This may not represent the form of all the taxa included, especially in the larger families. Illustrations in Arnett (1973), Arnett et al. (2001, 2002), Hatch (1953-1971) and White (1983) will help give a better idea of the diversity in this very large Order of insects in this region of Canada.

Finally, when there is a comprehensive monograph for a beetle family in Canada, we have indicated this at appropriate places in the text.

It should be noted that this is part of a larger project, and will be eventually revised and modified to fit in with other parts of the large work on the Insect Families of British Columbia.

### References

- Arnett, R.H. Jr., 1973. Beetles of the United States. A manual for identification. American Entomological Institute, Ann Arbor, MI. 1112 pp.
- Arnett, R.H. Jr. and Thomas, M.C. 2001. Volume 1. American Beetles. Archostemata, Myxophaga, Adepaga, Polyphaga: Staphyliniformia. CRC Press, Boca Raton, FL. 443 pp.
- Arnett, R.H. Jr., Thomas, M.C., Skelley, P.E. and Frank, J.H. (Eds.) 2002. Volume 2. American Beetles. Polyphaga: Scarabaeoidea through Curculionoidea. Boca Raton, FL. 861 pp.
- Bousquet, Y. (Ed.). 1991. Checklist of Beetles of Canada and

Alaska. Research Branch, Agriculture Canada, Ottawa, ON. Publication 1861/E:  
430 pp.

Hatch, M.H. 1953-1971. The Beetles of the Pacific Northwest. Parts I-V. University of  
Washington Publications in Biology. Vol. 16.

White, R.E. 1983. A field guide to the beetles of North America. The Peterson Field  
Guide Series. Houghton Mifflin Co., Boston 368 pp.

## Keys and Descriptions to the Families of Coleoptera of British Columbia

### Order COLEOPTERA (Beetles)

From the Greek *koleos* = sheath; *ptera* = wings. The forewings of beetles are usually hardened, sheathing cases protecting the hindwings and much of the body.

Beetles are tiny to very large insects (about 0.4 mm to 130 mm long) of variable shape and colour, but mostly strongly sclerotized, compact and more or less flattened so that the lateral sclerites are mostly ventrally placed, The compound eyes are normally conspicuous; ocelli are almost always absent. Antennae usually have 10 to 14 segments (most are 11-segmented) and are variable in form – threadlike, comblike, beaded, sawtoothed, elbowed or enlarged at the end in various ways. Mouthparts are normally of the chewing type; a very few beetles have mouthparts modified into a sucking tube. Adults normally have two pairs of wings, the front ones (elytra – singular, elytron) are usually hard and shell-like, folding over the back and meeting in a straight line to make stout covers for the folding, membranous second pair, which are used for flight. Some species have reduced wings. The legs are normally strongly sclerotized; tarsi usually have 3 to 5 segments. Beetles have both a larval and pupal stage. Larvae have sclerotized head capsules, chewing mouthparts, distinct antennae and, usually, ocelli. There are no labial silk glands. Thoracic legs are the rule; sometimes they have fewer than the usual 5 or 6-segments, or are absent. The abdomen lacks legs, or rarely has one or two pairs of prolegs. The pupa normally is exarate, with the appendages free, but sometimes they are fused to the body (obtect type).

The Coleoptera is the most diverse order of living organisms. The numbers are extraordinary – the more than 350,000 named species represent about 40% of all insects and 30% of all animals. There are at least six times as many beetles as vertebrate species and 90 times more than the number of mammals. The order is usually divided into four suborders (Archostemata, Myxophaga, Adepaga and Polyphaga) and about 150 families. Perhaps the single most important factor in the success of the Coleoptera is the development of the elytra, which protect the folded hind wings, permitting the occupation of enclosed spaces and hidden habitats by adults. The resulting subelytral space, enclosing most of the spiracles, reduces water loss through transpiration.

Beetles live in almost every conceivable terrestrial and freshwater habitat and even in some marginal marine ones. They thrive in plant foliage, flowers, fruits and seeds; in living plant tissue in galls, stems and roots; in soil, leaf litter, under bark and in rotting wood; under stones and in fungi; in dung and carrion; in the nests of vertebrates and social insects; in stored foods; in running and still fresh waters; in saline ponds and estuaries; in sand and mud along water; among debris along the ocean and in caves.

Many species live in fresh water, either in the larva stage or in both larval and adult stages. Many adults, especially in the Hydrophilidae and Elmidae, have ventral

patches of fine hairs (plastrons) that trap air bubbles for use in breathing. Larvae have various sorts of external gills and siphon-like spiracular tubes.

Most species of beetles probably eat living plant tissue, but many feed largely on decomposing material acted on by fungi and bacteria. Others are fungal feeders. Most phytophagous species belong to the Scarabaeoidea, Chrysomeloidea and Curculionoidea, and the families Buprestidae, Elateridae, Bostrichidae and Anobiidae. Carnivorous beetles are common, and include almost all Adepaga and Polyphaga such as the Hydrophilidae (larvae), Histeridae, Staphylinidae, Elateridae, Lampyridae, Cantharidae, Cleridae and Coccinellidae. Most are general predators, but some are more specialized; for example, Coccinellidae feed mostly on aphids and coccoid Hemiptera and the Lampyridae feed mostly on snails.

Beetles are of immense ecological and economic importance. Many are vital in the cycles of decomposition of plant and animal matter. Others are predators of insects and other invertebrates that damage crops and other plants. Many beetles feed on the foliage and roots of plants, causing much damage to crops; they can kill huge tracts of valuable forests in a short time. Others damage our wooden homes, our furniture and many kinds of stored foods and other products.

## Key to families of Coleoptera in British Columbia

### I. Key to subfamilies of Coleoptera in British Columbia

1. Notopleural sutures present, OR abdomen with only 3 visible sterna, soft-bodied beetles, less than 2.6 mm long, and with wings rolled in a spiral "cigar" manner (not folded) .....2
- Notopleural sutures absent; abdomen with 4 or more visible sterna; wings folded or not, but not rolled .....POLYPHAGA (Key IV)
- 2 (1). Hind coxae immovably fused to metasternum, completely dividing first visible abdominal sternum ..... ADEPHAGA (Key III)
- Hind coxae freely moveable, first visible abdominal sternum extending entirely across abdominal venter behind them...ARCHOSTEMATA (Key II)

### II. Key to families of Archostemata

1. Notopleural sutures present; elytra reticulate, long, covering pygidium; body covered with scales; antennae filiform to subserrate; length over 4 mm..... CUPEDIDAE
- Notopleural sutures absent; elytra smooth, short, and leaving at least pygidium exposed; body without scales; antennae sub-moniliform and gradually widened from fourth segment; length less than 2.6 mm..... MICROMALTHIDAE

### III. Key to families of Adephaga

1. Hind coxae greatly enlarged, with ventral plate concealing trochanter and basal half of femur, and covering most of first three basal abdominal sterna .. HALIPLIDAE
- Hind coxae not greatly enlarged, or if so, then all abdominal sterna visible, coxae not concealing trochanter, basal half of femur and first three abdominal sterna .....2
- 2 (1). Hind coxa not reaching elytron laterally; metepimeron and first abdominal sternum in contact laterally of hind coxa, and mesad of elytral margin; antennae usually at least partly pubescent, in addition to scattered long sensory setae; fore coxal cavities usually closed behind; IF hind coxa reach elytron and fore coxal cavities open, THEN first visible abdominal sternum 3X as long as hind coxa, at insertion of leg AND last segment of maxillary palp distinctly narrower than penultimate.....3
- Hind coxa reaching elytron laterally, junction of metepimeron and first abdominal sternum not visible, when elytron in place; antennae not pubescent, but with only scattered long sensory setae; fore coxal cavities open behind; first visible abdominal sternum 3X as long as hind coxa; last segment of maxillary palp not distinctly narrower than penultimate .....4



- 2 (1). Antenna strongly asymmetrical, usually lamellate club of 3-8 segments; fore coxae large, strongly transverse or conical and projecting below prosternum; fore coxal cavities closed; trochantins concealed; fore tibia flattened with one or more teeth on outer edge; tarsi with 5 distinct segments, none of which are lobed or densely pubescent .....3  
 - Antennae not lamellate, or coxae, tibiae or tarsi not as above.....9
- 3 (2). Antennae 11-segmented.....GEOTRUPIDAE  
 - Antennae with fewer than 11 segments .....4
- 4 (3). Middle tibia with long apical spur pectinate along one edge.....  
 ..... OCHODAEIDAE  
 - Middle tibia with longer apical spur simple, not pectinate.....5
- 5 (4). Segments of antennal club not capable of being tightly closed together .....  
 ..... LUCANIDAE  
 - Segments of antennal club capable of being tightly closed .....6
- 6 (5). Abdomen with 5 visible sterna; dorsal surface roughened and tuberculate, not shining.....7  
 - Abdomen with 6 visible sterna; dorsal surface variably sculptured, shining or not .....8
- 7 (6). Eyes divided by prominent canthus; clypeus with sides subparallel to divergent anteriorly; colour testaceous to light reddish-brown; hind femora and hind tibiae enlarged, covering most of abdomen ..... GLARESIDAE  
 - Eyes not divided by canthus; clypeus with sides narrowing apically; colour brown, gray, or black; hind femora and hind tibiae not enlarged, not covering abdomen ..... TROGIDAE
- 8 (6). Elytra shortened and widely divergent at apex, not covering pygidium; eight morphological abdominal segment with spiracle ..... GLAPHYRIDAE  
 - Elytra not shortened or widely divergent at apex, pygidium exposed or not; eight morphological segment lacking spiracle.....SCARABAEIDAE
- 9 (2). Tarsi pseudotetramerous on all legs, with apparent penultimate segment lobed below, enclosing or nearly hiding true fourth segment; often with long antennae, rostrate head or enlarged hind femora; hind coxa without exposed posterior face.....10  
 - Tarsi with 2-5 segments not pseudotetramerous on ALL legs (i.e. third of 5 segments on hind leg not lobed and enclosing small fourth, but any other configuration possible); antennae, mouthparts, femora and hind coxae variable; OR tarsi pseudotetramerous and hind coxae with distinct posterior face (at least medially) set off from ventral surface by a carina or flange; OR tarsi pseudotetramerous, head not at all rostrate, and antennae strongly or weakly clubbed, but not geniculate.....11

- 10 (9). Palps on mouthparts very short, usually immovably fixed and not visible;; head rostrate, prolonged into a variously developed beak AND/OR antennae geniculate with compact club.....11  
 - Palps on mouthparts longer, flexible, and usually evident; head usually not prolonged into a beak, but if rostrate or antennae elbowed and club compact, then palps longer and flexible .....20
- 11 (9). Antennae distinctly clubbed, with 4 or fewer segments in club; OR if antennal moniliform, head distinctly rostrate; OR if club with 5 or more segments, length of head from vertex to clypeal margin greater than width of head just behind eyes .....16  
 - Antennae usually without distinct club, filiform, moniliform, serrate or pectinate; head not rostrate; if antennae distinctly clubbed, then club of 5 or more segments and length of head to clypeal margin less than or equal to width of head just behind eyes.....12
- 12 (11). Antennae usually more than half length of body, often inserted on prominence, and capable of being reflexed backward over body; tibiae with 2 obvious apical spurs; first antennal segment usually several times longer than second; pygidium never sclerotized and exposed; length 3 to 75 mm..... CERAMBYCIDAE (in part)  
 - Antennae usually less than half length of body, seldom inserted on prominence, and not flexible back over body; tibiae without or with one or 2 apical spurs; first antennal segment seldom more than 2 to 3 times length of second; pygidium of some species sclerotized and exposed; length usually less than 12 mm .....13
- 13 (12). All tibiae with 2 distinct apical spurs, AND frons without "X" grooves; mesonotum with or without stridulatory file; ligula large, membranous and bilobed.....15  
 - At least one tibia without 2 apical spurs OR frons with deep "X" grooves; mesonotum without stridulatory file; ligula normal .....14
- 14 (13). Elytra usually with more or less evident epipleura, seldom strongly abbreviated exposing pygidium, if latter exposed seldom declivous; if body oval, venter not strongly convex..... CHRYSOMELIDAE  
 - Elytra without epipleura, abbreviated posteriorly, exposing a declivous pygidium; body oval, with ventral strongly convex ..... BRUCHIDAE
- 15 (13). Head with short, but distinct temple behind eye, set off from narrowed neck; apex of mandible bidentate; ligula with a single lobe; mesonotum with stridulatory file..... MEGALOPODIDAE  
 - Head lacking temples, evenly narrowed from behind eyes to neck; apex of mandible unidentate or bidentate; ligula bilobed; mesonotum without stridulatory file..... ORSODACNIDAE

- 16 (11). Antennae geniculate (rarely appearing straight or nearly so), club compact; hind trochanter not cylindrical, femur attached obliquely .....  
 .....CURCULIONIDAE
- Antennae straight (very rarely geniculate), club loose or not evident; hind trochanter variable, but if antennal geniculate, trochanter cylindrical and squarely attached to femur .....17
- 17 (16). Labrum visible and free; second tarsal segment not spongy beneath; maxillary palps normal .....18
- Labrum never free; tarsi variable; maxillary palps rigid .....19
- 18 (17). Antennae situated adjacent to eye or laterally near base of short dorsoventrally flat rostrum; apex of third antennal segment reaching well beyond front margin of eye; all tibiae lacking spurs or spurs vestigial; notosternal sutures indistinct to obsolete ..... ANTHRIBIDAE
- Antennae situated distally on long cylindrical rostrum; apex of third antennal segment not or barely reaching front margin of eye; all tibiae with spurs; notosternal sutures distinct ..... NEMONYCHIDAE
- 19 (17). Antennae straight and clubbed; body pear-shaped, and hind trochanter cylindrical, squarely joined to femur ..... BRENTIDAE
- Antennae straight, not elbowed, but with 11 segments and a distinct club; hind trochanter triangular or diamond-shaped, obliquely joining to femur; body form variable ..... ATTELABIDAE
- 20 (10). Body length 1.2 mm or less; antennae long, thin, with loose to indistinct club; antennal segments each with a whorl of long setae at apex; hind wings fringed with long setae that are longer than width of wing, or hind wings absent ..... PTILIIDAE
- Body length variable; antennae not as above; hind wings rarely with fringe longer than width of wing .....21
- 21 (20). Head with paired ocelli .....22
- Head without paired ocelli, at most with a single ocellus.....24
- 22 (21). Anterior edge of scutellum abruptly and sharply elevated above mesoscutum; metepisternum reaching middle coxal cavity and contacting first abdominal sternum to separate hind coxa from elytral edge .....  
 ..... DERODONTIDAE
- Anterior edge of scutellum not abruptly elevated, continuous with mesoscutum; metepisternum variable .....23
- 23 (22). Elytra completely covering abdomen; antennae short, not reaching middle of pronotum; antennae 9-segmented, with club of 5 pubescent segments;

- underside of body with hydrofuge pubescence.....  
 .....HYDRAENIDAE (Subfamily Ochthebiinae)
- Elytra usually exposing one or more abdominal terga; antennae short to long, reaching beyond middle of pronotum in species with long elytra; antennal club, if present, not involving 5 segments; underside of body without hydrofuge pubescence ...STAPHYLINIDAE (Subfamily Omaliinae)
- 24 (20). Elytra very short, leaving 3 or more abdominal terga exposed .....25  
 - Elytra longer, leaving no more than one or 2 abdominal terga exposed.....38
- 25 (24). Hind tarsus with one fewer segments than middle tarsus .....26  
 - Hind and middle tarsus with same number of segments.....28
- 26 (25). Antenna strongly serrate to pectinate, flabellate, bipectinate or biflabellate  
 .....RIPIPHORIDAE  
 - Antennae at most, very weakly serrate .....27
- 27 (26). Tarsal claws with long, acute process or blade arising from base, usually more than half as long as claw; antennae filiform; body corpulent and soft ....  
 .....MELOIDAE (in part)  
 - Tarsal claws simple; antennae weakly clubbed; body cylindrical .....  
 .....STAPHYLINIDAE (Subfamily Euaesthetinae)
- 28 (25). Scutellary striole present; basal two abdominal sterna united, suture not diminished medially antennae of males pectinate to flabellate or plumose  
 ..... BUPRESTIDAE (in part)  
 - Scutellary striole absent; all abdominal sterna free, or 4 sterna united; antennae variable .....29
- 29 (28). Antennae with distinct club .....30  
 - Antennae without club .....34
- 30 (29). Middle tarsus with 2, 3 or 4 segments .....STAPHYLINIDAE (in part)  
 - Middle tarsus with 5 segments.....31
- 31 (30). Antennae with 4 apical segments expanded into asymmetrical club, first segment shining, other 3 tomentose; elytra usually some combination of black and orange, but occasionally all black; fifth abdominal tergum with a pair of longitudinal carinae topped by stridulatory files; body length 12 mm or more .....SILPHIDAE<sup>1</sup> (in part)

<sup>1</sup> Individuals of *Thanatophilus* (Silphidae) with extended abdomen should key out here, because of antennal characters, but beetles in this genus lack the stridulatory files on the fifth abdominal tergum, and are only 8 to 14 mm long.

- Antennae not as above; fifth abdominal tergum without stridulatory files; colour variable; body length 13 mm or less, usually less than 10 mm long.....32
- 32 (31). Antennae with 3 segments only; pronotum with antennal pockets antero-laterally above lateral margins; dorso-ventrally flattened, and louse-like; parasites of beavers .....LEIODIDAE (Genus *Platypsyllus*)
- Antennae 9 to 11-segmented; pronotum without antennal pockets .....33
- 33 (32). Fore coxal cavities open.....STAPHYLINIDAE (in part)
- Fore coxal cavities closed .....NITIDULIDAE (in part)
- 34 (29). Middle tarsus with 4 or fewer segments .....STAPHYLINIDAE (in part)
- Middle tarsus with 5 segments.....35
- 35 (34). Head covered above by pronotum; often with luminous organs on abdomen.. ..... LAMPYRIDAE (in part)
- Head visible from above; never with luminous organs .....36
- 36 (35). Pronotum with lateral eversible vesicles.....
- .....MELYRIDAE (Subfamily Malachiinae)
- Pronto without eversible vesicles.....37
- 37 (36). Elytra individually rounded, not meeting apically at suture; mandibles long and narrow .....CANTHARIDAE (in part)
- Elytra truncate, meeting at suture apically; mandibles often short and broad .. .....STAPHYLINIDAE (in part)
- 38 (24). Apices of penultimate 2 or 3 antennal segments each completely ringed with microsetose groove (periarticular gutters) [must be viewed distally, difficult to see in very small specimens or in those with very compact antennal club]; antennae with distinct to indistinct loose club; prothorax with sharp lateral margins; abdomen with 5 or 6 visible sterna; fore trochantin exposed or hidden, if hidden and antennae 11-segmented, segment 8 smaller than segment 7 or 9 .....39
- Antennae usually lacking periarticular gutters on antennal club; other characters variable; if complete periarticular gutters present, fore trochantin hidden, antennae 11-segmented AND segment 8 not smaller than segment 7 or 9 .....40
- 39 (38). Hind tibial spurs subequal in length; body small (1 to 6 mm), round to elongate oval, shining, granulate or transversely strigulate; elytra glabrous or pubescent, striate or not; prothorax as broad as elytra; fore coxae strongly projecting and constricted by fore coxal cavity; often capable of retracting into a ball-shape by curling head and prothorax under body; antennae

- distinctly clubbed, often with 11 segments, 5 of which are involved in club, and segment 8 smaller than 7 or 9 (some genera with 10 or 11-segmented antennae and with distinct club of 3 or 4 segments, have flattened, externally flanged hind femora, apical portion of which are excavate to receive tibiae); tarsal formula highly variable 3-3-3, 4-4-4, 5-4-4, or 5-5-5; the genus *Colon* with 11-segmented antennae and somewhat gradually clubbed antenna lacking small segment 8, has elytra pubescent ..... LEIODIDAE (in part)
- Hind tibial spurs distinctly unequal; body moderately sized (4 to 14 mm), somewhat flattened and shining; elytra striate or glabrous; pronotum somewhat narrowed relative to elytra; fore coxae strongly projecting and transverse; body not retractile; antennae long, club loose and indistinct, with segment 8 never smaller than 7 and 9; femora simple; tarsal formula 5-5-5....  
..... AGYRTIDAE (in part)
- 40 (38). Middle tarsus with 3 apparent segments, either clearly with 3 segments, or second segment strongly lobed and hiding small penultimate (third) segment .....41
- Middle tarsus with 4 or 5 distinct segments OR first segment distinctly lobed, engulfing very small second and small third of fourth, appearing to have 2 or 3 segments.....44
- 41 (40). Middle tarsus pseudotrimerous, with second segment strongly lobed, hiding small penultimate (third) segment .....42
- Middle tarsus truly with 3 segments, second segment not greatly lobed.....  
..... LATRIDIIDAE
- 42 (41). Fore coxal cavities closed; head small, usually covered by hood-like pronotum; if head exposed from above, then fore coxal cavities closed ;very small beetles, less than 2 mm long..... CORYLOPHIDAE (in part)
- Head visible from above in front of pronotum; fore coxal cavities open; size up to 11 mm long .....43
- 43 (42). Frontoclypeal suture distinctly impressed; all abdominal sterna free; pronotum often with sublateral lines.....ENDOMYCHIDAE (in part)
- Frontoclypeal suture absent; 2 basal abdominal sterna united, first with postcoxal lines; pronotum lacking sublateral lines .....COCCINELLIDAE
- 44 (40). Antennae 9-segmented, last 5 involved in club; abdomen with 6 or 7 visible sterna; with minute intercoxal sclerite between hind coxae; maxillary palp long relative to antenna; body ventrally with hydrofuge pubescence ..... HYDRAENIDAE (in part)
- Antennae not as above; other characters not in above combination .....45
- 45 (44). Antennae 7-9 segmented, segments 7-9 usually forming loose, tomentose club, segment 6 often forming a cupule at base of club; maxillary palp often as long as or longer than antenna, always more than half antennal length;

- hind coxae with ventro-posterior carina setting off convex posterior face, that rotates against anterior excavation of first visible abdominal sternum; planes of ventral surface of hind coxa and first abdominal sternum discontinuous; hind trochanter inserted on ventral (not posterior) surface of hind coxa, femur being held against ventral face of coxa, but not against posterior face of coxa or flat onto abdominal surface when fully retracted .....  
 .....HYDROPHILIDAE (in part)
- Antennae variable, but not as above; maxillary palp usually much shorter than antenna; hind coxa configured differently .....46
- 46 (45). Hind coxa with distinct posterior face (at least medially), set off from ventral surface by carina or flange, with posterior face often excavated; ventral surface of hind coxa not co-planar with first visible abdominal sternum; hind femur inserted on posterior face of hind coxa and femur held posterior to coxa when retracted; fore coxal cavities open; middle and hind tarsi with equal number of segments .....47
- Hind coxa without distinct posterior face; hind trochanter often inserted on ventral surface or on small medial projection of coxa, never received in coxa; excavation and resting ventral to hind coxa in retracted position; ventral surface of hind coxa more or less continuous with first visible abdominal sternum OR hind tarsus with one fewer segment than middle tarsus; fore coxal cavities open or closed .....75
- 47 (46). Abdomen with 7 or 8 visible abdominal sterna; hind tarsus with 5 segments .....48
- Abdomen with 6 or fewer visible abdominal sterna; hind tarsus with 4 or 5 segments.....50
- 48 (47). Middle coxae distinctly separated; elytra often reticulate, at least feebly costate; femur and/or tibia compressed; pronotum with distinct median longitudinal carina, groove or cell, occasionally restricted to base of disc .....  
 .....LYCIDAE
- Middle coxae contiguous or nearly so; elytra not reticulate; femur and tibia seldom compressed; pronotum rarely with distinct median longitudinal carina, groove or cell.....49
- 49 (48). Pronotum extended forward, covering head in dorsal view; abdominal venter with one or more sterna often with luminous organs (most obvious in males); separation of antennae insertions equal to or less than diameter of antennal fossa..... LAMPYRIDAE (in part)
- Head exposed in dorsal view when extended, OR if covered by pronotum, antennae separated by nearly twice diameter of antennal fossa; abdominal venter lacking luminous organs .....CANTHARIDAE (in part)
- 50 (47). Posterior angles of prothorax acute, embracing elytral humeri; hind tarsus with 5 segments; abdominal venter with 3 or more sterna united; prothorax

- dorsoventrally mobile relative to mesothorax; intercoxal process of prosternum long, notched dorsally, and received in deep middle coxal cavity as a clicking mechanism; IF clicking mechanism not visible owing to portion of intercoxal process being flat ventrally and received tightly in deeply emarginate mesosternum, THEN sternopleural suture or hypomeron grooved to receive antennae.....51
- Posterior angles of prothorax not acute and embracing elytral humeri, or rarely somewhat acute and weakly embracing humeri; hind tarsus with 4 or 5 segments; abdominal sterna variable; prosternal process variable, but if large and received in deeply emarginate mesosternum, apex of prosternal process not notched dorsally, nor capable of clicking; if large prosternal process received tightly in deep middle coxal cavity AND underside of prothorax grooved to receive antennae, then hind tarsus with four segments .. .....53
- 51 (50). Labrum not externally visible; abdomen with 5 united sterna..... EUCNEMIDAE

  - Labrum free and visible; abdomen with 3, 4 or 5 sterna united .....52
- 52 (51). Antennae indistinctly to distinctly clubbed; apex received in margined cavity on postero-lateral portion of hypomeron, just anterior to retracted foreleg; metasternum with or without oblique margined groove for middle tarsus; prosternum with click mechanism hidden by plate-like ventral surface of postcoxal intercoxal process which fits tightly against exposed portion of middle coxal cavity; elytra strongly striate and covered with silky, subrecumbent setae; abdomen with 5 united sterna; body length 1 to 5 mm ... THROSCIDAE

  - Antennae variable, but not clubbed; antennal groove, if present, at or near sternopleural suture; metasternum without margined groove for middle tarsus; IF click mechanism hidden as above, THEN elytra not strongly striate, and setae suberect; abdomen with 3 or 4 sterna united; body length 1 to 60 mm .....ELATERIDAE
- 53 (50). Middle coxal cavities closed laterally, with mesosternum and metasternum meeting lateral to middle coxa OR antennae elongate, segments 3-8 with long rami, 9-11 flattened, elongate-serrate, pronotum often hood-like, covering head from above.....54

  - Middle coxal cavities open laterally, with mesosternum and metasternum separated lateral to middle coxa by mesepimera or mesepimera and mesepisternum; antennae not as above; pronotum variable .....55
- 54 (53). Hind trochanter cylindrical, short to long, squarely attached to femur, distinctly separating coxa and tibia..... ANOBIIDAE (in part)

- Hind trochanter short, triangular, obliquely attached to femur so that femur and coxa are adjacent or narrowly separated on one side ..... BOSTRICHIDAE (in part)
- 55 (53). Anterior margin of scutellum with abrupt, carinate elevation that fits against posterior margin of pronotum, or scutellum absent or not visible .....56
- Anterior margin of scutellum not abruptly elevated, fitting under overlapping posterior margin of pronotum .....72
- 56 (55). Fore coxae strongly and distinctly projecting ventral to prosternum, one-third or more of dorso-ventral length ventral to intercoxal process; fore coxae usually conical or transversely conical .....57
- Fore coxae not or weakly projecting ventral to prosternum; if fore coxae conical, then lying longitudinally and not or weakly projecting ventrally, ventral of intercoxal process .....62
- 57 (56). Tarsi with 4 distinct segments; hind coxal plates greatly expanded, hiding most of first visible abdominal sternum; hind wing, when developed, often fringed with long setae; body length 0.7 to 2 mm ..... CLAMBIDAE
- Tarsi with 5 distinct segments; hind coxal plates distinct, but not hiding most of first visible abdominal sternum; hind wing not fringed; body length variable .....58
- 58 (57). Antenna with distinct, simple club of 3 segments .....59
- Antenna variously constructed, but without a simple club of 3 compact segments .....61
- 59 (58). Elytra truncate; pygidium sclerotized and completely or nearly completely exposed ..... SPHAERITIDAE
- Elytra complete; pygidium not sclerotized, complete covered or with only small portion exposed .....60
- 60 (59). Upper surface of body glabrous; body contractile; fore tibia held anterior to fore femur and covering antenna in hypomerale cavity when contracted ..... NOSODENDRIDAE (Subfamily Orphilinae)
- Upper surface of body variously pubescent, setose or scaled; body not strongly contractile: fore tibia held posterior to fore femur and antennal club not covered by leg when contracted ..... DERMESTIDAE (in part)
- 61 (58). Base of pronotum crenulate; scutellum usually medially notched on anterior margin; antennal insertion not elevated; mandibles moderate and evenly curved; labrum large, sclerotized and dorsal to mandibles ..... PTILODACTYLIDAE
- Base of pronotum simple; anterior margin of scutellum not notched; dorsal margin of antennal insertion elevated and protuberant; mandibles large, abruptly curved inwardly at nearly a right angle; labrum either short and

- membranous, or extending between and below mandibles ..... DASCILLIDAE (in part)
- 62 (56). Head with single median ocellus ..... DERMESTIDAE (in part)
- Head without ocellus.....63
- 63 (62). Antennae short, not reaching middle of pronotum, first two segments relatively large, together one-third or more of total length; rest of antennal segments transverse; body covered with dense tomentum .....64
- Antennae short to long, first two segments not on-third of total length; rest of antennal segments variable; body vestiture variable .....65
- 64 (63). Head distinctly prognathous, mandibles strongly projecting forward; fore femur inclined medially and armed externally with strong spines; middle tarsus with 4 segments ..... HETEROCERIDAE
- Head distinctly hypognathous, mandibles either directed ventrally or hidden; fore femora simple, neither widened medially nor armed with large spines; middle tarsus with 5 segments ..... DRYOPIDAE
- 65 (63). Head with subgenal ridges that fit against fore coxae when head deflexed ..... SCIRTIDAE (in part)
- Head without subgenal ridges, genae not in contact with fore coxae.....66
- 66 (65). Basal two abdominal sterna united, either with suture between them partially obliterated medially OR if suture between them not medially indistinct, THEN sternopleural sutures at least moderately grooved to receive antennae .....67
- All abdominal sterna free, OR 3 to 5 of them united; sternal and sternopleural sutures variable .....68
- 67 (66). Suture between basal two abdominal sterna distinct medially; middle tarsus with small, bisetose empodium; antennae filiform to distinctly clubbed; body strongly convex..... BYRRHIDAE
- Suture between basal two abdominal sterna weak to absent medially; middle tarsus lacking visible empodium; antennae usually serrate, pectinate or flabellate; body weakly dorso-ventrally flattened... BUPRESTIDAE (in part)
- 68 (66). Legs retractile, rotated forward in repose, with tibia held anterior to femur; fore femur with flange on posterior face covering tibial excavation, fore tibia grooved to receive tarsus; usually with margined excavations on propleuron, mesosternum, and abdominal sterna to receive legs .....69
- If legs retractile, fore tibia held posterior to or ventral to femur; fore femoral flange, if present, located on anterior face.....70
- 69 (68). Mentum strongly sclerotized, expanded, covering labium and maxillae; head not deflexible; antennae covered by forelegs in broad sternopleural pocket;

- basal two abdominal sterna excavate for hind leg; middle tibia with marginal spines; body length 4 to 9 mm ..... NOSODENDRIDAE (in part)
- Mentum normal, head usually retractable into pronotum up to anterior margin of eyes; antennae received in internal pronotal cavities or partly in sternopleural grooves and partly under legs against hypomeron; excavation for hindlegs, if present, limited to first visible abdominal sternum; margin of middle tibia not spinose; body length 1 to 2 mm ..... LIMNICHIDAE
- 70 (66). Elytra with thumb-like process on inner lateral surface near subapical curve, locking into 5<sup>th</sup> visible abdominal sternum; this character visible when elytra are separated from side of abdomen ..... ARTEMATOPODIDAE
- Elytra without such a locking device ..... 71
- 71 (70). Propleuron extended toward middle of body behind fore coxae for approximately half length of trochantin; body length 10 to 15 mm ..... DASCILLIDAE (in part)
- Margin of propleuron curved laterally posteriorly, not extended toward middle of body behind fore coxae; body length 1 to 8 mm ..... ELMIDAE
- 72 (55). Head with subgenal ridges that fit against fore coxae when head deflexed; prosternum in front of coxa narrow, shorter than intercoxal process ..... SCIRTIDAE (in part)
- Head without subgenal ridges, genae usually not in contact with fore coxae; prosternum in front of coxae nearly as long as or longer than intercoxal process ..... 73
- 73 (72). Hind coxal plates large, plate-like, longer medially than metasternum, hiding most of hind femur, even when fully extended ..... EUCINETIDAE
- Hind coxal plates narrow, forming either a parallel plate or simple carina; hind femur fully visible ..... 74
- 74 (73). Elytra with 9 or 10 punctate striae; posterior portion of hypomeron extending up to half the distance to mesal edge of fore coxae; body length 7 to 14 mm ..... AGYRTIDAE (in part)
- Elytra without punctate striae, otherwise variable, irregularly punctate, with complex low sculpture, or up to 3 carinate costae; posterior portion of hypomeron not extending behind fore coxae or extending only a short distance mesad of lateral edge of coxa; body length 7 to 45 mm ..... SILPHIDAE (in part)
- 75 (46). Hind coxae widely separated by broad, truncate intercoxal process of first abdominal sternum ..... 76
- Intercoxal process of first abdominal sternum absent, acute or rounded ..... 77
- 76 (75). Middle coxal cavities open laterally, closure involving mesepisterna ..... HYDROPHILIDAE (Subfamily Georissinae)

- Middle coxal cavities open or closed; if open, closure solely involving mesepimeron .....77
- 77 (75, 76). Antennae geniculate, club usually of 3 segments; elytra short and truncate, exposing 2 non-flexing abdominal terga; body compact..... HISTERIDAE
- Antennae not obviously geniculate, clubbed or not; elytra rarely exposing 2 abdominal terga, IF 2 terga exposed, THEN exposed abdominal segments flexible, body not oval or body cylindrical and compact.....78
- 78 (77). Fore legs with exposed trochantin .....79
- Fore legs with trochantin concealed or absent .....95
- 79 (78). Hind coxa extending laterally to reach elytral epipleuron or side of body, no visible contact between metathorax and first abdominal sternum .....80
- Hind coxa not reaching elytron, first abdominal sternum and metathorax visible and in contact lateral to coxa.....85
- 80 (79). Hind tarsus with 5 segments .....81
- Hind tarsus with 4 segments .....120
- 81 (80). Head with temples and occipital ridge distinct, occipital ridge closely fitting against pronotum, constricted behind to a distinct neck (difficult to see when head is retracted with ridge and temples against pronotum); elytra with strong characteristic sutural striae, no other striae evident; antennal 11-segmented, with gradual club apically composed of 3-4 segments; males with 5 visible abdominal sterna, females with 4 visible abdominal sterna..... LEIODIDAE (Genus *Colon*)
- Head without ridge and constricted neck that fits against pronotum; elytra striate or not, but not as above; antennae variable; with at least 5 visible abdominal sterna .....82
- 82 (81). Prosternal process between coxae distinctly elevated above level of prosternum, apex strongly curved dorsally, reaching level of postcoxal extensions of hypomeron; cervical sclerites absent; antennae not clubbed; elytra glabrous or subglabrous; body length 8 to 20 mm..... CERAMBYCIDAE (in part)
- Prosternal process not elevated between coxae nor with apex strongly curved dorsally; cervical sclerites present; antennae clubbed or not; elytra densely to sparsely setose, subglabrous or glabrous; body length 1 to 24 mm .....83
- 83 (82). Fore coxae not projecting distinctly below intercoxal process, large and transverse; antennae distinctly clubbed; prothorax with sharp lateral margins; IF fore coxae slightly projecting THEN antennae distinctly clubbed and tarsi not lobed beneath; not bright red..... TROGOSSITIDAE

- Fore coxae projecting distinctly below intercoxal process, conical or transverse; antennae variable; lateral margins of prothorax variable; IF fore coxae only slightly projecting, THEN antennae feebly clubbed, and tarsi lobed beneath AND coloration bright red.....84
- 84 (83). Tarsi with lobes on multiple segments; fore coxal cavity circular, elongate or slightly transverse; labrum subtruncate to concave or deeply emarginate; eye often emarginate; antenna usually apically clubbed, club of one or more segments; elytra often punctate-striate; pronotum and abdomen never with eversible glands.....CLERIDAE
- Tarsi not lobed beneath; fore coxal cavity strongly transverse; labrum subtruncate to convex, rounded or acute; eye not emarginate; antennae rarely with distinct apical club, and if so, club of 5 or more segments; elytra usually confusedly punctate; pronotum and abdomen sometimes with eversible glands..... MELYRIDAE (in part)
- 85 (79). Elytra short, completely exposing one or more abdominal terga .....86
- Elytra covering all of abdominal dorsum, or exposing apex of only a single tergum .....88
- 86 (85) Labial palps non-articulated; prosternal process elevated between fore, coxae, and strongly curved dorsally behind.....BRACHYPTERIDAE
- Labial palps with 3 segments; prosternal process flat or elevated between fore coxae, but not strongly curved dorsally behind.....87
- 87 (86). Antennae 10-segmented, club of only one segment; elytra more than twice as long as wide .....MONOTOMIDAE (Subfamily Rhizophaginae)
- Antennae 10 or 11-segmented, club of 3 or more segments; elytra less than twice as long as wide .....NITIDULIDAE (in part)
- 88 (85). Middle tarsus with 4 segments; tarsal lobes, if present, small, not obscuring penultimate segment .....89
- Middle tarsus with 5 segments, fourth possible obscured by enlarged lobe of third (pseudotetramerons) .....90
- 89 (88). Body nearly spherical, capable of being rolled into a ball; mandibles resting against metasternum in retracted position.....
- ..... NITIDULIDAE (Genus *Cybocephalus*)
- Body flattened cylindrical, not at all spherical .....
- ..... MYCETOPHAGIDAE (in part)
- 90 (88). Antennae 10-segmented, one segment involved in club.....
- .....MONOTOMIDAE (Subfamily Rhizophaginae)
- Antennae 10 or 11-segmented, if clubbed, club of 2 or more segments.....91

- 91 (90). Body extremely flattened; elytra nearly parallel-sided, disc almost perfectly flat between rounded lateral carinae running from humeri to near apex, setting off vertical sides and guttered epipleura margin; either large (over 10 mm) and red with expanded temples, or small (less than 5 mm) and dull brown without temples..... CUCUJIDAE  
 - Body not so distinctly flattened; elytra distinctly transversely arched, not with combination of characters as above .....92
- 92 (91). Dorsal face of mandible with tubercle that fits into cavity on clypeus, setose cavity at base, hidden when mandibles are closed (mycangium); elytra with scutellary striole; antennae with 2 or 3 segments forming club; body oval to cylindrical .....SPHINDIDAE  
 - Mandibles without dorsal mycangium; elytra without scutellary striole; antennae and body shape variable.....93
- 93 (92). Antennae with a distinct club AND middle and hind tarsi with equal number of segments .....94  
 - Hind tarsus with one fewer segments than middle tarsus; antennae distinctly clubbed or not .....120
- 94 (93). Pygidium at least partially exposed, strongly sclerotized, punctate, distinctly different from other abdominal terga; tibiae usually spinose or denticulate on external margin .....NITIDULIDAE (in part)  
 - Pygidium not exposed, not strongly sclerotized, similar to other abdominal terga; tibiae smooth on external margin..... BYTURIDAE
- 95 (78). Antennal insertion concealed from above by lateral expansion of frons; AND abdominal venter with 3 basal sterna united, fourth and fifth movable, AND fore coxal cavities closed by mesad extension of the posterior portion of the hypomeron; AND fore coxal process not expanded laterally at apex to close fore coxal cavities; antennae usually 11-segmented (rarely 9- or 10-segmented) ..... TENEBRIONIDAE  
 - Combination of characters not as above .....96
- 96 (95). Abdominal venter with basal 4 sterna united..... ZOPHERIDAE  
 - Abdominal venter with fewer than 4 sterna united.....97
- 97 (96). Hind tarsus with 5 segments, first reduced and often difficult to see; basal segment of hind tarsus either hidden in apical excavation of hind tibia OR if hind tarsal insertion fully exposed, THEN basal segment of hind tarsus less than one-fourth length of second segment and obliquely attached under second (may only be visible from below in oblique distal angle); elytra covering pygidium; antenna with distinct club of 2 to 4 capitate to elongate loose segments; AND one of the following combinations: :i) head somewhat to distinctly hypognathous; pronotum hood-like, projecting anteriorly (or ventrally in some fully hypognathous species) beyond antero-lateral angles

- of head (Subfamilies Bostrichinae, Dinoderinae); ii) head prognathous; intercoxal process of first abdominal sternum truncate, hind coxae widely separated, hind coxa reaching elytra laterally, separating metathorax from first abdominal sternum (Subfamily Lyctinae); OR iii) head prognathous; fore coxae transversely cylindrical, projecting at sides, foreleg attached at directed laterally, femur and trochanter large (Subfamily Polycaninae) .....
  - ..... BOSTRICHIDAE (in part)
- Tarsi with basal segment not reduced; other characters variable; if basal segment of hind tarsus reduced relative to second, pronotum not hood-like, head not hypognathous AND/OR hind tarsus 4-segmented, pygidium exposed, basal abdominal sternum not widely truncate between hind coxae; fore coxae not transversely cylindrical and projecting at sides .....98
- 98 (97). Middle tarsus with 4 distinct segments .....99
- Middle tarsus with 5 segments, or tarsi pseudotetramerous .....109
- 99 (98). Middle coxal cavities closed laterally .....100
- Middle coxal cavities open laterally .....105
- 100 (99). Antennal insertions concealed from above ..... COLYDIIDAE
- Antennal insertions exposed from above .....101
- 101 (100) Genae with pair of anteriorly directed horns extending beyond labium, an visible from above..... PROSTOMIDAE
- Gena lacking gular horns .....102
- 102 (101). Abdomen with 6 visible sterna; pronotum usually large, hood-like, covering or nearly covering head; pygidium usually exposed; epipleuron incomplete; frontoclypeal suture absent; body length less than 2 mm .....
- ..... CORYLOPHIDAE (in part)
- Abdomen with 5 or 6 visible sterna; pronotum never hood-like, head visible from above; pygidium, epipleura and frontoclypeal suture variable; IF abdomen with 6 visible sterna, THEN body length 4 mm or more, and frontoclypeal suture present.....103
- 103 (102). Antennae longer, reaching to or beyond middle of pronotum, club loose; pronotum usually with pair of sublateral discal carinae or grooves, running from base, lateral of basal pits; body usually round to oval .....
- ..... ENDOMYCHIDAE (in part)
- Antennae shorter, not reaching beyond middle of pronotum, club compact; IF pronotum with discal carinae or grooves, THEN usually with a median groove or pit and body elongate.....104
- 104 (103). Posterior margin of last abdominal sternum crenulate OR body distinctly oval, length no more than twice maximum width; antennae 8-, 9- or 10-

- segmented; hind trochanter obliquely attached to femur, but distinctly separating coxa from femur ..... CERYLONIDAE
- Posterior margin of last abdominal sternum never crenulate, antennae with 10 or 11 segments; body elongate, at least 2.75 times maximum width; hind trochanter offset, so that femur and coxa are in contact or nearly so ..... BOTHRIDERIDAE
- 105 (99). Hind coxae separated by more than half transverse coxal diameter ..... 106
- Hind coxae separated by less than half transverse coxal diameter ..... 104
- 106 (105). Fore coxal cavities narrowly closed; fore and middle coxae strongly transverse; mandible tucked into cavity when closed, not visible from side; antenna 9-segmented, last 5 segment forming club; pronotum not grooved or carinate on disc; small beetles, body length less than 2 mm ..... CORYLOPHIDAE (Genus *Orthoperus*)
- Fore coxal cavities narrowly to widely open; fore and middle coxae circular to slightly transverse; mandible visible from side; antennae 8 to 11 segmented, if clubbed, club of 1, 2 or 3 segments; pronotum usually with submarginal grooves or carinae, especially basally; body length 1 to 10 mm ..... ENDOMYCHIDAE (in part)
- 107 (105) Intercoxal process of first abdominal sternum absent, no part of sternum extending between coxae to contact metasternum; first abdominal sternum lacking margined hind coxal cavities; body soft; small triangular part of morphological abdominal sternum 2 usually visible lateral to hind coxa (i.e. sternum 1 small and divided); often brightly coloured beetles, with red, yellow or metallic blue/green markings; body length 5 to 12 mm ..... BOSTRICHIDAE (Subfamily Psolinae)
- Intercoxal process of first abdominal sternum complete; first abdominal sternum with margined coxal cavities; hind coxae transverse; body fully sclerotized; basal abdominal sternum closing antero-lateral angle between hind coxa and abdomen, not divided by hind coxae; never metallic; body length 0.5 to 6.5 mm ..... 108
- 108 (107). Body elongate-oval and somewhat cylindrical; pronotum usually very convex in transverse section, edges often directed ventrally; pronotum without basal pits or impressions; head or pronotum of male often with horns or tubercles; antennae 8- to 10-segmented, and with club of 2-3 segments; males often with pubescent median fova on first abdominal sternum; head without distinct temples or neck..... CIIDAE
- Body oval to elongate-oval, usually somewhat dorsoventrally depressed; pronotum usually weakly convex transversely, edge directed laterally; pronotum with 2 basal pits or impressions lateral to scutellum (sometimes in posterior marginal groove and difficult to detect); head and pronotum without horns or tubercles; antennae 11-segmented, last 2-5 segments

- forming club; all abdominal sterna free, without fovea.....
  - ..... MYCETOPHAGIDAE (in part)
- 109 (98). Abdomen with 6 visible sterna AND hind tarsi with 5 segments; terminal segment of maxillary palp shorter and narrower than penultimate segment; body length 0.6 to 2.7 mm .....SCYDMAENIDAE
  - Abdomen with 4 or 5 visible sterna; tarsi variable; terminal segment of maxillary palp as wide or wider than penultimate segment AND/OR as long or longer than penultimate segment; size variable.....110
- 110 (109). Abdomen with first visible sternum longer than second (measured behind coxae); elytra without punctate or impressed striae (traces of striae occasionally visible through cuticle, but not expressed on the surface); epipleura distinct in basal half, not reaching apex (usually narrowed at level of third abdominal sternum); genae carinate and projecting ventrally between eye and mentum; apex of elytra with double suture or "subapical gap" caused by wide flange of elytral coupling system; elytra complete, exposing at most tip of last abdominal tergum .....
  - ..... CRYPTOPHAGIDAE
  - Combination of characters not as above, EITHER with first visible abdominal sternum short, elytra striate, epipleura complete to apex, gena flat between eye and mentum OR elytra not covering most of pygidium.....111
- 111 (110). Hind trochanter transversely or obliquely attached to femur, distinctly separating femur from coxa .....
  - .....112
  - Hind trochanter obliquely attached to femur, offset so that femur abuts coxa .
  - .....120
- 112 (111). Antennal insertions close together or separated by less than half width of head behind eyes AND pronotum without lateral carinae; hind tarsus with 5 segments; hind trochanter elongate and cylindrical .....
  - .....ANOBIIDAE (Subfamily Ptininae)
  - Without combination of narrowly separated antennal insertions and no lateral carina on pronotum; other characters variable .....
  - .....113
- 113 (112) Pronotum with sublateral lines or grooves that extend from base forward to midpoint, often to anterior margin; head usually with sublateral lines from median margin of eye to pronotum; lateral margins of pronotum smooth, or wavy, or with few obtuse angles, that is not acutely denticulate or serrate; head not sharply constricted to form a distinct neck; body oval to elongate, subcylindrical to strongly dorso-ventrally flattened.....LAEMOPHLOEIDAE
  - Pronotum usually without sublateral lines that extend from base forward to midpoint; head variable; IF pronotum with sublateral lines that extend from base forward to or beyond midpoint THEN lateral margins of pronotum sharply denticulate, anterior angles acutely projecting AND/OR head sharply constricted behind small temples: body variable .....
  - .....114

- 114 (113). Middle coxal cavities open laterally .....115  
 - Middle coxal cavities closed laterally .....117
- 115 (114). Antennae 10-segmented, distinctly clubbed; elytra shortened, exposing all of pygidium; head abruptly constricted to form neck; body length 1 to 4 mm .....  
 .....MONOTOMIDAE (in part)  
 - Combination of characters not as above.....116
- 116 (115). Body elongate, flattened; middle and hind tarsus with some number of segments; head usually with distinct temples before abruptly constricted neck; fore coxae either closed behind, or if open, elytra transversely flat or slightly concave between slight to distinctly raised interstria between stria 6 and 7; elytra with scutellary striole; base of mandible with dorsal setose pit (mycangium) hidden beneath clypeus when mandibles closed; antennae filiform with basal segment (scape) more than 3 times length of second segment (pedicel) ..... SILVANIDAE  
 - Hind tarsus with one segment fewer than middle tarsus; other characters variable .....120
- 117 (114). Body shining, oval and strongly convex; pronotum tightly embracing elytra; pronotum laterally at posterior with a vaguely transparent, thin flange which slides over a smooth area on base of humeral angle of elytron, this area on elytron delimited posteriorly by a thin carina; pronotum and elytra with wide propleura and epipleura, lateral margins sharp, explanate, strongly directed ventrally, so that lateral margins are far below level of fore coxa, dorsal surface forming an inverted 'U' in cross section; tarsal claw toothed or appendiculate ..... PHALACRIDAE  
 - Body usually not evenly oval; pronotum not fitted to elytra as above, that is without flanged areas on basal angles of pronotum, or associated elytral area; lateral margins of pronotum and elytra directed sideways, rather than ventrally to lie below level of fore coxa; tarsal claws toothed only in groups with pronotum narrowed posteriorly .....118
- 118 (117). Middle and hind tarsi with same number of segments; face of head often with beaded lateral margins .....119  
 - Middle tarsus with one more segment than hind tarsus; face of head without lateral margins .....120
- 119 (118). Fore coxal cavities open behind; terminal segment of maxillary palp narrow and elongate; body length 9 to 11.5 mm ..... LANGURIIDAE  
 - Fore coxal cavities closed behind by lateral expansion of the prosternal process; terminal segment of maxillary palp securiform or narrow and elongate; body length 2.9 to 4.4 mm ..... EROTYLIDAE

- 120 (80, 93, 111, 166, 118). Last visible segment of abdomen forming a terminal spine; body wedge-shaped and humpbacked; head retracted to hypognathous position; hind tibia and hind tarsus usually with oblique or transverse, comb-like serrate ridges subapically on lateral faces .....MORDELLIDAE
- Abdomen not prolonged into a terminal spine; body not as above; hind tibia and hind tarsus without comb-like serrate ridges as above, but IF similar combs are present, THEN they are apical .....121
  
- 121 (120). Tarsal claws with a ventral blade or elongate lobe beneath; head sharply or gradually constricted behind eyes to form a distinct neck .....122
- Tarsal claws without ventral blade or elongate lobe beneath, if claw toothed or appendiculate, not with appendage 2/3 length of upper blade; head constricted or not .....123
  
- 122 (121). Ventral appendage of tarsal claw usually lobe-like, membranous, but occasionally blade-like and sclerotized; elytra usually meeting along suture margin to very near apex, which may be narrowly separately rounded; prothorax with lateral margin entire, separating pronotum from hypomera or prothorax lacking complete lateral margin, with pronotum and hypomera evenly rounded laterally, not separated; middle coxal cavities usually narrowly separated, occasionally contiguous; maxillae not forming sucking tube; antennae without club or with vague to distinct club of 3 segments; hind wing with well developed radial cell; if pronotal margin completely absent, antenna with a least vague indication of club in last 3 segments and middle coxal cavities narrowly separated; if elytra broadly separated and rounded, pronotum with lateral carina at base .....STENOTRACHELIDAE
- Ventral appendage of tarsal claw blade-like, and sclerotized; elytra usually diverging along elytral suture before apex, broadly separately rounded; pronotum lacking marginal carina laterally; antennae without club of 3 terminal segments; middle coxal cavities contiguous; maxillae usually normal, but occasionally with galeae produced into a filiform sucking tube which is at least as long as mandibles; radial cell absent in hindwing; if elytra meeting on elytral suture to very near apex, then maxilla forming sucking tube .....MELOIDAE (in part)
  
- 123 (121) Base of pronotum with marginal groove that extends laterally onto hypomeron, ending in a pit near posterior margin of coxa; pronotum narrowed posteriorly, not margined laterally; head sharply narrowed behind distinct temples to form narrow neck; elytra sparsely to densely setose.....124
- Basal groove of pronotum, if present, not ending in pit on hypomeron; pronotum margined laterally or not; elytra with or without setae .....125
  
- 124 (123) Antennae with last 3 segments forming elongate apical club, with latter being more than half total length of antenna..... PYROCHROIDAE (in part)

- Antennae not clubbed, with weak, short club with last 3 segments shorter than half total length of antenna OR with only last antennal segment long, and subequal to combined length of segments 7-10.... ANTHICIDAE (in part)
- 125 (123). Middle coxal cavities closed laterally .....126
- Middle coxal cavities open laterally.....128
- 126 (125). Abdomen with basal 3 visible sterna united; antennae 11-segmented, submoniliform/triangular, filiform, serrate to subflabellate; cervical sclerites present ..... MYCTERIDAE
- Abdomen with none or no more than 2 basal sterna united; antennae 10- or 11-segmented; moniliform to capitate; cervical sclerites absent.....127
- 127 (126). Prothorax with pleurosternal suture ending in a large setose pit at antero-lateral margin of fore coxal cavity; abdomen with 2 basal sterna united; antennal 11-segmented; body length 1.5 to 3.8 mm..... PYROCHROIDAE (in part)
- Prothorax with or without pleurosternal suture, but lacking large setose pit on anterior margin of fore coxal cavity; abdomen with all sterna free, or with 2 basal sterna united (Genus *Aegialites*): antennae 10- or 11-segmented; body length 1.5 to 7.0 mm; widespread in forests and Pacific beaches (Genus *Aegialites*)..... SALPINGIDAE
- 128 (125). Pronotum lacking lateral carina.....129
- Pronotum with complete or incomplete lateral carina.....133
- 129 (128). Hind coxae extending laterally to elytron or side of body, completely separating metepisternum from basal sternum of abdomen .....130
- Hind coxae not reaching elytron or side of body, metepisternum and basal sternum of abdomen in contact lateral to hind coxae .....132
- 130 (129). Tarsal formula 4-4-3 (actually 5-5-4, pseudotetramerous/pseudotrimerous); eyes coarsely faceted, appearing "hairy", interfacetal setae as coarse, long and dense as those on front and sides of head adjacent to eyes; body length 1 to 4 mm..... ADERIDAE
- Tarsal formula distinctly 5-5-4; eyes with or without interfacetal setae, IF interfacetal setae present, THEN setae not as coarse, long or obvious as on front and sides of head adjacent to eyes; body length 4 to 21 mm.....131
- 131 (130). Head prognathous, not abruptly constricted to narrow neck, and lacking distinct temples; anterior portion of prosternum as long as or longer than prosternal process; abdomen with basal 2 sterna united .....OEDEMERIDAE
- Head distinctly declined, abruptly constricted to form narrow neck behind distinct temples; anterior portion of prosternum shorter than prosternal process ..... ANTHICIDAE (Subfamily Eurygeniinae)

- 132 (129). Elytra distinctly setose; eye emarginate anteriorly; penultimate tarsal segment with large lobe beneath..... PYROCHROIDAE (in part)  
 - Elytra glabrous; eye not emarginate; penultimate tarsal segment simple .....  
 .....PYTHIDAE (in part)
- 133 (128). Hind coxa extending laterally to elytra or side of body, completely separating metepisternum from basal abdominal sternum; middle tibiae spurs serrate, pectinate or pubescent .....134  
 - Hind coxa not reaching elytra or side of body, metathorax and basal abdominal sternum at least narrowly closing hind coxal cavity laterally; middle tibial spurs variable .....135
- 134 (133). Head vertically narrowed behind eyes to form narrow neck, head not received into prothorax, either bulging beyond pronotal margin, or fitting closely against pronotal margin so that head in lateral view has a posterior carina or crest meeting anterior margin of pronotum..... SCAPTIIDAE  
 - Head gradually narrowed behind eyes, fitting into pronotum in a telescoping manner ..... MELANDRYIDAE
- 135 (133). Elytra with sutural and epipleural margins elevated; with strongly elevated carina running from humeral angle to near apex of elytra, resulting in distinctly concave elytral disc; pronotum with median longitudinal elevated carina on basal third, and with deep transverse grooves with pints at each end on either side of carina ..... ANTHICIDAE (Genus *Ischalia*)  
 - Elytra and pronotum without strongly elevated carinae; elytra disc convex.....  
 .....136
- 136 (135) Median longitudinal line (discrimen) of metasternum short, extended from hind margin forward less than half length of sternum; middle coxae normal, convex and punctate anterior to trochanter insertion .....137  
 - Median longitudinal line (discrimen) of metasternum longer, extending from hind margin forward more than half length of sternum; middle coxa with unique, polished, ventral face anterior to trochanter insertion (this polished area opposed by flat surface if trochanter and base of femur when leg rotated forward) ..... TETRATOMIDAE
- 137 (136). Antennae short, not reaching middle of pronotum; antennae with apical 3 segments forming on distinct, rather abrupt club .....BORIDAE  
 - Antennae longer, reaching base of elytra; antennae with apical segments somewhat wider than basal segments, but not forming abrupt club .....  
 .....PYTHIDAE (Genus *Sphalma*)
- 138 (1). Head prognathous; pronotum expanded anteriorly, extending over head in retracted position, or head retractile into tubular prothorax; distinctly to slightly dorso-ventrally flattened; antenna with 9 or fewer segments; some, possibly all, bioluminescent ..... LAMPYRIDAE

- Head hypognathous, not retractile into prothorax; body globular-cylindrical; antennae 11-segmented; not bioluminescent.....RIPIPHORIDAE

## DESCRIPTION OF FAMILIES

### Suborder ARCHOSTEMATA

Antennae filiform; prothorax with notopleural sulcus present or absent; hind coxae not fused to metasternum, and not dividing first visible abdominal sternum; hindwings with apex spirally rolled in repose.

#### Family CUPEDIDAE (Reticulated Beetles) [Fig. 1]

Body elongate, 7-12 mm long, more or less paralleled-sided, and somewhat dorsally depressed, but covered with broad scale-like setae. Antennae longer than the combined length of head plus pronotum, and inserted dorsally on the head; mandibles short and blunt with a single apical tooth; prothorax with notopleural suture present and distinct; elytra with rows of closely placed, square window-like punctures; tarsal formula 5-5-5; abdomen with five visible, distinctly overlapping sterna.

Larvae are wood boring, living in nothing but firm fungus infested wood. Adults are rarely collected, but occur under bark, on foliage, or occasionally at light.

Worldwide there are nine genera and 30 species. Four genera, each with a single species occur in the USA with three of these known from Canada. Only one species, the black and grey *Priacma serrata* (LeConte) occurs in British Columbia, and characteristically lacks distinct tarsal grooves on the prosternum. It is a western species, the males of which have been attracted to chlorine bleaches in large numbers.

#### Family MICROMALTHIDAE (Telephone-pole Beetles) [Fig. 2]

Very small, 1.5 to 2.5 mm long, elongate, narrow and flattened, with body relatively soft, and with at most scattered fine setae. Coloration is dark brown to black with pale yellow legs and antennae. The head is broad, with large eyes projecting laterally beyond the pronotum; it is prognathous with short moniform antennae with 11 segments; the mandibles are large, curved and with a three-toothed tip. The prothorax lacks a notopleural suture, and the elytra are short and truncate, leaving the last five abdominal terga exposed. The hindwings have a reduced venation, the tarsal formula is 5-5-5, and the abdominal venter has six overlapping sterna. Males also have large, median setose cavities on sterna 3-5.

The family is represented by a single described species *Micromalthus debilis* LeConte, which is native to the eastern United States, and perhaps Belize. However, it has been widely distributed through commerce, is known from British Columbia, and has been reported from New Mexico, Brazil, Cuba, Hawaii, Hong Kong and South Africa. The species is associated with rotten structural timbers, the larvae being wood borers.

*Micromalthus debilis* is not common, but has one of the most complex life cycles in the Coleoptera. It can have three different larvae forms, namely carabid, cerambycoid and curculionoid. The caraboid larva is elongate and narrow with long legs, and is a motile form which moults to form a cerambycoid larva. The latter is similar to the caraboid larva, but lack legs. It can either pupate to form an adult female, or it can develop directly into a paedogenetic female-producing larva which gives birth viviparously to more caraboid larvae. Alternatively, the cerambycoid larva can develop into a male-producer, which lays a single egg that hatches into a curculionoid larva. This curculionoid larva is rather grub-like and pupates to form a haploid adult male.

#### Suborder ADEPHAGA

Hind coxae immovably fused to metasternum, completely dividing first visible abdominal sternum. The prothorax usually has a notopleural suture.

#### Family RHYSODIDAE (Wrinkled Bark Beetles) [Fig. 3]

Elongate, cylindrical, dark brown to black, glabrous, shiny beetles, 5-8 mm long, with head and pronotum deeply grooved. The moniliform antennae are 11-segmented, the prothorax has notopleural sulci, and the tarsal formula is 5-5-5. The outer angle of the fore tibiae have a large inwardly curved unguis, and the elytra have deep longitudinal grooves. The abdomen has five visible sterna, with the first divided into three parts.

Adults and larvae are found in moist rotten logs infested with slime molds. The larvae being grub-like, and presumably feed on the molds.

Worldwide there are about 170 species in 20 genera. Eight species in two genera occur in North America. Both genera, each with a single species have been recorded from Canada. Only *Clinidium calcaratum* LeConte is reported from British Columbia in Canada. The other species *Omoglymmius americanus* (Castelnau) occurs in Ontario.

#### Family CARABIDAE (Ground Beetles) [Fig. 4]

Body usually rather elongate-oval, 2.5-30 mm long; usually dark coloured, but sometimes bicoloured or tricoloured dorsally and variously marked, and/or metallic; body rather glabrous with prominent sensory setae; head, pronotum and elytra without deep grooves. Head prognathous, relatively large, but not usually projecting laterally beyond pronotum; eyes variously developed; antennae at least partially pubescent, but never moniliform; mandibles prominent, the apices acute and with inner, biting or chewing surface variously toothed. Legs long, slender and spinose; fore tibia with outer surface straight or curved, armed with teeth or spines, and with an antennal cleaner apically; hind coxae rarely extending laterally to margin of abdomen; tarsal formula 5-5-5. Elytra usually complete and striate; hindwings sometimes reduced or absent.

Most adults are active olfactory-tactile predators or scavengers and ground-dwelling, although tiger-beetles use vision for hunting prey and readily fly; some members of the tribe Harpalini are seed feeders, feeding on seeds either on the ground or up on the plant. Larvae, which are all predators and typically ground dwelling in the

upper layers of the soil or under leaf-litter, are elongate and campodeiform, with the head, dorsal part of the prothorax and tip of abdomen at least heavily sclerotized.

Worldwide there are about 40,000 species. At least 2635 species in 189 genera are recorded in North America. Over 946 species in 118 genera are recorded from Canada (monographed by Lindroth (1961-1969) and Wallis (1961), with an update on tiger beetle nomenclature in Freitag (1999)): some 46 of these are introduced aliens. To date, 483 species in 71 genera, are known from British Columbia. Carabids are important predators in the forest floor ecosystem, destroying pest species when part of their life cycle is in or on the soil. Twenty-two of these are aliens, one of the largest and commonest of which is *Carabus nemoralis* Müller. *Pterostichus melanarius* (Illiger) an introduced species and a predator of the alien codling moth (*Cydia pomonella* (L.)), is the commonest carabid in certified organically managed apple orchards in the southern Similkameen Valley.

While most predatory carabids are generalists and opportunistic feeders, some, like *Scaphinotus angusticollis* (Fischer von Waldheim), one of the commonest species in our coniferous forests, is a specialist feeder on terrestrial molluscs. Some species, such as *Zocotus matthewsii* LeConte in coastal forests, are evidently old-growth specialists.

Because they are relatively common, well distributed and seem to have definite microhabitat preferences, carabid beetles have become one of the favourite species assemblages to study in evaluating the impact of forest harvesting practices on forest-floor biodiversity. Their study is facilitated by the monumental work of Lindroth (1961-1969). Other beetles, such as the Staphylinidae would be a good group to utilize also in this context, but unfortunately, there are no similar monographs for these insects.

#### References

- Freitag, R. 1999. Catalogue of the Tiger Beetles of Canada and the United States. NRC Research Press, Ottawa. 195 pp.
- Lindroth, C.G. 1961-1969. The ground-beetles (Carabidae, excl. Cicindellinae) of Canada and Alaska. Ouscula Entomologica. Supplementum 20, 24, 29, 33, 35: 1192 pp.
- Wallis, J.B. 1961. The Cicinellidae of Canada. University of Toronto Press, Toronto. 74 pp.

#### Family GYRINIDAE (Whirligig Beetles) [Fig. 5]

Ovate to broadly-ovate, flattened, aquatic beetles, 2.5 to 15 mm long; black, stream-lined and rather glabrous. Most often found swimming on the water surface. Head prognathous and retracted into prothorax; eyes characteristically divided into two, with the upper pair remaining above the water-line, and the lower pair below the water-line when swimming on the surface. Prothorax with notopleural and pleurosternal suture distinct; prosternal process short; scutellum exposed or concealed. Anterior legs long and adapted for grasping prey on the water surface; fore tarsi of male with segments elongate

and broad and adapted for grasping female; middle and hind femora and tibia short, wide and paddle-like, with long setae for swimming; tarsal formula is 5-5-5. Elytra striate or smooth, truncated, exposing one or two posterior abdominal terga. Abdomen with six visible sterna.

Adults are scavengers on the water surface, feeding on dead or dying insects. They typically glide or skate on the surface, and may cluster together when alarmed, often swimming in circles in mixed species swarms. Such alarm circling gives them the common name whirligig beetles. However, when disturbed, adults may also dive below the surface and disperse.

Larvae are predacious on other immature insects. They are elongate, with a prognathous head bearing slender perforate mandibles; the abdominal segments bear lateral filamentor gills, and terminates in four posteriorly projecting, curved hooks.

Worldwide there are 12 genera and about 700 species. There are four genera and 56 species in North America. In Canada, 37 species in two genera are known, with both genera and 19 species recorded from British Columbia. There is a single species of *Dineutus*, *D. assimilis* (Kirby) with a characteristic concealed scutellum, and 18 species of *Gyrinus*, recognized by having an exposed scutellum. Species identification in *Gyrinus* is very difficult and requires dissection of the genitalia in the male. The genus in North America has been monographed by Oygur and Wolfe (1991). Of the three Holarctic species of *Gyrinus* in British Columbia (*G. aeratus* Stephens, *G. minutus* Fabricius, *G. opacus* Sahlberg), *G. minutus* is mainly a lotic species, while the other two are lentic types, with *G. opacus* often in peat pools. Most of the other 15 species in British Columbia are primarily lentic species, although at least five seem to be lotic types.

#### Reference

Oygur, S. & Wolfe, G.W. 1991. Classification, distribution, and phylogeny of North American (North of Mexico) species of *Gyrinus* Müller (Coleoptera: Gyrinidae). *Bulletin of the American Museum of Natural History* 207: 97 pp.

#### Family HALIPLIDAE (Crawling Water Beetles) [Fig. 6]

Ovoid, 1.5 to 5 mm long aquatic beetles, usually distinctly marked with yellowish ground colour; dorsally convex and distinctly punctate. Head small and prognathous; pronotum widest posteriorly; scutellum concealed; elytra with 10+ rows of punctures, tapering posteriorly, and with costal margin convex. Legs with fringe of long setae on the tibia and tarsi; tarsal formula is 5-5-5; hind coxae greatly enlarged, forming ventral plates that conceal the base of the legs and much of the abdominal venter.

Adults swim slowly or crawl in submerged vegetation and primarily feed on algae, but may also be facultative scavengers. Species of *Brychius* are found in the erosional portion of streams, while other haliplids occur commonly in permanent, clear, nutrient-rich ponds and lakes or in slow flowing backwaters of rivers. Larvae are elongate, slender, cylindrical or subcylindrical, with prognathous head and feed on

periphyton or algae. The head, thorax and abdomen either have numerous microtracheal gills or greatly elongate tracheal gills.

Worldwide there are about 200 known species in four genera. Some 67 species in four genera occur in North America, with 37 species in three genera known from Canada. Twenty-two species in three genera are recorded from British Columbia. The two species of *Brychius* have a bell-shaped pronotum, and a distinct median groove on the last abdominal sternum. The three species of *Peltodytes* can be recognized by the two large black spots at the posterior of the pronotum, and the very large hind coxal plates that leave only the terminal abdominal sternum exposed. Species of *Haliphus* are recognized by the lack of large fuscous spots at the posterior of the pronotum, and the smaller hind coxal plates that leave the last three abdominal sterna exposed.

#### Family TRACHYPACHIDAE (False Ground Beetles) [Fig. 7]

Glossy black beetles, 4-7 mm long, with distinct metallic luster. Head prominent and prognathous, with relatively large eyes, and two pairs of supraorbital setae; antennae not pubescent, at most with scattered long sensory setae; maxillae with last segment of palp distinctly narrower than the penultimate segment. Legs with tarsal formula 5-5-5; fore coxal cavities open behind; fore tibia with antennal cleaner on inner apical angle; hind coxae extending laterally to reach side margins of body; junction of metapimeron and first abdominal sternum not visible when elytra in repose; second abdominal sternum less than 3 times as long as hind coxae.

These beetles, look like carabids, and are day-active, olfactory-tactile predators or scavengers. The campodeiform larvae, like the adults, live in dry, more or less shaded soil, often under leaf-litter.

Worldwide there are two genera and six species. Only a single genus with three species occurs in western North America. Two species are known from Canada, with both being recorded from British Columbia. *Trachypachus holmbergi* Mannerheim occurs from Alaska to Saskatchewan, and has been collected in synanthropic localities, such as urban flower gardens. The other species *T. gibbsii* LeConte only occurs in British Columbia in Canada.

#### Family AMPHIZOIDAE (Trout-stream Beetles) [Fig. 8]

Elongate-oval, slightly convex, glabrous, dull black, 11-16 mm long, air-breathing semiaquatic beetles. Body without prominent sensory setae. Head quadrate, with small eyes, and antennae filiform, stout and exposed. Pronotum with lateral margins slightly crenulate; notopleural suture distinct; prosternum with anterior and posterior projecting processes; elytra vaguely striate. Legs not adapted to swimming, and lacking long swimming setae; hind coxae extending to lateral margin of abdomen; tarsal formula is 5-5-5.

Adults and larvae are usually found crawling over rocks, debris or wood in cool or cold fast flowing mountain streams or waterfalls, where they feed on stonefly

(Plecoptera) nymphs. The larvae are fusiform or slightly flattened, heavily sclerotized with the last antennal segment greatly reduced in size.

Worldwide there is only one genus, namely *Amphizoa*, with six species. Three of these occur in the Western United States and Canada, and three are known from the northeastern and southwestern parts of China. All three species in western North America occur in British Columbia. The most common species is *Amphizoa lecontei* Matthews, and also is known from Alberta and Yukon. *Amphizoa insolens* LeConte also occurs in Alaska, Alberta and Yukon, while *A. striata* Van Dyke is only present in Canada in British Columbia.

#### Family DYTISCIDAE (Predaceous Diving Beetles) [Fig. 9]

Oval to elliptical, stream-lined water beetles, 1.5 to 40 mm long, rather flattened and glabrous; brown to black in colour, sometimes with yellowish markings, or yellowish with brown-black markings. Head prognathous and sunk into prothorax; antennae glabrous and longer than palps on mouthparts. Prothorax with notopleural and pleurosternal sutures; pronotum widest posteriorly; scutellum exposed or concealed. Legs often spinose, but obviously adapted for swimming with long setae on tibia and tarsi; tarsal formula is 5-5-5; tarsi of forelegs in most males with basal three segments expanded; hind legs paddle-like; hind coxae large, the hind trochanters fused to base of femora. Abdomen with six visible sterna.

Adults and larvae are voracious predators, inhabiting a wide variety of shallow water habitats, including saline waters. Adults are air-breathing, and use an air bubble beneath the elytra as a physical gill. However they disperse by flying and can be attracted to light.

Larvae are elongate, tapering posteriorly with long, slender legs with swimming setae, the head has long and slender mandibles which are grooved or perforate. Most have a posterior pair of terminal urogomphs.

Worldwide there are at least 160 genera and over 4000 species. Some 52 genera and over 500 species are reported from North America. In Canada there are 35 genera and 276 species (monographed by Larson et al. 2000), with 26 of these genera and 175 species known from British Columbia. Many species are difficult to identify especially in the genera *Agabus* and *Hygrotus*. The large species of *Dytiscus* are some of the most aggressive predators in freshwater ecosystems.

The genera and species of Dytiscidae tend to prefer either still or flowing water. Hence, species of *Acilius*, *Coptosoma*, *Dytiscus*, *Graphoderus*, *Hygrotus* and *Laccophilus* occur in lentic habitats, that is the still water of ponds, while species of *Agabinus* and *Neoclypodytes*, and some species of *Agabus* occur in lotic, or running water habitats. Species of *Sanfilippodytes* are confined to springs. There are then species such as *Desmopachria convexa* Aubé and *Neoscutopterus hornii* (Crotch) that are found in bog and fen pools, while others such as *Stictotarsus spenceri* (Leech) and several species of

*Hygrothus* (e.g. *H. masculinus* (Crotch), *H. tumidiventris* (Fall)) occur in saline waters. However, even these can also be found in fresh waters.

#### Reference

Larson, D.J., Alari, Y. & Roughley, R.E. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Regions, with emphasis on the fauna of Canada and Alaska. NRC Research Press, Ottawa, 982 pp.

#### Suborder POLYPHAGA

#### Series STAPHYLINIFORMIA

#### Superfamily HYDROPHILOIDEA

#### Family HYDROPHILIDAE (Water Scavenger Beetles) [Fig. 10]

Hydrophilids are 1.0 to 40 mm long (usually 1.5-30 mm), broadly oval, strongly convex dorsally and flattened or concave ventrally. They are usually black and shiny, but sometimes brown, yellow or patterned. Normally glabrous dorsally, they are covered below with dense water repellent pile that forms a plastron for retaining an air bubble for respiration. The head is usually deflexed; the antennae are short, 6- to 10-segmented with a densely setose, 3-segmented club, the segment before the club forming a cupule. The maxillary palps are often longer than the antennae, especially in aquatic species. The elytra are broader at the base than the pronotum, widest near the middle and with surfaces smooth, roughened or striate with punctures. The tarsi are nearly always 5-5-5 or 5-4-4.

Most water scavenger species are aquatic or semiaquatic in both larval and adult stages, and most of these prefer shallow standing water. The terrestrial species (Subfamily Spheridiinae) live in moist soil, dung, carrion, decaying leaves and other organic matter. Adults of most hydrophilids are herbivorous or scavengers, although a few are predators. Adults of aquatic species usually come to the surface head first, breaking the surface film with their antennae and storing air on the ventral plastron or under the elytra. Underwater many appear silvery because of the thin film of air coating their ventral surface. Unlike dytiscid beetles, they swim using alternating leg strokes. The larvae are predaceous and have large, sickle-like mandibles.

Worldwide, there are about 2475 hydrophilid species described in about 125 genera; approximately 258 species in 35 genera live in North America. BC has 81 species in 19 genera. *Hydrophilus triangularis* Say, which lives in weedy ponds, is the largest species in the family in BC; it can reach 40 mm long. The widespread *Tropisternus lateralis* (Fab.) is a rapid colonizer, appearing quickly in pools as they form. *Hydrochus* (4 species) and *Helophorus* (13 species) have rather rough, somewhat metallic bodies and striate elytra. They cling to underwater vegetation and are not active swimmers. Three species of *Berosus* live in BC; typically, they are light coloured with dark markings. The eyes bulge, the elytra are striate. The larvae lack functional spiracles and have lateral gills. *Cercyon* is the largest genus in the family in the province, with 19 species; 7 are

introduced from Europe. Usually less than 4mm long, they are widespread and live in rich organic matter. The introduced *C. haemorrhoidalis* (Fabricius) feeds in dung, as do our three species of *Sphaeridum* (also introduced). The latter resemble hister and scarab beetles. *Georyssus pusillus* LeConte is an unusual species. It is about 2 mm long, ovate, strongly convex, and with rough elytra. The head is concealed from above and the antennae are 9-segmented with a 3-segmented club. It is often placed in the small family Georyssidae (Minute Mud-loving Beetles). Only two species of these beetles live in North America; they live in stream banks, often coating themselves with sand and mud.

#### Family SPHAERITIDAE (False Clown Beetles) [Fig. 11]

False clown beetles are black, metallic, elongate-oval, convex and about 4.5 to 7 mm long. The head is conspicuously narrower than the pronotum, but lacks a differentiated neck and is largely concealed from above. The eyes are large and oval; the antennae are 11-segmented and weakly elbowed, inserted under a slight frontal ridge between the eyes and mandibles. The last three segments form a large, densely setose club, the segments distinct but fused. The prothorax is movable; the pronotum is broadly concave in front, convex and margined laterally, wider at the base than at apex. The elytra are striate and truncate, exposing the last abdominal segment. Tibiae spiny; tarsal formula 5-5-5.

Sphaeritids live in dung and decaying organic material, including fungi, carrion, fermenting fruit and sap. Like histerid beetles, sphaeritids play dead when disturbed.

A tiny family, the Sphaeritidae contains a single genus, *Sphaerites*, with four species restricted to the Northern Hemisphere. Three live in Eurasia. *Sphaerites politus* Mannerheim is the only North American species; it lives from Alaska south to California. Among other habitats, it is reported from carrion and bear dung.

#### Family HISTERIDAE (Hister Beetles) [Fig. 12]

Most hister beetles are shiny and glabrous, black or metallic coloured, rarely brownish, and ranging from 0.5 to 20 mm long (usually 1.5-12 mm). The body is normally ovate to oblong and strongly convex, sometimes it is elongate and cylindrical or dorsoventrally flattened. The head is usually tucked deeply into the prothorax. The form of the antennae is striking – short, elbowed (the first segment is long and curved) and 10- or 11-segmented with a tight, 3-segmented club. The underside of the prothorax is expanded and excavated to receive the front legs and often the antennae. The front tibiae are broad and often spiny; the tarsal formula is 5-5-5 or rarely 5-5-4. The elytra are striate, shortened and truncate, usually exposing two or three apical segments of the abdomen.

Adults and larvae are predators of other insects, especially the soft-bodied larvae and eggs of flies. Most are associated with decaying organic matter such as dung, carrion, rotting plants and fungi, where fly maggots abound. Others live in mammal burrows, ant nests, under bark and in bark beetle galleries. Some appear in stored products, where they feed on other insects.

The Histeridae contains about 3900 species in 330 genera worldwide. There are 118 species recorded in Canada, and 57 in BC (22 genera). With nine species in the province, *Margarinotus* is the most diverse genus; *M. umbrosus* (Casey) is common in carrion, sometimes in dung. *Saprinus* contains four species in the province; *Saprinus lugens* Erichson is common and widespread on carrion. All but one of the seven species of *Plegaderus* reported in BC are restricted to the province in Canada; most live under bark, and some are predators of bark beetles. For example, *P. nitidus* Horn has been collected in scolytid galleries in pine trees in the BC interior. *Hypocaccus* (4 species) species live on ocean, river, lake and alkaline pond beaches. *H. bigemmeus* (LeConte) hunts on sand dunes on the Brooks Peninsula, Vancouver Island. Several species live in ant nests; *Hetaerius exiguus* Mannerheim and *Psilocelis subopaca* (LeConte) occur in *Formica* nests where they feed on dead or dying ants and other insects.

## Superfamily STAPHYLINOIDEA

### Family HYDRAENIDAE (Minute Moss Beetles) [Fig. 13]

Minute moss beetles are 0.5 to 3.0 mm long (usually less than 2 mm), coloured black to yellow-brown. The body is narrowly elliptical, flattened to slightly convex; the underside is covered in water-repellent pubescence, the upper surface usually with sparse setae. The maxillary palps are usually longer than the antennae, which are inconspicuous and often concealed beneath the head. They are 9-11-segmented and have a 2-, 3- or usually 5-segmented club clothed with water-repellent setae, preceded by a cup-like segment. The prothorax is broader than the head; elytra usually cover the abdomen completely, but sometimes expose the tip. Tarsal segmentation is normally 5-5-5 with segment 5 elongate. Hydraenids are generally similar to the Hydrophilidae but with 6 or 7 instead of 5 abdominal segments; a characteristic, small, usually triangular sternite lies between the hind coxae.

Both adults and larvae feed on algae, bacteria and other microscopic organisms on the stones, sand, vegetation and debris along the edges of streams and waterfalls, ponds and ditches, marine rock pools and saline lakes. Adults of many species can breathe under water using a plastron (respiratory air bubble) formed by dense, minute water-repellent hairs on the ventral surfaces, but most larvae have no morphological adaptations for aquatic life and live in moist habitats near the aquatic adults. Three genera, *Ochthebius*, *Hydraena* and *Limnebius*, have glandular secretions that are spread by the legs along the specialized cuticle at the edge of the air bubble; this increases the effectiveness of the bubble in gas exchange. These three genera are most successful and make up 85% of the family.

The Hydraenidae (= Limnebiidae) is a family of about 38 genera and 1200 described species worldwide; there are 27 species (5 genera) recorded in Canada and most of these (21 species in 4 genera) are known from British Columbia. *Ochthebius* is the largest genus (12 species). *Hydraena* (6 species) and *Limnebius* (2 species) live along streams. In Canada, *Neochthebius vandykei* (Knisch) is recorded only in British Columbia; it lives in rock crevices in the intertidal zone.

## Reference

Perkins, P.D. 1980. Aquatic beetles of the family Hydraenidae in the Western Hemisphere: Classification, biogeography and inferred phylogeny (Insecta: Coleoptera). *Quaestiones Entomologicae* 16: 3-554.

## Family PTILIIDAE (Feather-winged Beetles) [Fig. 14]

Feather-winged beetles are tiny, 0.4 to 1.2 mm long in North America, but up to 4.0 mm in the tropics. Most in our region are 0.6 to 1.0 mm long -- they are the smallest beetles and among the smallest of all insects. They are yellow, brown or black, broadly elongate-oval, moderately to strongly convex and normally densely covered with golden hairs. The head is usually visible from above and the antennae are threadlike, with 8- to 11- segments (bearing whorls of long hairs) and a 2 or 3 segmented club. The elytra are either rounded apically, covering the abdomen, or short and exposing 3 to 5 abdominal segments; the scutellum is usually large. Feather-winged beetles are well-named – long hairs fringe their delicate hind wings, which often extend past the elytra; some have the wings reduced or completely absent. Tarsal segmentation is 3-3-3, but the first segment is reduced and the second one vestigial, so the formula appears 2-2-2 or often 1-1-1.

Adults and larvae live in decaying organic material – leaf litter, mosses, rotten wood, under bark, in mouldy dung, compost and fungi. They eat mostly fungal hyphae and spores. Some live in ant or termite nests. Others inhabit sand or gravel along streams or piles of seaweed on beaches. Some genera, such as *Acrotrichis*, contain some parthenogenetic species, with populations composed entirely of females.

Worldwide, there are about 550 species (70 genera) of Ptiliidae; 16 species (5 genera) of the 120 species (27 genera) known in North America live in British Columbia. Many undescribed species are known. *Acrotrichis* contains nine species in the province; most are black with golden hairs and are about 1 mm long. *A. vicina* (Matthews) and *A. xanthocera* (Matthews) are common in compost leaf litter and humus. *Actidium crotchianum* Matthews lives on sandbars on streams; *Motschulskium sinuatocolle* Matthews inhabits piles of seaweed on ocean beaches. Both represent the only species in Canada in their respective genera; they are restricted to the province in Canada. *Ptenidium pusillum* (Gyllenhal) is a European introduction and is common in compost.

## Family AGYRTIDAE (Primitive Carrion Beetles) [Fig. 15]

Agyrtids are oval to oblong, slightly flattened beetles; they are brown, hairless, glossy, and 4 to 14 mm long. The head is deflexed or projecting with conspicuous eyes. The antennae are 11-segmented and may be threadlike or, more usually, with a 4- or 5-segmented, gradually widening club. The pronotum is wider than the head and has complete lateral margins. The 9- or 10-striate elytra cover the whole abdomen, which has five (rarely six) visible sternites. The tarsal formula is 5-5-5.

Adults, and probably larvae, are scavengers of decaying organic material. Species tend to be cold-adapted, with adults most active from late autumn to early spring. They

live in wet areas along mountain streams, in beach debris, near snowfields, in leaf litter and around fungi under bark or in the soil.

Traditionally, the Agyrtidae have been included in the Silphidae, but are now considered more closely related to the Leiodidae. The family consists of about 8 genera and 61 species; most species are Holarctic, although two live in New Zealand. In North America, there are 11 species in 6 genera; 6 species live in BC. *Agyrtes* is the only genus in BC having 10 striae on each elytron. One of two North American species, *A. longulus* (Le Conte), occurs in Canada; its range extends northwards from California into BC, where it has been collected mostly west of the Coast Range and in the Columbia-Kootenay region. *Apteroloma* are elongate species that can be confused with carabid beetles. *A. caraboides* (Fall) and *A. tenuicorne* (LeConte) are restricted to western North America. They live along streams and lakeshores and, at high altitudes, are found on or near glaciers, where they scavenge dead insects. The only *Ipelates* species in North America, *I. latus* (Mannerheim), is widespread in BC, living as scavengers in leaf litter and around mushrooms, especially in Douglas-fir and Lodgepole Pine woods. *Necrophilus hydrophiloides* Guérin-Ménéville is a large, oval agyrtid with clubbed antennae. It lives around carrion and decaying plant material in coastal forests from Alaska to California. *Pteroloma nebrionides* Brown is found in moss and rocks along mountain streams in the ranges of the central and southern interior of BC.

The Canadian and Alaskan species of Agyrtidae are treated in Anderson, R.S. and S.B. Peck. 1985. The insects and arachnids of Canada, Part 13. The carrion beetles of Canada and Alaska. Coleoptera: Silphidae and Agyrtidae. Publication 1778. Research Branch, Agriculture Canada, Ottawa. 121 pp.

#### Family LEIODIDAE (Round Fungus Beetles) [Fig. 16]

Leodids are broadly oval to oblong beetles, 1 to 8 mm long, slightly flattened to strongly convex; the brown to black cuticle is bare and shining or clothed with hairs. The antennae usually ends in a 3- to 5-segmented club (segment 8 is usually smaller than either 7 or 9); there is a unique, enclosed depression on the dorsal side of segments 7, 9 and 10 or 8-10 in 11-segmented antennae and segments 7-9 in 10-segmented antennae. The tibiae are frequently expanded and spiny; the tarsal formula is variable – usually 5-5-5, but sometimes 3-3-3, 4-4-4, 5-5-4 or 5-4-4. The elytra almost always completely conceal the abdomen; their surfaces are often striate, finely transverse-striate or granular.

Both larvae and adults feed on fungi and decaying material in wet forest or field environments. Others live in caves or in mammal, bird or ant nests.

The Leiodidae is sometimes treated as several separate families. It contains about 3000 species in 250 genera worldwide. There are 30 genera and 324 species in North America north of Mexico; 24 genera and 84 species live in BC. Members of the subfamily Leiodinae (= Anisostomidae, Agathidiidae) (round fungus beetles) are usually globular. Some dig in soil and eat fungi; others hunt slime molds or feed on decaying organic matter. This is by far the largest subfamily in the province, with ten genera, the largest of which are *Leiodes* (18 species), *Agathidium* (10 species), *Hydnobius* (8 species)

and *Anisotoma* (7 species). Many *Agathidium* species, most common in fungi under dead bark, are able to roll into a tight ball. Several BC *Hydnobius* species have been collected on snow.

Subfamilies Cholevinae, Catopcerinae and Coloninae (= Leptodiridae, Catopidae, Colonidae), the small carrion beetles, are elliptical, usually narrowed to the rear; they feed on dung or carrion and often live in the nests and burrows of vertebrates. The largest BC genus in the Cholevinae is *Catops*, with nine species; *C. basilaris* Say is common and has been collected in pocket gopher burrows. *Colon* (13 species in BC The surface of the elytra is often striate, finely transverse-striate or granular;) is the only Canadian genus in the Coloninae.

The Leptininae (mammal nest beetles and beaver beetles) scavenge in the nests of small mammals or live on beavers. Generally, they are flattened with eyes reduced or absent. *Platysyllus castoris* Retsma is holarctic; it is flea-like, highly modified for an eoparasitic life. *Leptinillus validus* (Horn) ranges across the boreal forests of North America. Both species have been found on beavers in BC; they eat particles of fur and skin.

#### Family SCYDMAENIDAE (Antlike Stone Beetles) [Fig. 17]

The Antlike Stone Beetles are 0.5 to 7 mm long (usually 1 to 3 mm) and normally elongated and antlike, with a constriction between the prothorax and elytra and the head often strongly narrowed posteriorly to form a neck. Brown, black, or often reddish, they are usually glossy and densely hairy. The antennae are 11-segmented, usually long and hairy with a distinct or weak, 3- to 5- segmented club. The pronotum is oval or spherical, often with depressions or a transverse furrow along the hind margin. The elytra usually cover the abdomen and range from oval and convex to rectangular and flat. Hindwings are well-developed or absent. The femora are club-shaped; the tarsal formula is 5-5-5. The abdomen has six visible sternites.

Scydmaenids are nocturnal, living in concealed, moist, forest habitats such as leaf litter, logs, decaying wood, tree holes and moss mats. Others are known from deserts. Some species prey on oribatid mites; others occur in ant or termite nests.

About 80 genera and 4500 described species of Scydmaenidae occur around the world; 217 species in 18 genera are recognized in North America. In BC 12 species in 6 genera are recorded. The two most diverse genera are *Lophoderus* and *Stenichnus*, each with four BC species, all of which are unknown in the rest of Canada. *S. pacificus* Casey was collected on sand dunes on the Brooks Peninsula, Vancouver Island. Over 2500 species of the huge genus *Euconnus* are described worldwide, but only one, *E. longiceps* Fall is known in BC.

#### Family SILPHIDAE (Carrion Beetles) [Fig. 18]

Carrion beetles are relatively large and distinctive beetles, 7 to 45 mm long (usually 12 to 20 mm), ovate to rather elongate and slightly to strongly flattened. They

are usually hairless dorsally and coloured black, often with red, orange or yellow markings. The head is usually narrowed into a neck behind. Antennae are 11-segmented and the last 3 segments are abruptly clubbed or the last 5 are gradually clubbed. The pronotum has complete lateral edges and the scutellum is large. The elytra can be truncate and short, leaving the last 1-4 abdominal segments exposed; in other species the abdomen can be completely covered. The surface of the elytra is smooth, reticulate or strongly ridged (not striate). Tarsal segmentation is 5-5-5.

Silphids are mainly scavengers and carrion feeders, but some species eat plants and others feed on caterpillars and snails. Adults and larvae of most species eat the carcasses of vertebrates. *Nicrophorus* species (subfamily Nicrophorinae) are called burying beetles because they dig under the dead body of a mouse, vole or other small vertebrate, sinking the body into the ground, where it lies, stripped of hair and molded into a sphere, in a chamber produced by the pair of beetles. The carcass will then not dry out and the beetles will not have to compete with flies for its use as food. The female lays eggs near the carcass and feeds the young larvae with regurgitated fluids; they then feed on the carcass. Adults also often feed on the fly maggots feeding in larger, exposed carcasses. Beetles in the subfamily Silphinae develop differently. *Silpha* species feed on larger carcasses than *Nicrophorus* and feed later than fly maggots, avoiding competition with both.

About 175 species (15 genera) of carrion beetles live worldwide, most in the Northern Hemisphere; a few species extend their ranges into South America, Southeast Asia and Australia. North America has 30 species in 8 genera; 13 (5 genera) live in BC. None of the latter is introduced. Three species of *Thanatophilus* live in the province – the most widespread, *T. lapponicus* (Herbst), is holarctic and cold-adapted, often being found high in the mountains. *Necrodes surinamensis* (Fabricius) occurs across North America. It deters predators with a spray of noxious, acidic fluid from the anus. *Heterosilpha ramosa* (Say) is a western species common in grassland-forest transition habitats. *Aclypea bituberosa* (LeConte) is typical of prairies, grassland and some montane meadows in western North America. Unlike any of our other carrion beetles, it eats plants, especially in the family Chenopodiaceae and is reported as a pest of spinach, beets and other crops.

*Nicrophorus* is the most familiar genus of BC carrion beetles – the adults of our seven species are readily recognized by their truncate elytra, which are usually marked with red or orange. Antennal segment 2 is tiny, and the antennae appear 10-segmented. *N. defodiens* Mannerheim ranges all across North America; in coastal BC the beetles are much darker than in the rest of their range. The adults do not bury carcasses but cover them with leaves or other debris. *N. guttula* Motschulsky and *N. hybridus* Hatch & Angell are western; they inhabit dry forests and grasslands in southern BC. *N. investigator* Zetterstedt and *N. vespilloides* Herbst are holarctic and range across Canada; in BC the former is widespread, the latter is known only from the southern interior. *N. nigrata* Mannerheim is a small, entirely black species, living only west of the Rocky Mountains; it is rare in southern BC. In the province, *N. marginatus* Fabricius is only known from the southern Rocky Mountain trench; its range extends eastward to southern Ontario and Quebec and south throughout most of the United States.

The Canadian and Alaskan species of Siphidae are treated in Anderson, R.S. and S.B. Peck. 1985. The insects and arachnids of Canada, Part 13. The carrion beetles of Canada and Alaska. Coleoptera: Silphidae and Agyrtidae. Publication 1778. Research Branch, Agriculture Canada, Ottawa. 121 pp.

#### Family STAPHYLINIDAE (Rove Beetles) [Fig. 19]

Rove beetles show great variation in form, but are typically elongate, slender and parallel-sided and convex to flattened in cross-section. Sometimes they are ovate or wedge-shaped in outline. They are 0.5 to 50 mm long (usually 1 to 20 mm), brown to black (sometimes brightly coloured or shiny) and glabrous to hairy. The antennae are usually 10- or 11-segmented, threadlike, sometimes clubbed, and the first segment is usually elongate. The elytra are usually short and truncate, exposing 5 to 6 abdominal segments; hindwings are normally functional. The tarsal formula is 5-5-5, but is 3-3-3 in the Pselaphinae and variable in other groups. The abdomen in most taxa is flexible dorsoventrally, often held upward, showing 6 or 7 abdominal sternites.

Rove beetles live in many different habitats, but are most abundant in leaf litter, decomposing matter and moist soil. Many live in fungi, carrion, dung, vertebrate nests, ant and termite nests, under bark, on vegetation and flowers, and in tidal debris; some are active on beaches. Most run quickly and fly well. The vast majority are predators of other invertebrates, but some apparently eat fungal spores (Scaphidiinae, Aleocharinae), fungal hyphae (Oxyporinae, Scaphidinae) or algae (Oxytelinae). The larvae are variable in form, but mainly long and slender; they live in habitats similar to those of adults.

The Staphylinidae, as here defined, includes the Micropeplidae (micropeplid beetles), Scaphidiidae (shining fungus beetles) and the Pselaphidae (short-winged mold beetles). It is a huge, diverse and successful group, vying with the weevils as the largest family of beetles – it contains over 46,200 described species in more than 3200 genera around the globe, and about 400 species are named each year. Its fossil history goes back more than 200 million years. The Staphylinidae is the largest family in North America with 4100 named species; in BC, 581 species are recorded, and many more likely occur.

Species in the Subfamily Omaliinae normally have a pair of ocelli; *Omaliium* species typically have rather long elytra, reaching at least the middle of the abdomen. *Pelecomalium testaceum* (Mannerheim) swarms in the yellow spathes of Skunk Cabbage in the spring, and pollinates the plant. Members of the Subfamily Oxytelinae have seven abdominal segments rather than the normal six. *Bledius*, the largest genus in our area (21 species) burrow in moist mud or sand along beaches and eat algae. The Tachyporinae are unusually wedge-shaped; among other genera, 22 species of *Tachinus*, and 16 species of *Tachyporus* are recorded for the province. *Tachinus semirufus* Horn and *T. nigricornis* Mannerheim are common in dung; *Tachyporus nitidulus* (Fabricius) is holarctic; it has been collected in the burrows of Meadow Voles (*Microtus pennsylvanicus*) in the interior.

Everywhere the diverse Aleocharinae are the least known of the Staphylinidae; species of *Aleochara* (18 species in the province) are ectoparasites of the pupae of

cyclorrhaphous Diptera. In the Steninae, species of *Stenus* have large bulging eyes; the 58 BC species mostly live near water and are specialized predators of springtails. If a *Stenus* accidentally falls into the water and is threatened by a predator, it secretes a chemical from a gland at the tip of the abdomen that reduces the water's surface tension, making the beetle shoot away on the water surface. Some of the larger beetles in the Subfamily Staphylininae are among the most obvious rove beetles. The genus *Philonthus* has 48 species in the province; *P. grandicollis* Horn is common around saline lakes and *P. puberulus* Horn lives in gravel bars by streams. *Quedius* has 47 BC species, many of which inhabit subalpine forests. *Cafius cansecens* Maklin and the big, yellow and brown, wingless *Thinopinus pictus* LeConte hunt amphipods at night in the intertidal zone of sandy ocean beaches.

Until recently, the following three subfamilies were classified in separate families. The Micropeplinae has eight species in BC -- *Kalissus nitidus* LeConte, which lives on muddy and pebbly lake margins on the coast, and seven species of *Micropeplus*. *M. laticollis* Mäklin also lives on the coast and has been collected in Bushy-tailed Woodrat nests. Species of Pselaphinae are distinctive – most are compact, rather ant-like in form, orange or red-brown, with clubbed antennae. They live in moist places, especially in leaf litter and rotting wood, and are predators of springtails, nematodes and mites.

BC has 23 species in 16 genera, including *Reichenbachia* (4 species), *Actium* (3 species) and *Sonoma* (2 species). The Scaphidiinae contains only four species in two genera in BC. These beetles are broadly oval, compact, convex and shiny brown to black. The elytra are shorter than the abdomen and the tips are squared off; the antennae are usually clubbed and the legs are long and slender. Shining fungus beetles feed on fungi and slime molds. *Baocera* contains two BC species; *Scaphium* and *Scaphisoma*, one each.

#### Reference

Klimaszewski, J. 2000. Diversity of the rove beetles in Canada and Alaska (Coleoptera Staphylinidae). *Mémoires de la Société royale belge d'Entomologie* 39: 126 pp.

#### Series SCARABAEIFORMIA

#### Superfamily SCARABAEOIDEA

#### Family LUCANIDAE (Stag Beetles) [Fig. 20]

Body elongate and evenly convex dorsally, 8-60 mm in length, black or reddish-brown and subglabrous. Head prognathous, not deflexed, and not constricted behind eyes; antennae elbowed or straight, 10-segmented, with segments 3-8 forming a club, but these segments not capable of being tightly closed together; mandibles projecting beyond apex of labrum, in males often enlarged. Pronotum weakly convex, with base narrower than elytra; scutellum exposed. Elytra present and usually covering whole of abdomen. Fore legs with coxae large and projecting; fore tibia flattened, and with 1 or 2 apical spurs;

middle legs with coxae projecting; middle tibia not flattened or dilated, with spur not pectinate; tarsal formula 5-5-5.

Stage beetles are usually associated with decaying wood and logs in coniferous and deciduous forest habitats. The C-shaped larvae are yellowish or creamy white, with a heavily sclerotized head capsule, and are wood borers.

There are about 800 species worldwide, with the richest fauna in Asia. Eight genera and 24 species are reported in North America. There are seven genera and 14 species in Canada, with four of these genera and seven species known from British Columbia.

The genera *Ceruchus* and *Sinodendron* have straight rather than elbowed antennae. Whereas males of *Ceruchus* have large and conspicuous mandibles and the head of both sexes lacks a median horn or tubercle, in *Sinodendron* the mandibles are small and inconspicuous in both sexes, but the male has a long, median horn on the head, and in the female a small median tubercle. *Sinodendron rugosum* Mannerheim occurs in British Columbia, along with two species of *Ceruchus*.

Both the genera *Platycerus* and *Platyceropsis*, have elbowed antennae. *Platyceropsis*, with one species *P. keeni* (Casey) in British Columbia, has the posterior tibia stout and expanded at the apex, and the apical spur is spatulate. The three species of *Platycerus* known from the province typically have the hind tibia narrow and not expanded at the apex, and the apical spur is slender and not spatulate.

The species of *Lucanus*, with their very enlarged mandibles in the male, which show allometric growth, are confined to the east in Canada.

#### Family GLARESIDAE (Enigmatic Scarab Beetles) [Fig. 21]

Body oblong-oval, convex, dark brown, 3.4-4.5 mm long in British Columbia species, and with short setae. Head deflexed; antennae 10-segmented, with a 3-segmented terminal club, the first segment of which is hollowed out to receive the other segments of the club. Pronotum short, broad and convex and without projections; scutellum exposed. Elytra convex with 10 distinct costae. Legs fossorial, the fore tibia with outer margin toothed and apex with a single spur; middle and hind tibia with 2 apical spurs; hind legs with femora and tibia enlarged, covering abdomen when retracted; tarsal formula 5-5-5.

Adults are found in dry, sandy areas, and are attracted to light. Larvae and their biology are unknown.

There are about 50 species worldwide described to date, with some 15 of these reported from North America. Two species of *Glaresis* occur in Canada, only *G. medialis* Gordon being reported in British Columbia.

#### Family TROGIDAE (Hide Beetles) [Fig. 22]

Body oblong-oval in shape, convex, 6.2-6.5 mm long in British Columbia species, setose, brown to gray or black, with a warty, dirt-encrusted, or greasy dorsal surface. Antennae are 10-segmented, with a 3-segmented terminal club with segments opposable. Pronotum short, broad and convex, sculptured with depressions, ridges or tubercles; scutellum exposed, and oval in shape. Elytra convex, covering abdomen and with striae, impressions or tubercles. Fore legs with femora enlarged, the fore tibia slender with the outer margin weakly toothed, and with 1 apical spur; middle and hind femora not enlarged; middle and hind tibia with 2 apical spurs; tarsal formula 5-5-5.

Adults may be attracted to light. Adults and larvae are scavengers, feeding on the dry remains of dead animals, namely feather, fur and skin, and the organic matter found in the nests of mammals and birds. Larvae are C-shaped 'white grubs', with the head capsule dark and heavily sclerotized. There are about 51 species worldwide, with two genera and 43 species known from North America. Fifteen species in the genus *Trox* occur in Canada, three of which are recorded from British Columbia.

#### Family GEOTRUPIDAE (Earth-boring Scarab Beetles) [Fig. 23]

Body round to oval in shape, reddish-brown to black, 10.3-13.5 mm long in British Columbia species. Head not deflexed; antennae 11-segmented, with terminal 3 segments opposable and forming a club; clypeus often with horn or tubercle. Pronotum convex, with base the widest, and with surface often with horns, ridges, sulci or tubercles; scutellum exposed and triangular. Elytra convex, with or without striae. Fore legs with tibia serrate on outer margin, the apex with 1 spur; middle and hind tibia with ridges, the apices with 2 spurs; tarsal formula 5-5-5.

Adults of most species provision earthen burrows with dead leaves, cow dung, horse dung or humus for their C-shaped, 'white grub' larvae. The larvae are not tended by the adults, although there is an overlap of generations in some species. Adults are attracted to light, and both adults and larvae stridulate.

Worldwide there are about 600 species. Twelve genera and 28 species are recorded from North America, with four genera and 12 species known from Canada. The only species recorded from British Columbia is *Bolboceras obesus* (LeConte).

#### Family OCHODAEIDAE (Sand-loving Scarab Beetles) [Fig. 24]

Body elongate and convex, reddish-brown to black, 4.0-7.0 mm long in British Columbia species, and setose. Head not deflexed; antennae 10-segmented, with apical 3 segments opposable and forming a club; mandibles projecting beyond apex of labrum and prominent. Pronotum convex and subquadrate, punctate and setose, but without horns, ridges, sulci or tubercles; scutellum exposed and triangular. Elytra convex and usually covering abdomen. Fore tibia dentate on outer margin, and with 1 apical spur; middle and hind tibia not greatly flattened or dilated, but with 2 apical spurs, the longer spur on the middle tibia pectinate along one edge; tarsal formula 5-5-5; abdominal venter with stridulatory peg.

Adults are frequently attracted to light, but little is known about the biology. Larvae are C-shaped 'white grubs'.

Worldwide there are about 80 described species. Four genera and 35 species occur in North America, with one genus and four species reported from Canada. Only one species, *Ochodaeus luscinus* Howden is recorded from British Columbia.

#### Family GLAPHYRIDAE (Bumble Bee Scarab Beetles) [Fig. 25]

Body shape elongate, 6-20 mm long, blackish and densely covered with moderately long setose variously coloured white, yellow, orange, red, brown or black. Head deflexed; antennae 10-segmented, with terminal 3 segments opposable and forming a club. Pronotum convex, subquadrate, densely setose and without horns, ridges, sulci or tubercles; scutellum exposed and U-shaped. Elytra elongate, setose, not covering end of abdomen, with tips widely divergent. Fore tibia dentate and with apical spur; middle and hind tibia with 2 apical spurs, but the longest spur on the middle tibia not pectinate; tarsal formula 5-5-5.

Adults are active fliers during the day, and can be found hovering near flowers or foliage or flying in sandy areas. The C-shaped 'white grub' larvae live in sandy riparian or coastal dune areas, where they feed on decaying litter and detritus that is layered in the sand.

Worldwide there are eight genera and about 80 species, with one genus and eight species known from North America. Only one species, *Lichnanthe rathvoni* (LeConte) occurs in Canada, being confined to British Columbia.

#### Family SCARABAEIDAE (Scarab Beetles) [Fig. 26]

Body oblong to oval in shape, colour variable, 2-60 mm in length, sometimes with metallic coloration or reflection. Head weakly deflexed at most; antennae 10-segmented, the terminal 3 segments opposable and forming a club, but with first segment of club not hollowed out to receive the rest; clypeus sometimes with horn or tubercle not project beyond apex of labrum. Pronotum variable in shape, with or without horns or tubercles; scutellum exposed or not. Elytra convex or flattened, with or without striae; elytra if shortened, then not widely divergent at apex. Fore tibia tridentate, bidentate or serrate on outer margins, the apex with 1 or 2 spurs; middle and hind tibia with 1 or 2 spurs, the larger spur at the apex of the middle tibia not pectinate; tarsal formula 5-5-5.

Adults are exceptionally variable in both appearance and habits. Larvae are typical C-shaped, white grubs. Species feed on dung, carrion, vegetation, pollen, fruit, fungi, compost or roots. Adults and larvae of a few species of scarabs are of economic importance and may cause considerable damage to foliage and roots. One of the best known of such pests is the Japanese Beetle (*Popillia japonica* Newman), a destructive pest introduced from Asia into eastern North America in 1913. Fortunately, so far, it is not yet present in western Canada. However, the European chafer *Rhizotrogus majalis* (Razoumouky) has recently been accidentally introduced into British Columbia, and is

attacking lawns in the lower mainland. Other species of scarab are important in the decomposition of cattle dung, and have been intentionally introduced into Australia where there are no native beetles adapted to feed on the dung of domestic cattle.

Worldwide there are over 27,800 described species. About 125 genera and some 1700 species are reported in North America. In Canada, so far 36 genera and 211 species are recorded, with 19 of these genera and 75 species known from British Columbia.

The scarabs, which form one of the largest beetle families, is represented in North America by six subfamilies. The Aphodiinae and Scarabaeinae are the scarabs commonly called dung beetles. In the Aphodiinae, the end of the abdomen is completely covered by the elytra, whereas it is exposed in the Scarabaeinae, which have the scutellum hidden and the antennal insertion hidden from above. The Aphodiinae in British Columbia is represented by six genera and 51 species, most in the genus *Aphodius*. There are just four species of Scarabaeinae in British Columbia, *Canthon praticola* LeConte, *C. simplex* LeConte, *Onthophagus hecate* (Panzer) and *O. nuchicornis* (L.), the latter an alien introduced species.

In the subfamily Cetoniinae, the end of the abdomen is exposed beyond the elytra, and the antennal insertion is visible from above. Four species in this subfamily occur in British Columbia, namely *Euphoria rufobrunnea* Casey, *Cremastocheilus armatus* Walker, *C. crinitus* LeConte and *Trichiotinus assimilis* (Kirby).

Subfamilies with the end of the abdomen exposed and the scutellum visible include the Dynastinae, Rutelinae and Melolonthinae. In the Rutelinae the claws on the middle and hind legs are unequal in length and independently moveable. In both the Dynastinae and Melolonthinae, the claws on the middle and hind legs are of equal length, but not independently moveable. The claws are simple in the Dynastinae and often cleft or toothed in the Melolonthinae. *Cyclocephala longula* LeConte is the only representative of the Dynastinae known from the province, and there are no species of Rutelinae present. In the Melolonthinae there are seven genera and 16 species, including the well-known 10-lined June Beetle (*Polyphylla decemlineata* (Say)).

## Series ELATERIFORMIA

### Superfamily SCIRTOIDEA

#### Family EUCINETIDAE (Plate-thigh Beetles) [Fig. 27]

Eucinetids are small beetles (1 to 4 mm long), streamlined and compact, ovate to oblong and narrowed posteriorly, slightly flattened to convex, and with fine decumbent pubescence and yellow-brown to black coloration. The head is concealed from above and rests against the front coxae. The antennae are 11-segmented, normally thread-like or slightly saw-toothed, gradually widened apically. Occasionally the mouthparts form a piercing and sucking beak. The pronotum is broader than the head, short and narrowed in front; the elytra frequently are marked with fine cross-striations. The hind coxae are large, forming plates that cover the femora and the first abdominal segment -- this

unusual feature gives the family its name. The ends of the tibiae are enlarged; the middle and hind ones have two large spurs and a ring of spines. The tarsal formula is 5-5-5.

Adults and larvae live where there is decaying fungi and slime molds, such as leaf litter and under the bark of trees and logs. Adults can jump using their modified hind legs.

The Eucinetidae is a small family of 9 genera and 37 described species. Eleven species (four genera) occur in North America; five of these live in BC. All are placed in the genus *Eucinetes*, which is worldwide in distribution. *Eucinetes terminalis* LeConte and *E. infumatus* LeConte are restricted to British Columbia in Canada. The later species is coastal; it has been collected from under the bark of dead Sitka Spruce on the Queen Charlotte Islands. The most widespread species in Canada, *E. haemorrhoidalis* (Germar), is introduced from Europe.

#### Family CLAMBIDAE (Minute Beetles) [Fig. 28]

Minute beetles are tiny, globular and glossy, 0.7 to 2 mm long; many can roll into a ball when disturbed. They are coloured from yellow through brown to black and often clothed in rather long, dense and decumbent setae. The head is broad, concave beneath, fitting against the coxae and not usually visible from above. The mouthparts are also concealed from above by a sharp ridge that holds the antennal insertions and partially or completely divides the eyes. The 8- to 10- segmented antennae bear an abrupt, 2-segmented club. The pronotum is short, broader than the head and overlaps the bases of the elytra behind; the elytra are smooth or roughened, but not striate. The hind coxae are expanded plates that conceal the hind femora and at least part of the first abdominal sternite; the tarsal formula is 4-4-4. In BC species the hind wings have a marginal fringe of hairs in BC species; some genera are secondarily wingless.

Minute beetles are poorly known; many collections are made at lights during the beetles' evening flights. Most species apparently live in leaf litter, compost and other decaying vegetation where they feed on fungal spores.

Five genera and 70 species are known worldwide. In North America there are three genera and 12 species recorded; British Columbia reports three species in these two genera. *Calyptomerus oblongulus* Mannerheim is a Cordilleran beetle that inhabits subalpine forests in the province's interior. *Clambus pubescens* Redtenbacher has a holarctic distribution and *C. gibbulus* (LeConte) is probably introduced from Europe.

#### Family SCIRTIDAE (Marsh Beetles) [Fig. 29]

Marsh beetles are round to oblong, 1.5 to 12 mm long (usually 2 to 8 mm) and somewhat flattened, yellow to black, sometimes with orange or red markings. The narrow head has a sharp ridge under each eye, which fits against the front coxae when the head is deflexed. The antennae are usually thread-like and 11-segmented; the first segment is large. The pronotum is short and transverse, normally concealing the head; the elytra are

often ridged. The tibiae have distinct outer keels and the tarsi are segmented 5-5-5, with segment 4 lobed beneath. Some species have enlarged hind femora.

Adults live near water, usually on vegetation; in damp, humus rich soil; under stones and in waterside debris. Some are active jumpers. The larvae are mostly aquatic, inhabiting streams, ponds, springs, tree holes, damp wood and litter. They have filtering mouthparts and are generally considered filter-feeding detritivores. Their antennae are unusually long and slender.

The Scirtidae (= Cyphonidae, = Helodidae) consists of 30 genera and 600 species around the world; most are temperate in distribution. The main holarctic genera are *Elodes* and *Cyphon*. Eight genera and 50 species are recorded in America north of Mexico; three of these genera with 10 species are known in BC. Three species of *Elodes* occur -- *E. angusta* Hatch and *E. emarginata* Hatch are coastal, *E. apicalis* Leconte lives in the interior. *Cyphon* (6 species) adults are usually on vegetation; *C. concinnus* (LeConte) and *C. variabilis* (Thunberg) are the most common and widespread BC species.

### Superfamily BUPRESTOIDAE

#### Family BUPRESTIDAE (Metallic Wood-boring Beetles) [Fig. 30]

Body elongate-oval in shape, weakly dorso-ventrally flattened, 3-100 mm long, with colour often brightly iridescent or dark-coloured and often patterned; surface glabrous or with setae or scales. Head greatly deflexed, retracted into thorax and resting on prosternum; without either ocelli or subgenal ridges; surface punctate or rugose; antennae 11-segmented, serrate, pectinate or flabellate, not lying in excavation between fore and middle coxae. Pronotum slightly broader than head, laterally carinate, and without postero-lateral angles not acute; prosternum with distinct process; scutellum triangular to cordiform, small to moderate in size. Elytra usually entire with apex rounded, the striae punctate or carinate. Tarsal formula 5-5-5, the fourth with an undivided lobe beneath.

Adults are good fliers, but can be found resting or ovipositing on bark or foliage of trees and shrubs or feeding on pollen-rich flowers. Larvae are fairly host specific and burrow through roots and logs from within the bark to the cambium layer. Some are however, leaf and stem miners of herbaceous or woody plants, including grasses. Some also form galls or live within conifer cones.

The wood borers, commonly called flat-headed wood borers, mostly attack dying trees or dead or dying branches of healthy trees. They rarely bore into green wood.

Worldwide there are some 14,600 described species, with 762 of these reported in North America. Twenty genera and 152 species are recorded from Canada (monographed by Bright 1987), with 12 genera and 75 species known from British Columbia. Currently the North America fauna is placed in three subfamilies, The Agrilinae, Buprestinae and Polycestinae. In the latter there is a sternal cavity for the reception of the prosternal

process, this groove formed entirely by the mesosternum: in the other two subfamilies, the groove is only partly formed by the mesosternum. In the Buprestinae, the hind coxal plates are distinctly dilated medially, whereas in the Agrilinae this is not the case. Most buprestids in British Columbia belong to the genus *Chrysobothris*, a member of the Buprestinae. This genus typically has the frons contracted by the antennal insertion, the prosternum acutely angled behind the coxae, the eyes close together, elytra with distinct fovea and carinate, the tooth on the fore femur being right or acute angled and the third segment of the tarsi is truncate at the apex.

Many species take a long time to complete development. The relatively common golden buprestid (*Buprestis aurulenta* L.) at times taking at least 70 years. Another emerald green species is the western cedar borer (*Trachykele blondei* Marseul) and has larvae that bore into the wood of *Thuja plicata*.

*Agrilus hyperici* (Creutzer), a native to the drier regions of southern, central and eastern Europe, has been introduced into British Columbia a number of times to control St. John's wort (*Hypericum perforatum* L.), but most attempts were not successful as the buprestid did not become established. However, insects imported from Idaho in the late 1980s have survived, but populations are low. In contrast, the eastern European *Sphenoptera jugoslavica* Obenberger, introduced in to British Columbia in 1982-1995 to control diffuse knapweed, did establish and in some places attacks over 40% of populations of this alien weed.

#### Reference

Bright, D.E. 1987. The Metallic Wood-boring Beetles of Canada and Alaska. Coleoptera: Buprestidae. The Insects and Arachnids of Canada. Part 15. Research Branch, Agriculture Canada Publication 1810: 335 pp.

#### Superfamily BYRRHOIDEA

##### Family BYRRHIDAE (Pill or Moss Beetles) [Fig. 31]

Body oval or elongate-oval in shape, and strongly convex dorsally; 1-40 mm long, variable coloured, with or without setae. Head hypognathous, lacking both ocelli and subgenal ridges; frons deflexed and forming ridge between eyes, antennae 11-segmented, filiform to distinctly clubbed, but not provided without excavation between fore and middle coxae. Pronotum convex, laterally finely or strongly carinate and with posterolateral angles not acute; scutellum small to minute. Elytra entire, strongly convex with surface finely to coarsely punctate. Femora fitted into grooves on coxae; middle tarsus with small, bisetose empodium; tarsal formula 4-4-4 or 5-5-5.

Larvae are either fusiform and dorso-ventrally curved or cylindrical. Both adults and larvae are obligate moss feeders, and exhibit microhabitat specificity.

Worldwide there are some 290 species, with 35 of these reported in North America. In Canada there are 13 genera and 26 species, with most of these occurring in

the Montane coniferous forests. So far, 12 genera and 15 species are recorded from British Columbia, with most of these in the genus *Byrrhus* characterized by clavate antennae and simple setae on the body. Some species of *Byrrhus* have been reported to feed incidentally on coniferous seedlings.

#### Family ELMIDAE (Riffle Beetles) [Fig. 32]

Body ovate or elongate, rather parallel-sided and somewhat flattened; length usually less than 5 mm; colour black, often with red or yellow markings, the legs pale. Head deflexed, often sunk into prothorax; antennae 7 to 11-segmented, filiform to clavate. Pronotum broader than head, with posterior margin not crenulate, the postero-lateral angles not acute and lacking a short distinct carina; scutellum small, subovate, triangular or pentagonal, and exposed. Elytra covering abdomen, with free ends rounded and surface sculptured. Legs not retractable and not adapted for swimming; tarsal formula 5-5-5.

Adults are either riparian species as in the subfamily Larinae, or totally aquatic as in the Elminae, living in fast flowing riffles and with a hydrofuge plastron for respiration. Larvae are elongate, cylindrical and more or less evenly sclerotized. Both larvae and adults feed on decaying vegetation, being detritivorous or algae feeders.

Worldwide there are over 1110 species with 26 genera and 99 species known from the United States. So far 14 genera and 32 species are recorded from Canada. To date, eight genera and 14 species are reported from British Columbia, one species *Lara avara* LeConte in the subfamily Larinae, and the rest in the subfamily Elminae.

#### Family DRYOPIDAE (Long-toed Water Beetles) [Fig. 33]

Body oval elongate, nearly parallel-sided and convex; length 1-8 mm; colour dull silvery gray, brown or black. Head distinctly hypognathous, deflexed and sunk into prothorax; antennae 8-1 segmented, short, clavate, with segments broader than long. Pronotum broader than head, laterally convex, with postero-lateral angles not acute; scutellum small and exposed. Elytra covering abdomen, the surface smooth or punctate. Tarsal formula 5-5-5; tarsal claws long and simple.

Elsewhere in the world, these beetles are often forest litter inhabitants. However, in North America, most adults are aquatic or riparian habitat species and phytophagous. Larvae are terrestrial as far as known.

Worldwide there are at least 12 genera and 200 species. Five genera and 13 species are known from North America with two genera and six species reported in Canada. Only two species of *Helichus*, *H. columbianus* W.J. Brown and *H. striatus* LeConte are known from British Columbia. Like other adult *Helichus* species, these inhabit riffles in watercourses and use a hydrofuge plastron for respiration.

#### Family LIMNICHIDAE (Minute Marsh-loving Beetles) [Fig. 34]

Body oval to elongate and convex; only 1-2 mm long, brown to black in colour, sometimes appearing metallic; with distinct pubescence of dense, fine, golden or grayish setae, these sometimes flattened. Head small and usually retracted into pronotum to anterior margin of eyes; antennae 11-segmented, short and clavate, capable of being recessed into pronotal cavities beneath head. Pronotum subquadrate, laterally angled, with postero-lateral angles not acute; scutellum small and triangular. Elytra covering abdomen, with surface finely punctate. Legs retractable, rotated in repose with tibia held anterior to femur. Tarsal formula 5-5-5.

Both adults and larvae are evidently herbivorous. Adults occur in riparian areas, on streamside plants and emergent vegetation, but are readily attracted to light. Larvae live in damp soil or humus near streams or other water bodies.

Worldwide there are some 40 genera and 225 species. Six genera and 28 species are known from the United States, with two genera and four species known from Canada. Only one species *Limmichites punctatus* (LeConte) is recorded from British Columbia.

#### Family HETEROCERIDAE (Variegated Mud-loving Beetles) [Fig. 35]

Body elongate, parallel-sided and moderately flattened, 4-6 mm long, pale brown to black in colour, with elytra distinctly variegated; dorsal surface distinctly setose. Head distinctly prognathous, at most only partially deflexed; antennae 9 to 11-segmented, not lamellate, but short and not reaching middle of pronotum; last 6-7 segments forming a compact, serrate club. Pronotum widest posteriorly, the sides somewhat convex and with postero-lateral angles not acute; scutellum well developed and triangular. Elytra covering abdomen, posteriorly rounded. Legs fossorial; tarsal formula 4-4-4. First visible abdominal sternum with arching stridulatory file. Adults are associated with riparian habitats, although they fly readily, are nocturnal and are attracted to light. Adults and larvae live in tunnels in damp sand or mud substrates, feeding on zooplankton, desmids and algae.

Worldwide there are some 30 genera and 300 species. Ten genera and 34 species are reported from North America. So far eight genera and 25 species are recorded from Canada, with five of these genera and nine species occurring in British Columbia. *Lanternarius brunneus* (Melsheimer) is one such species, with 3 broken zigzag bands on each elytron.

#### Family PTILODACTYLIDAE (Ptilodactylid Beetles) [Fig. 36]

Body elongate-oval in shape, moderate in size 2-16 mm long, and covered with fine, short setae. Head strongly deflexed, without ocelli and not produced into a rostrum or beak; antennae 11-segmented, serrate or pectinate. Pronotum narrowed anteriorly, with posterior margin crenulate, and the postero-lateral angles not acute; scutellum triangular, often with median notch at base. Tarsal formula 5-5-5. Elytra elongate and covering abdomen dorsally.

Adults are frequently attracted to light, but can be beaten from vegetation. Adults of *Ptilodactyla* have maxillae modified into spore brushes to feed on moulds, but feeding habits of other genera are unknown.

Larvae live and feed on damp decaying vegetation, rotting wood or in aquatic habitats. *Areopideus* larvae live at the margin of streams.

Worldwide there are about 500 described species, with six genera recorded in North America. To date three genera and four species are recorded in Canada. Only two species occur in British Columbia, *Ptilodactyla semicolis* (Say) and *Areopideus monachus* (LeConte), the latter formerly placed in the family Dascillidae.

## Superfamily ELATEROIDEA

### Family ARTEMATOPODIDAE (Artematopodid Beetles) [Fig. 37]

Artematopodids are ovate to elongate, convex and setose brown or black beetles, 3 to 10 mm long. The head is deflexed and inserted strongly in the prothorax. The antennae are 11-segmented and often serrate. The prothorax lacks an interlocking device; the pronotum is broader than the head, with the posterior angles hardly produced. The elytra are apically rounded, striate and punctate with a characteristic tongue-like process near the ventral apex. The femora and tibiae are slender and the latter bear prominent apical spurs; the tarsal formula is 5-5-5 and segments 2-4 or 3-4 are lobed beneath.

The larvae of some artematopodids live in mosses. Adults are usually found on foliage.

The Artematopodidae (=Artematopidae, including Eurypogonidae) are sometimes included by some authors in a broadly defined Dascillidae. There are about 60 species in 7 genera in the family, which is primarily found in the Northern Hemisphere, but extends into South America. Three genera and 8 species live in North America; there are 3 British Columbia species. *Eurypogon californicus* Horn and *Macropogon testaceipennis* Motschulsky range from British Columbia south to California; *M. piceus* LeConte is boreal.

### Family EUCNEMIDAE (False Click Beetles) [Fig. 38]

False click beetles are similar to elaterids. The body is slender, elongate and convex, with the sides nearly parallel; the body is often broadest at the pronotum tapering to the rear. Brown or black, the beetles are covered in short, sparse setae; they range in length from 2 to 30 mm (usually 3 to 10 mm). The head is strongly deflexed and retracted into the prothorax; the labrum is membranous and concealed under the clypeus. Unlike in the Elateridae, the antennae are not inserted close to the eyes; the 11-segmented antennae are sawtoothed, beaded, threadlike, comblike or fanlike. The hind angles of the pronotum are acute; the front edge of the prosternum is straight, not lobed as in click beetles. The elytra are striate. The tarsal formula is 5-5-5.

False Click beetles are poorly known. Adults live under bark, in decaying wood and on vegetation; sometimes they come to lights. They have a clicking mechanism, but only a few species apparently use it. Most larvae live in rotting wood, especially that of hardwoods, where they probably feed on fungi. They often make characteristic tunnels across the grain of the wood. Others develop in the soil.

About 1300 species of eucnemids are known worldwide; 85 live in North America. Of the 10 genera recorded in British Columbia, 8 are represented by only one species except for *Melasis* (2 species, with their distinctly flattened tibiae) and *Dromaeolus* (3 species), the most diverse North American genus. Rusty brown and over 1 cm long, *Anelastes druryi* Kirby is the largest and most noticeable species in the family in British Columbia.

#### Family THROSCIDAE (Throscid Beetles) [Fig. 39]

Adult throscids look like small, stout click beetles. They are oblong to elongate, coloured red-brown, brown, or black, sometimes with red markings and are finely setose. They range from 1 to 5 mm in length. The head is deflexed and deeply inserted into the prothorax. The 11-segmented antennae fit into prosternal grooves; they are sometimes sawtoothed, seldom thread-like, and end in a 3-segmented club. The hind angles of the prothorax extend backward, smoothly and tightly joining the sides of the normally striate elytra; the body is usually widest at the base of the elytra. The junction of the prothorax and the rest of body is not loose and flexible, but there is a prosternal posterior process that fits into a mesosternal cavity, allowing clicking. Tarsal formula is 5-5-5.

Throscids are mostly forest dwellers, and are usually found on flowers and foliage or in litter and rotting wood. Adults probably eat pollen and fungi. They can click and jump like the Elateridae and Eucnemidae. Larvae are grublike and live in litter, decaying wood and under bark.

The Throscidae contains 152 named species, but there are only 20 in North America and nine in Canada. Six of these live in British Columbia -- four species of *Trixagus* occur, and the other two, *Aulonothroscus validus* (LeConte) and *Pactopus hornii* (LeConte), are known only in British Columbia in Canada.

#### Family ELATERIDAE (Click Beetles) [Fig. 40]

Click beetles are distinctive black or brown beetles, sometimes iridescent or marked with pale or bright patterns. The body is 1.5 to 45 mm long (usually 3 to 20 mm), elongate narrow, often nearly parallel sided or with the elytra tapering at the apex. The antennae arise close to the eyes; they are nearly always sawtoothed, but sometimes are comblike. The prothorax is unusually large, loosely linked to the rest of the thorax and can be moved; the hind angles of the pronotum almost always extend backward. The front edge of the prosternum is normally lobed and the rear edge bears an elongate process that fits into a depression in the mesosternum. The tarsal formula is 5-5-5.

Adults click when lying on their back, flipping upright. The body is arched and the prosternal lobe is snapped into the mesosternal groove, causing the beetle to recoil into the air. Most common in forest and meadow habitats, click beetles occur on flowers, foliage, under bark and in rotten wood. Some are predators of insects, but many eat nectar, pollen, fruit, flowers and fungi. Larvae are elongate, slender, cylindrical to flattened; the head is strongly sclerotized. Those living in leaf litter and rotting wood are mostly predaceous; the many species living in soil (wireworms) feed on plant roots, tubers and sprouting seeds, and some can be pests of crops.

With about 10,000 described species, the Elateridae is the ninth most diverse beetle family. There are almost 1000 named species in North America; 194 species in 26 genera are known in British Columbia. The largest British Columbia genera are *Ctenicera* (54), *Ampedus* (20), *Limonius* (19), *Cardiophorus* (15), *Dalopius* (12), *Agriotes* (12) and *Negastrius* (10).

*Alaus melanops* LeConte, an inhabitant of dry Ponderosa Pine and Douglas-fir woods; at 45 mm, it is our largest species. It has a pair of large black, white-ringed eyespots on the prothorax. British Columbia's species of *Lacon*, *L. rorulentus* (LeConte) and *L. sparsus* (Candèze) are restricted to the province in Canada. They bear distinctive, flattened, scale-like setae. The larvae are predators. *Negastrius* species are often found near water, especially under rocks near streams. They are especially good at clicking and flipping. Some major agricultural pests occur in the genera *Agriotes*, *Limonius* and *Ctenicera*. The dusky click beetle (*Agriotes obscurus* (L.)) and the lined click beetle (*A. lineatus* (L.)), two introduced European species, are serious pests of several crops (corn, cereals, potatoes) in the lower Fraser Valley and Vancouver Island. Adults of *Limonius canus* LeConte (Pacific Coast Wireworm) eat the buds and blossoms of apples, cherries and other fruit trees. *Ctenicera pruinina* (Horn) and *C. aeripennis* (Kirby) are large black species; *C. suckleyi* (LeConte) is black with striking orange patches on the elytra.

#### Family LYCIDAE (Net-winged Beetles) [Fig. 41]

Net-winged beetles are soft bodied, often flattened, with distinctive leathery elytra parallel-sided or often widening rearward and bearing longitudinal ridges joined by weaker cross-ridges. This net-like pattern gives the family its English name. These beetles are 2 to 22 mm long (usually over 5 mm), and are black, red or yellow, or a combination of these colours. Some species have wingless, larva-like females. The head is usually partly concealed by the pronotum; some species have beaked mouthparts. The antennal bases lie close together; the antennae are usually 11-segmented, and often flattened and serrate or pectinate. The tarsal formula is 5-5-5.

Look for adults on flowers, foliage and bark where they feed on pollen, nectar, honeydew, fungi or even other insects. The larvae are mostly fungal feeders in rotten wood, under bark or in leaf litter, although they have also been reported as predators. They often have lateral processes on the abdominal segments and their unusual mandibles are longitudinally divided. Both adults and larvae are frequently brightly coloured and are evidently distasteful to predators. Some adults are apparently mimicked by species of long-horned beetles and tiger moths.

Lycids alive around the world and are most diverse in the tropics; 3500 species in about 85 genera are described. In North America, 76 species (16 genera) are recorded; 8 of these (4 genera) live in British Columbia. Striking in orange and black, *Calochromus dimidiatus* (Le Conte) and *C. fervens* LeConte are restricted to the western mountains in Canada. *Dictyopectera* is a genus of coniferous forests; species are bright orange-red. *D. aurora* (Herbst) is distributed across the Nearctic boreal forest; *D. hamatus* Mannerheim, *D. simplicipes* Mannerheim and the closely related *Benibotarus thoracicus* (Randall) are boreal across the Old and New worlds. *Plateros* is the largest North American genus; species are black with orange markings on the pronotum.

#### Family LAMPYRIDAE (Fireflies) [Fig. 42]

Fireflies are soft bodied, flattened, elongate to rarely oval beetles, 4 to 30 mm long; the head is concealed from above by the pronotum. The colour ranges from black to pale brown or olive with markings of yellow, pink or red. The antennae are variable – threadlike to saw-toothed, more rarely comblike or fanlike; there are 8 to 13 (usually 11) segments. The pronotum is large, flattened and laterally expanded, often coloured. In males the elytra are normally fully formed, but in females they are often shortened; females of some species are wingless and larva-like. The tarsal formula is 5-5-5. In both sexes of many species (or in some species, females only), light-producing organs occur near the tip of the abdomen.

Nocturnal species use their light organs to attract mates; the wavelength of the light and the pattern of flashes (number, duration and interval between flashes) is important in species recognition and, in some cases, the only reliable character for identification (*Photuris*). When handled or attacked, beetles may exude noxious blood from the body, especially the elytra. Larvae are soil dwelling predators that eat insects, snails, worms and other invertebrates. The larvae are well sclerotized and elongate or oval and flattened. The abdominal terga are expanded laterally and the tip of the abdomen has luminous organs. Larvae usually glow in damp places on wet nights; larval light production is thought to warn predators that the insects are distasteful.

Worldwide, there are about 2000 described species in about 85 genera, although there may be twice this number of species. More than half the species live in the American tropics. British Columbia has 10 species in 5 genera. The best known British Columbia species are active during the day and do not produce light; the largest genus is *Ellychnia*, with 5 species. They are black with red-margined elytra. *Pyropyga nigricans* (Say) is also nonluminescent, and uses pheromones to communicate between the sexes. Luminescent fireflies are restricted to the interior of the province and are mainly reported from the Prince George, Cariboo-Chilcotin, Shuswap and East Kootenay regions; two examples are *Photinus ardens* LeConte and *Photuris pennsylvanica* (DeGeer).

#### Family CANTHARIDAE (Soldier Beetles) [Fig. 43]

Cantharids are elongate, parallel-sided, moderately flattened beetles with rather soft, flexible bodies. They range from 1 to 28 mm long, but most are 2 to 15 mm. Colour ranges from completely black or brown (often with red or yellow on the pronotum) to

mostly red or yellow. The body is usually covered in short, rather dense setae. The head is not concealed by the pronotum; the antennae are 11-segmented, usually threadlike, with the insertions well separated. The legs are long and slender; the tarsal formula is 5-5-5, with the fourth segment bilobed. In many species the elytra are short, exposing the wings and abdomen. The abdominal segments bear a pair of lateral glandular pores that secrete noxious defensive compounds.

Adult soldier beetles are found mostly on foliage and flowers, and most are diurnal. They eat pollen, nectar and other insects. Some are important pollinators and, because they move from flower to flower, many soldier beetles are among the most actively flying beetles. Many species are also frequently exposed to predators on vegetation, and have developed chemical defences and warning coloration. Larvae tend to live in damp habitats such as soil, leaf litter and decaying wood. Mostly fluid-feeding carnivores, they feed on insect larvae and eggs, but some eat plant material. They have a characteristic dense, velvety covering of setae that renders them waterproof – probably an adaptation to wet areas prone to flooding.

Over 5000 named species (about 140 genera) live in all the world's zoogeographic regions. In North America 473 species in 23 genera are known; there are 57 species in British Columbia. Our largest, at almost 2 cm long, is *Cantharis consors* (LeConte), a species with yellow-brown elytra and an orange prothorax. There are 7 other British Columbia species in the genus. The most abundant genus is *Podabrus*, with 22 species in the province; they are especially common near water, where adults eat aphids on foliage. The largest species, such as *P. pruinosus* LeConte, are black with an orange pronotum. Twelve *Malthodes* species occur, mostly in moist, shady habitats. This is the largest North American genus (126 species, mostly in the West); the elytra are short and the hindwings are exposed. *Rhagonycha*, abundant on foliage and flowers, has 5 species in British Columbia; *R. fulva* (Scopoli) is introduced from Europe. *Silis* (8 species) has the sides of the pronotum characteristically notched.

## Series BOSTRICHIFORMIA

### Superfamily DERODONTOIDEA

#### Family DERODONTIDAE (Tooth-necked Fungus Beetles ) [Fig. 44]

Derodontids are elongate, oval, dorsally convex and ventrally flattened beetles ranging from 1.5 to 4 mm in length. The rough-looking surface ranges from brown to black; some species are mottled. The head bears paired ocelli and the 11-segmented antennae have a 3-segmented club. The prothorax in some species (*Derodontus*) has its lateral ridges distinctively toothed. Except in *Peltasticta*, which has raised tubercles, the elytra are striate. The tarsal formula is 5-5-5 and the tibial apex bears two small spurs; in *Laricobius* the tibiae have apical combs.

Larva and adults often occur together at feeding sites. Most species feed on fungi such as mushrooms or on yeasts and bacteria in sap, but some prey on aphids.

Tooth-necked fungus beetles live in temperate areas of the Northern and Southern hemispheres; there are 24 species in 4 genera. In North America there are 9 named species in 3 genera; British Columbia has 5 species in 3 genera. *Laricobius* species feed on adelgid aphids. One of the three species, *L. erichsonii* Rosenhauer, was introduced to northeastern and northwestern North America to control *Adelges piceae* (Ratzeburg) (Balsam Woolly Adelgid), and a second species *L. nigrinus* Fender, native to British Columbia, was recently introduced into eastern North America as a biocontrol of *Adelges tsugae* Annand (hemlock woolly Adelgid). *Peltasticta tuberculata* Mannerheim is restricted to British Columbia in Canada; it feeds in fermenting sap. *Derodontus trisignatus* (Mannerheim) lives in mushrooms.

#### Superfamily BOSTRICOIDEA

##### Family NOSODENDRIDAE (Wounded-tree Beetles) [Fig. 45]

Species of Nosodendridae are black, oval, strongly convex beetles, 2 to 9mm long. The head is not retractable into the prothorax, but the 3-segmented club of the 11-segmented antenna is protected in a cavity between the front legs. The prothorax is widest at the base and is rounded anteriorly. The legs are retractable. The femora and tibiae are broad and flattened; the latter are excavated to conceal the tarsi. The tarsal formula is 5-5-5. The smooth, shining or minutely punctate elytra often bear tufts of stout setae or scale-like setae.

Adults and larvae feed in oozing, fermenting tree wounds and fungus infested wood where they eat bacteria and fungi. The larvae of *Orphilus* burrow in dead wood.

The family is mainly tropical; about 60 named species are placed in two genera. *Nosodendron* has 58 species with 2 in North America. The western one, *N. californicum* Horn, lives in British Columbia where it inhabits true firs and Douglas-fir. *Orphilus* is placed in the Dermestidae by some entomologists; it has 4 species with 3 in North America, including a Miocene fossil species. British Columbia has *O. subnitidus* LeConte; larvae have been reported from fungi on the dead branches of *Arbutus*. Adults gather on the dense inflorescences of plants such as *Achillea*, *Spiraea* and *Eriogonum*.

##### Family DERMESTIDAE (Dermestid Beetles) [Fig. 46]

Dermestids are compact, oval, usually strongly convex beetles 1 to 12 mm long. The base colour is black; some species have patterns of white, yellow, brown or red setae or scales.

The head may be retracted into the prothorax up to the eyes. There is a median ocellus. The antennae are inserted in front of the eyes -- they are threadlike or comblike, have 5 to 11 segments, and usually bear a 3-segmented club. The antennae fit in grooves below the pronotum. The legs are mostly retractile; the hind coxae are excavated to hold the folded femora. The tarsal formula is 5-5-5.

The larvae, densely clothed with mostly spiny setae, are scavengers, feeding on dried carcasses, fur, feathers, wool, silk, leather, cereals and many other organic materials. With these habits, many are damaging pests in human habitations; elsewhere they are valuable recyclers. Many live in bee and wasp nests feeding on old pollen stores or insect remains, or in bird and mammal nests eating feathers and hair and other organic matter. Some *Trogoderma* species are predators of wasp and bee larvae and spider eggs. Adults are usually found on flowers where they eat pollen and nectar.

There are about 700 species of named dermestids worldwide; 9 of the 30 recorded British Columbia species (in 9 genera) are introduced from elsewhere. The largest is *Dermestes marmoratus* Say (over 1 cm long), a native species found on carcasses. Nine other *Dermestes* species are reported -- 5 of these are native. The Larder Beetle (*D. lardarius* Linnaeus) is introduced and may be a pest where cheese and dried meats are stored; the Leather Beetle (*D. maculatus* DeGeer) is used in museums to clean dried tissue from bones. *Anthrenus* is patterned in flat, coloured scales. The three British Columbia species are all alien; by far the most common is the Varied Carpet Beetle (*A. verbasci* (Linnaeus)), a major pest of fabrics in households and of dried animal and plant collections in museums around the province. The Black Carpet Beetle (*Attagenus unicolor* (Brahm)) is also a troublesome pest. Colourful *A. pimpinellae* Fabricius is abundant on spring wildflowers in the southern Interior. All 5 species of *Megatoma* are native; *M. variegata* Horn feeds on moth eggs.

#### Family BOSTRICHIDAE (Bostrichids and Powder-post Beetles) [Fig. 47]

Bostrichid beetles are a variable group with slender or rather broad bodies either cylindrical or flattened. The cylindrical forms usually have a hooded pronotum (the anterior dorsal surface is usually rough, toothed or horned) hiding the head from above. The narrow, flattened forms, including the Subfamily Lyctinae (former Lyctidae, the powder-post beetles), have an exposed head. In the powder-post beetles the head, pronotum and elytra are about equal in width and the pronotum widens slightly to the front. Species in the family range in size from 1.5 to 50 mm (most are 2 to 20mm); they are black, yellow or red-brown, sometimes with metallic green or blue markings. They either lack setae or are sparsely, densely or patchily covered with fine to scale-like setae. The elytra in Lyctinae usually bear rows of setae. Antennae are 8- to 11-segmented with a club of 2 to 4 segments often enlarged to one side; the Lyctinae have a compact 2-segmented club. The tarsal formula is 5-5-5.

The C-shaped larvae feed in seeds, twigs and wood of many kinds; they get most of their nutrition from the starch contained therein. Widely distributed because of their habits and the worldwide commerce in wood products, they are especially destructive in the tropics where they are common in logged timber and bamboo. Other species feed on stored grain and cereals.

There are 550 species in 99 genera worldwide. In North America, 73 species are known; more are constantly intercepted at ports but have not become established. British Columbia records 8 species in 6 genera. *Stephanopachys* contains three species in the province; the others are represented by a single species. The largest species, a black

beetle 2 cm long, is *Polycaon stoutii* (LeConte), known only from British Columbia in Canada. The Grape Twig Borer, *Psoa quadrisignata* (Horn), also restricted to British Columbia in Canada, has pale yellow elytra with dark spots. A destructive import, the Lesser Grain Borer (*Rhizopertha dominica* (Fabricius)), attacks grains and cereal products. All four species of the Lyctinae in British Columbia belong to *Lyctus*; *L. brunneus* (Stephens) and *L. linearis* (Goeze) are introduced. Powder-post beetles feed in hardwoods used for furniture, flooring, picture frames, carvings and many other products.

#### Family ANOBIIDAE (Deathwatch, Furniture and Spider Beetles) [Fig. 48]

In the most recent concept of the Anobiidae, the family not only contains the deathwatch and furniture beetles (Subfamily Anobiinae -- anobiids in the strict sense), but also the familiar spider beetles (Subfamily Ptininae = former family Ptinidae). The family is closely related to the Bostrichidae and may be best placed within that group.

Members of the Subfamily Ptininae are distinctively spider-like with long thin legs and antennae; the antennae arise close together, the pronotum lacks lateral carinae and the hind coxae are widely separated. Most Anobiinae have a hood-like prothorax that usually completely hides the head from above; the antennae are widely separated and the hind coxae are contiguous and excavated to accept the femora. Anobiids are ferruginous to brown or grey beetles (often multicoloured in the Ptininae), 1 to 9 mm long (usually 2 to 6 mm), ranging from elongate and cylindrical to nearly globular. They usually have scales or decumbent and erect setae. The head is large and deflexed. The antennae are 9 to 11 segmented, threadlike (Ptininae) or usually serrate or pectinate and clubbed with 3 enlarged, asymmetrical segments. The prosternum is reduced and often excavated to receive the head. The tarsal formula is 5-5-5.

Most adult and larval Anobiinae live in dead trees, logs and other wood; some attack fungi, cones and seeds and others bore into furniture or are pests of stored products. The larvae of spider beetles usually live in dried organic matter found in leaf litter; bird, mammal and social insect nests; dung and stored products.

Worldwide, the Anobiidae contains about 220 known genera and 2200 species; 24 genera and 48 species are recorded in British Columbia. Thirteen of these species are spider beetles; all but *Ptinus californicus* Pic, *P. fallax* Fall and *P. falli* Pic are introduced. *P. fur* (White-marked Spider Beetle) is perhaps the most common; it can be a minor pest in stored food and houses, but also lives outdoors. Of the Anobiinae, some of the most common are the introduced *Anobium punctatum* (DeGeer) (Furniture Beetle), which damages furniture and woodwork; *Stegobium paniceum* (Linnaeus) (Drugstore Beetle) and *Lasioderma serricornis* (Fabricius) (Cigarette Beetle), which can be serious pests of stored food, spices, seeds and drugs. Some wood boring species make tapping noises with their mandibles in their burrows; long ago in Europe superstitious people interpreted this sound as a sign of approaching death, thus the English name for the family.

#### Series CUCUJIFORMIA

## Superfamily CLEROIDEA

## Family TROGOSSITIDAE (Bark-gnawing Beetles) [Fig. 49]

Elongate, ovate to parallel-sided, rather flattened beetles, some 1.9 to 22.4 mm in length; usually brownish, but sometimes black or green to bluish; body glabrous or setose. Head sunk into pronotum, without ridges or paired ocelli and without a constricted neck; eyes well developed and sometimes somewhat protuberant; antennae 8 to 11-segmented, not geniculate, but with terminal three segments forming a club. Pronotum with lateral margins carinate and rather explanate; prosternal process not elevated above level of prosternum; legs relatively long; tibia with outer margin smooth or spinose, with apical spine; tarsal formula 5-5-5. Elytra completely covering abdomen, and without sutured striae; hind wing not fringed with long setae, longer than width of wing.

Adults can be found under bark of dead trees, in logs and in stumps; a few occur in fungi. The larvae and adults of most species feed on wood-eating insects, but a few feed on decaying matter or fungi.

Worldwide there are about 600 species, with 59 of them known from the United States. Ten genera are reported from Canada and British Columbia, with 22 species recorded in Canada and 17 in British Columbia. Best known is probably *Tenebriodes mauritanicus* (L.), an alien species that is a stored-product pest, that feeds on grains and cereal products. Both *Calitys minor* Hatch and the Holarctic *C. scabra* (Thunberg) have been taken on polyporus fungi, and *Thymalus marginicollis* Chevrolat taken from fungus on *Salix*.

## Family CLERIDAE (Checkered Beetles) [Fig. 50]

Very distinctive beetles, being usually somewhat narrow to broad, elongate or subovate, with bright or contrasting colours (often red or yellow), and with body densely setose; body 2-24 mm long, with a prominent, strongly deflexed head, which is usually wider than thorax, and often sunk into pronotum; surface of head usually finely punctate, but without ridges or paired ocelli, and without a neck; eyes often emarginated; clypeus narrow and transverse; antennae 9-11 segmented, non-geniculate, usually clubbed, with club of one or more segments. Pronotum subquadrate or elongate, usually finely punctate, and sometimes carinate; prosternal process not elevated between coxae; scutellum small and triangular. Elytra often punctate-striate, covering or not covering abdomen; tarsal formula 5-5-5, with most segments being distinctly lobed.

Adults of most species are predaceous and feed on adults of bark beetles. They are often found on trees, foliage or on flowers when they may feed on pollen.

Larvae feed on the eggs, larvae and adults of wood-boring beetles in their burrows. The three species of *Necrobia* in British Columbia (*N. ruficollis* (Fabricius), *N. rufipes* (DeGeer), *N. violacea* (L.)) are cosmopolitan species, not native to North America. They attack dried products of animal origin, and occur around dried carrion, bones and skins, and are more saprophagous than entomophagus.

Worldwide there are 3,366 described species. Some 291 species are reported from North America, with 49 of these in 19 genera. Eight genera and 20 species are known from British Columbia. Two of the commonest are *Trichodes ornatus* Say and the wasp-like *Enoclerus sphaeus* (Fabricius). Species of *Enoclerus* and *Thanasimus* are important predators of barkbeetles, while *Chariessa elegans* Horn preys on the larvae of various cerambycids, such as *Neoclytus conjunctus* (LeConte). *Chariessa pilosa* (Forster) is a predator of various borers, including scolytids, cerambycids and buprestids.

#### Family MELYRIDAE (Soft-winged Flower Beetles) [Fig. 51]

Robust, somewhat flattened and parallel-sided beetles, 2-10 mm long, often brightly coloured and usually moderately setose. Head large, nearly as broad as pronotum, somewhat deflexed, with eyes moderately large and rather bulging; antennae 9-11 segmented, not geniculate and inserted on front of head above base of mandibles. Pronotum typically quadrate in shape, with explanate lateral margin; surface often punctate; with lateral eversible sacs in the Malachiinae; tarsal formula 5-5-5, 4-4-4 or 4-5-5, the segments not lobed beneath. Elytra in most species entire, apically rounded or truncate, leaving last few terga exposed; hind wings not fringed with long setae.

Adults can commonly be found on flowers, feeding on pollen or other insects. Larvae are primarily predaceous, and can be found in soil, leaf litter or under bark.

Worldwide there are more than 300 genera, with over 6,000 species, being abundant and diverse in the dry temperate regions. Some 520 species in 58 genera are reported from north America, with 14 genera and 49 species recorded from Canada. So far 13 genera and 35 species are known from British Columbia. Three subfamilies are represented in the British Columbia fauna: Dasytinae (12 species), Malachiinae (22 species) and Rhadalinae (*Semijulistus ater* (LeConte) only). Two of the species of Malachiinae are aliens, one of which *Malachius aeneus* (L.) has caused considerable damage to developing wheat in the prairie provinces.

#### Superfamily CUCUJOIDEA

#### Family SPHINDIDAE (Cryptic Slime Mold Beetles) [Fig. 52]

The adult sphindid body is convex, elongate oval to broadly oval, from about 1.5 to 3.5 mm long, and varying in colour from pale brown to red-black. The head is partly visible from above, bearing antennae with 10-11 segments including a 2- to 3-segmented, symmetrical, setose club; the scape and pedicel are asymmetrically inflated. Dorsally, the mandible has a central tubercle and a setose cavity. The pronotum is densely punctate, convex, almost as wide as the elytra, which are striate with fine punctures and usually setose. The tarsal formula is 5-5-5 in females, 5-5-4 in males.

Larvae and adults feed on the spores and other fruiting structures of slime molds in trees, stumps, logs and leaf litter.

The Sphindidae is a small family containing 61 species in nine genera; in North America there are nine species in four genera. Only two species live in British Columbia. *Odontosphindus clavicornis* Casey ranges south to northern California; it has 11-segmented antennae and toothed pronotum margins. *Sphindus americanus* LeConte has 10 segments in the antenna. It is widespread in North America; in British Columbia it has been collected under the bark of cottonwood trees.

#### Family BRACHYPTERIDAE (Short-winged Flower Beetles) [Fig. 53]

The Family Brachypteridae (=Cateretidae) is closely related to the Nitidulidae. Usually elongate-oval and 1.5 to 6 mm long, these beetles range in colour from light brown to black. Most body setae are fine, short and sparse. The head is narrower than the prothorax and mostly visible from above; the 11-segmented antennae have weak, 3-segmented clubs and arise between the large, lateral eyes and the mandible bases. The elytra are short, exposing the tip of the abdomen and at least one abdominal segment. The tarsal formula is 5-5-5 -- the first three segments are swollen, the fourth is tiny and the fifth is as long as the first two or three together.

The larvae live in seed capsules of various plants where they eat developing seeds. Adults feed on pollen and flowers.

The short-winged flower beetles comprise a small family of fewer than 100 species worldwide; 11 species (7 genera) are recorded in North America. The five British Columbia species fall into two genera – *Heterhelus*, with simple tarsal claws and *Brachypterus*, with claws distinctly toothed at the base. *Heterhelus pennatus* (Murray) is transcontinental in Canada, *H. sericans* (LeConte) occurs only in British Columbia. *Brachypterus globularius* Murray is a western Cordilleran species and *B. troglodytes* Murray is known only in British Columbia in Canada. *B. urticae* (Fabricius) is common on nettle (*Urtica dioica*) flowers; in North America it lives from coast to coast, but is probably introduced from Europe.

#### Family NITIDULIDAE (Sap Beetles) [Fig. 54]

Sap beetles are usually elongate or broadly oval, somewhat convex to flattened, glabrous or with short, sparse setae. They range in length from 1.5 to 12 mm and range in colour from pale brown to black, often with yellow or orange markings. The 11-segmented antennae have an abrupt 3-segmented, ball-shaped club. The elytra are usually not striate and are often short, exposing the abdominal tip (a few species have two or three terga exposed). The tibiae are often expanded and spiny. The tarsal formula is 5-5-5, rarely 4-4-4 (*Cybocephalus*); segment four is often tiny and segments 1-3 are swollen, bearing pads of setae underneath.

Nitidulids mostly eat plant fluids and fungi and are frequently found in decaying fruit, fermenting plant juices, sap and fungi. Some are collected in flowers and undoubtedly pollinate some plants. Others feed in bee and ant nests and others (*Nitidula* and *Omosita*) in carrion. The larvae of some *Glischrochilus*, *Nitidula* and *Pityophagus* prey on scolytid beetles and *Cybocephalus* larvae feed on coccids.

About 2800 species in over 170 genera are recorded around the world; 30 genera with about 165 species occur in North America. In British Columbia 58 species are known in 15 genera. *Eपुरaea*, with 17 species, is the largest genus in the province. *E. avara* (Randall) is common in sap and rotting fruit, *E. populi* Dodge lives under the bark of dead and dying aspen and cottonwood trees, *E. aestiva* (L) is a common introduced species found on flowers. Three *Carpophilus* species live in British Columbia; two are likely introduced, including *C. hemipterus* L. (Dried-Fruit Beetle), common around decaying fruit. Three of our five species of *Nitidula* are introduced; the western native *N. ziczac* Say is common on dry carrion. The nine species of *Thalycra* are fungus feeders; *T. concolor* (LeConte) is boreal, all the others live in the western Cordillera. *Meligethes* (5 species) are common on flowers; *M. nigrescens* Stephens is Holarctic and is drawn to clover and dandelion flowers. *Glischrochilus* species are black, often boldly marked with yellow or orange patches. Of the seven British Columbia species, *G. fasciatus* (Banded Sap Beetle) is probably the most familiar; its love of fruit and open beer bottles has resulted in some other names – Picnic Beetle, Beer Beetle.

#### Family MONOTOMIDAE (Root-eating Beetles) [Fig. 55]

The Family Monotomidae (= Rhizophagidae) is closely related to the Nitidulidae. The body is narrowly oval to elongate, usually rather cylindrical to flattened, mostly glabrous or with sparse short setae, 1.5 to 6 mm long. The head is clearly visible from above, frequently narrowed behind the small, lateral, coarsely faceted eyes; antennae 10-segmented with 1 or 2-segmented ball-like club. The pronotum is usually elongate; elytra striate, truncate apically, exposing one (females) or two (males) segments. The tarsal formula is normally 5-5-5 in females, 5-5-4 in males.

Most monotomids live under tree bark, but others are collected from leaf litter, rotting vegetation, compost and ant nests. Many probably eat fungi, but some *Rhizophagus* species apparently prey on scolytid beetle larvae.

There are 220 species of root-eating beetles recorded; 55 (11 genera) of these live in North America. In British Columbia 5 genera containing 15 species are reported. The two most diverse are *Rhizophagus* (8 species) and *Monotoma* (4 species). In Canada *Rhizophagus sculpturatus* Mannerheim is known only from British Columbia; it is common under pine bark. *Monotoma picipes* Herbst and *M. longicollis* (Gyllenhal) are both introduced species found transcontinentally, often in compost. The other three genera, each with a single British Columbia species, are *Macreurops*, *Bactridium*, and *Hesperobaenus*.

#### Family SILVANIDAE (Silvanid Flat Bark Beetles) [Fig. 56]

Silvanids, often included in the Cucujidae, are narrowly elongate and almost parallel-sided, usually somewhat flattened, with short decumbent setae. They are small to medium-sized (2 to 15 mm long), rusty to black in colour. The head is strongly constricted behind the prominent eyes. The 11-segmented antennae either are long, thread-like, with an elongate scape and without an obvious club, or have a normal scape and a distinct 3-segmented club. The pronotum is usually elongate, often with projecting

anterior corners and/or toothed lateral edges; the elytra are normally striate with punctures. The tarsal formula is 5-5-5; segment 4 is small, often giving the impression of 4-4-4.

Silvanids are fungal feeders in both larval and adult stages. Most species live under bark or in leaf litter. Introduced species are pests of stored food products.

Most diverse in the tropics, about 470 species (47 genera) of the Silvanidae live worldwide. Fourteen genera containing 32 species are recorded in North America; 5 genera and 7 species are known in British Columbia. *Silvanus bidentatus* (Fabricius) is introduced; *S. muticus* Sharp apparently is native. The native *Uleiota dubia* (Fabricius) and *Dendrophagus cygnaei* Mannerheim are widespread in British Columbia and are found under bark. Three species are introduced, cosmopolitan pests of grains, cereals, nuts and dried fruits -- *Ahasverus advena* (Waltl) (Foreign Grain Beetle), *Oryzaephilus mercator* (Fauvel) (Merchant Grain Beetle) and, probably the most common, *O. surinamensis* (Linnaeus) (Saw-toothed Grain Beetle).

#### Family CUCUJIDAE (Flat Bark Beetles) [Fig. 57]

Species of the Cucujidae are elongate, parallel-sided, strongly flattened, and normally glabrous dorsally. About 5 to 25 mm long, these beetles are often red or yellow and black. The head is large, often as broad as the pronotum, often with the hind angles swollen. The antennae are 11-segmented, thread-like or bead-like, the third segment the longest, the last three sometimes forming a vague club. The pronotum is quadrate to transverse with sublateral, serrate ridges. The elytra are punctate, with complete lateral carinae, completely covering the abdomen. The tarsal formula is 5-5-5 in females, 5-5-4 in males.

Cucujid larvae and adults live under the bark of dead trees. Some *Cucujus* are considered predaceous.

A small family, the Cucujidae contains only four genera. *Cucujus* (12 species) and *Pediacus* (16 species) are Holarctic; the two other genera live in the Neotropical and Australian regions. The three Nearctic species are all found in British Columbia. *Cucujus clavipes* Fabricius is a striking red beetle 10 to 15 mm long. Its range is transcontinental; in British Columbia it is common under the bark of dead pines and Douglas-fir. *Pediacus depressus* (Herbst) is probably introduced from Europe to the British Columbia coast where it has been collected in Western Hemlock. *P. fuscus* Erichson is Holarctic; in North America it ranges across the continent.

#### Family LAEMOPHLOEIDAE (Lined Flat Bark Beetles) [Fig. 58]

Lined flat bark beetles are elongate, mostly strongly flattened, glabrous or inconspicuously setose. Ranging from 1 to 5 mm, they are yellow-brown or red-brown to dark brown species. The head is usually shorter than broad, often prominent, bordered by raised or grooved sublateral lines. The long, 11-segmented antennae normally lack a distinctive club, but often have a vague club consisting of usually three, but up to 6,

segments. The scape is modified in the males of some genera. The pronotum is more or less constricted basally, bearing raised or grooved sublateral lines. The elytra are striate or striate-punctate; elytral cells and humeral carinae are usually present. The femora are swollen. The tarsal formula is usually 5-5-4 in males, 5-5-5 in females.

Laemophloeids live under bark and mainly feed on fungi, especially ascomycetes; some are considered predators of scolytid bark beetles and some *Cryptolestes* are reported to hunt scale insects. *Cryptolestes* are also pests of stored grains, cereals and dried fruits.

Often included in the Cucujidae, the Laemophloeidae is widely distributed around the world, but is most diverse in the tropics; 400 species in about 40 genera are known. There are over 50 species in North America; five of these live in British Columbia. *Laemophloeus biguttatus* (Say) is transcontinental and ranges over most of British Columbia; it lives under bark. Three red-brown *Cryptolestes* species are introduced, cosmopolitan pests of stored products in the province – *C. ferrugineus* (Stephens) (Rusty Grain Beetle), *C. pusillus* (Schonherr) (Flat Grain Beetle) and *C. turcicus* (Grouvelle). *Leptophloeus alternans* (Erichson) is probably introduced; it has been collected from pine bark in British Columbia.

#### Family PHALACRIDAE (Shining Flower Beetles, Shining Mold Beetles) [Fig. 59]

Phalacrid species are broad and oval, strongly convex dorsally and flat ventrally. Most are brown or black, but some are partly or entirely orange. They appear glabrous and are glossy or shining; they are small, ranging from 1 to 3 mm in length. The head is retracted, but not completely hidden from above; the antennae are 11-segmented with an oval, 3-segmented club, the last segment the largest. The pronotum is large, emarginate in front, widest at the base and nearly as broad as the widest part of the body. The elytra are broadly rounded, usually with 1 or 2 striae near the elytra suture. The femora are enlarged and flattened. The tarsal formula is 5-5-5 (sometimes 5-5-4 in males); segment 4 is reduced.

Most shining flower beetles live around fungi bearing powdery spore masses. Look for them on smutty grasses and moldy, decaying vegetation. Adults of *Olibrus* are common pollen feeders on flowers, especially those of the Asteraceae, where the larvae feed in the inflorescences.

Phalacrids are poorly known; about 500 species are recorded, with over 120 of these in North America. Three species in three genera occur in British Columbia. *Phalacrus penicillatus* (Say) is shining black and, as in the genus as a whole, the bases of the antennae are concealed from above by a frontal ridge. *Stilbus apicalis* (Melsheimer) is polished brown with pale elytral tips. *Olibrus rufipes* LeConte is known only from British Columbia in Canada; it is common west of the Coast Mountains.

#### Family CRYPTOPHAGIDAE (Silken Fungus Beetles) [Fig. 60]

The cryptophagid body is 0.8 to 5 mm long (usually 1 to 3 mm), oval to elongate-oval, convex or slightly flattened, frequently with silky setae. Most species are coloured yellow-brown, red-brown or dark brown, but some are bicoloured. The 11-segmented antennae normally have a loose, 3-segmented club; antennal bases are visible from above and are close together or wide apart. The pronotum is quadrate or rounded, usually with definite lateral carinae (sometimes irregularly serrate); often there are pits or depressions basally. In the basal half the elytra are more or less parallel-sided or arched and the elytral punctures are not arranged in striae. The tarsal formula is 5-5-5 (5-5-4 in male Cryptophaginae). The abdomen has 5 visible sterna, the first is longer than the rest combined.

Species of Cryptophagidae are fungus feeders, at home in leaf litter, rotten wood, decaying vegetation, fleshy fungi, compost, and under bark. Others are scavengers and fungal feeders in insect, bird and mammal nests and in stored food products.

*Telmatophilus* adults feed in flowers of some aquatic plants.

About 600 species of silken fungus beetles are known worldwide, but the family is not well studied. Approximately 150 species in 16 genera are described from North America; 47 species in 11 genera are recorded in British Columbia. *Cryptophagus*, with 21 species collected in British Columbia, is the largest genus; 5 species are introduced. There are 13 species of *Atomaria* in British Columbia and, in Canada, 12 are known only from the province. The Holarctic *A. kamtschatica* Motschulsky is an example -- in British Columbia it has been collected in debris from flour mills. *A. ephippiata* Zimmerman is the sole native boreal species in the genus. *Telmatophilus americanus* LeConte ranges from British Columbia to Québec; adults feed on the flowers of bur-reeds (*Sparganium*) in the British Columbia Interior. The larvae of *Antherophagus* (3 species) live in bumblebee nests; adults are collected on flowers and sometimes ride on bees. *Myrmedophila americana* (LeConte), a boreal species, lives in *Formica* ant nests and *Caenoscelis ferruginea* (Sahlberg), a Holarctic species, has been collected in Bushy-tailed Woodrat (*Neotoma*) nests.

#### Family LANGURIIDAE (Lizard Beetles) [Fig. 61]

Closely related to the Erotylidae, lizard beetles are variable in form: the body is elongate-slender, nearly parallel-sided, moderately flattened to convex; the elytra, pronotum and head are about equal in width. The body is usually glabrous, 2 to 20 mm long, pale to dark brown, sometimes with light elytral spots. Larger species are usually more colourful, often with blue, green, red or yellow colours. The antennae have a distinct, slender, 3-segmented club. The pronotum is usually narrower than the elytra basally and has definite lateral ridges. The elytra completely cover the abdomen; they have distinct epiplura and punctate striae. The tarsal formula is 5-5-5, with segment 4 reduced and segments 2 and 3 with setose lobes.

The larvae of the Subfamily Langurinae are stem borers in plants of the families Asteraceae and Fabaceae; the adults are collected on flowers and leaves of the host plants. Members of the Cryptophilinae and other subfamilies are mostly found in rotting

vegetation, leaf litter and under bark where they feed on plant fluids and fungi. Some attack stored grain.

Just over 1000 species of lizard beetles are described in the world, but only about 35 of these live in North America. One species, *Languria convexicollis* Horn, lives in British Columbia; it is restricted to the province in Canada. A black beetle with a red prothorax, it is 9 to 12 mm long. *L. mozardi* Latreille (Clover Stem Borer), an economic pest of red clover and alfalfa, is widespread in North America, but does not occur in British Columbia.

#### Family EROTYLIDAE (Pleasing Fungus Beetles) [Fig. 62]

Erotylids are elongate-oval to broadly oval and rather convex dorsally (some have inflated elytra that suggest a hump-backed form), but with a somewhat flattened pronotum. Glabrous or inconspicuously pubescent, these beetles are mostly shiny and black, often with red or yellow markings; they range from 3 to 22 mm long. The head is deeply inserted into the prothorax. The 11-segmented antennae have a distinct, sometimes flattened, usually 3-segmented club. The front angles of the pronotum are acute and the lateral margins are distinct and sharp. The elytra are usually finely striate. The tarsal formula is 5-5-5.

Larvae and adults are fungal feeders and are usually found in rotting logs, under bark and in mushrooms and other fungi. Many prefer the fruiting bodies of large basidiomycetes growing in wood or in mycorrhizal associations with tree roots. Others, such as *Dacne*, burrow in hard bracket fungi.

Throughout the world there are about 2500 named species of Erotylidae, and approximately 50 occur in North America. British Columbia has 5 species in 2 genera. *Dacne californica* (Horn) and *D. picea* LeConte are western species, in Canada known only from British Columbia. *Triplax* species feed in soft bracket fungi such as *Pleurotus* (e.g., Oyster Mushroom). Three live in British Columbia and all are restricted in Canada to the West; *T. californica* LeConte has black elytra and a red pronotum.

#### Family BYTURIDAE (Fruitworm Beetles) [Fig. 63]

Byturids are robust, oblong beetles with the elytra parallel-sided and the head more or less hidden from above. Usually 3 to 6 mm long, often fine and densely setose, they range in colour from pale yellow to black. They are usually uniformly coloured (*Byturus*), but some are patterned. The antennae are 11-segmented, including a definite three-segmented club. The elytra are punctured, but not striate. The tarsal formula is 5-5-5; the second and third tarsal segments bear distinctive plate-like lobes and the claws are toothed basally.

*Byturus unicolor* Say, the Raspberry Fruitworm, feeds on *Rubus* (raspberries, blackberries and other species) and *Geum* (Avens) plants. Overwintering adults emerge from the ground in spring and lay eggs on blossoms and developing berries, in which the larvae feed. Larvae pupate in the soil and emerge as adults there. The other Nearctic

species, *Xerasia grisescens* (Jayne), is mainly associated with oaks, where it feeds in galls and catkins.

Sixteen known species of fruitworm beetles occur worldwide; ten are Holarctic, the others live in southeast Asia. Two species live in North America and one, *Byturus unicolor* occurs in British Columbia. It is a widespread, variable species in North America and can be a serious pest of commercial *Rubus* crops.

#### Family BOTHRIDERIDAE (Bothriderid Beetles) [Fig. 64]

Narrow, elongate, subcylindrical or slightly flattened beetles, 1.5-13 mm long; generally subglabrous; antennae 10-11 segmented, with apical 1-3 segments forming a club; antennal insertion exposed. Pronotum laterally convex, at least in part. Legs with apex of tibiae expanded and spinose; tarsal formula 4-4-4.

This family includes species that are either ectoparasitic or fungus feeders. Species can be found in the galleries and tunnels of wood-boring beetles, where they are ectoparasitic on the larvae and pupae of other beetles, especially anobiids, bostrichids, cerambycids, scolytids and buprestids.

Worldwide there are about 35 genera and about 300 species. Eight genera and 18 species occur in North America. Three species, each in a separate genus, occur in Canada, with two of these *Deretaphrus oregonensis* Horn and *Oxylaemus californicus* Crotch being confined to British Columbia.

#### Family CERYLONIDAE (Minute Bark Beetles) [Fig. 65]

Cerylonids are elongate to broadly oval, convex to flattened, glabrous to finely pubescent, glossy or shining. Most are shorter than 2 mm, but range to 5 mm long; in colour they vary from light brown to black. The head is small, inserted deeply into prothorax; the antennae are 10- or 11-segmented with a distinct 1- or 2-segmented club. Some adults and most larvae have piercing and sucking mouthparts. The pronotum is transverse to slightly elongate with distinct lateral edges; the elytra are normally striate with lines of punctures. The tarsal formula is almost always 4-4-4. The abdomen has five freely articulating segments, the first much longer than the second.

Minute bark beetles feed on fungal hyphae and spores in forest litter, rotten wood, under bark and, sometimes, in ant nests and stored food products.

The family occurs around the world, but is most diverse in the tropics; more than 300 species are described in over 50 genera. In North America, 18 species are known in nine genera; British Columbia has three species in two genera. *Myhocerus discretus* (Casey) lives only in British Columbia in Canada, ranging to California. Both *Cerlyon castaneum* Say and *C. unicolor* (Ziegler) range across the continent. The latter has been collected under Ponderosa Pine bark in the British Columbia interior.

## Family ENDOMYCHIDAE (Handsome Fungus Beetles) [Fig. 66]

Endomychid species are oblong to broadly oval, normally rather convex, 1 to 10 mm (usually 4 to 8 mm) long. Usually coloured black with red or orange markings, they often appear glabrous and shiny dorsally; setae are reduced or fine. The head is partly concealed by the pronotum and has a frontoclypeal suture. The normally 11-segmented antennae end in a loose 1- to 3-segmented club (3 segments in British Columbia species). The pronotum is usually diagnostic – there are two longitudinal grooves at the base, often accompanied by a transverse groove just in front of the basal margin; the front angles are frequently produced forward. The elytra are punctate, but usually lack striae. The tarsal formula normally 4-4-4, the third segment is sometimes minute.

Larvae and adults feed on fungi and are found in fungi, rotting wood and decayed fruit, under bark and, once in a while, on dung or carrion. A few species can be minor pests in grain, feed and flour, where they eat molds. British Columbia genera eat mainly basidiomycete fungi; for example, *Lycoperdina ferruginea* LeConte specializes on puffballs.

The Family Endomychidae occurs worldwide, but diversity is greatest in the tropics; about 1300 species are described. In North America, 46 species are recorded in 22 genera; British Columbia reports seven species, each in a different genus. *Mycetaea subterranea* (Fabricius) is a widespread, introduced species collected in dead trees, compost, cellars, beehives and greenhouses; it can be a pest of stored food products. *Aphorista laeta* (LeConte) is native in the West; it reaches 7 mm in length and is mostly red with black elytra marked on the tips and shoulders with red. *Endomychus limbatus* (Horn) is another restricted to the Cordillera in Canada; it is black with red elytra, each marked with two black spots. On the other hand, *Mycetina idahoensis* Fall and *Phymaphora californica* Horn have black elytra with red spots.

## Family COCCINELLIDAE (Lady Beetles, Ladybird Beetles) [Fig. 67]

The coccinellid body is elongate-oval to nearly round with the dorsal surface moderately to strongly convex and the ventral surface usually flat. They range from 0.8 to 18 mm long (usually 1 to 10 mm in our fauna). The surface is dull to shiny, glabrous or setose; the setae are short and decumbent or long and semi-erect. Smaller species are often uniformly brown or black; others sport several colours. They range from pale brown, brown, yellow, orange and red to metallic blue or black, marked (often with spots) with contrasting colours on the pronotum and elytra. The head is partly to completely concealed from above; there is no frontoclypeal suture. The antennae are short, 8- to 11-segmented and with a distinct or weak club of 1 to 6 segments. The elytra are normally rounded and punctate, but without striae. The tarsal formula is normally 4-4-4, with segment 3 minute, so appear 3-3-3; segments 1 and 2 are strongly dilated ventrally.

Most larvae and adults prey on soft bodied insects and mites, especially aphids and scale insects. Adults and larva of each species typically have the same eating habits and live on plants where their prey is common. Lady beetles are crucial for the control of

aphids, scales and mites and have long been used in biological control of these pests. Some of our most common species were introduced for this purpose. A few other species feed on plants (*Epilachna* species damage beans and squash, but do not occur in British Columbia) or fungal spores. Some once-common native lady beetles have recently become scarce, apparently because of competition with introduced species (e.g., *Harmonia axyridis* (Pallas), *Coccinella septempunctata* Linnaeus). Hibernating as adults, coccinellids sometimes congregate in huge masses in sheltered places such as buildings or rocky crevices on mountaintops. Larvae are elongate fusiform to broadly ovate, rather flattened, armed with setae, spines and processes, some covered with waxy exudates; colour black, brown, grey to pink often marked with white, yellow or red.

Worldwide, about 6000 species and 360 genera are described. Over 480 species in 60 genera are recorded in North America and of these, about 95 (28 genera) occur in British Columbia. *Scymnus* is a large genus in North America with 93 species (17 in British Columbia); they are small (to 3 mm) and most are black or rusty and often setose. Equally diverse, *Hyperaspis* contains 11 species in the province; most are small, black and marked with red. *H. lateralis* Mulsant preys on mealybugs; the larva exudes waxy white strands and thus resembles its prey. *Chilocorus tricyclus* Smith is a common predator of scale insects on conifers; it is the British Columbia equivalent of the more widespread *C. stigma* (Say), the Twice-stabbed Lady Beetle, so-called because there is a single red spot on each black elytron. The 16 British Columbia species of *Hippodamia* are among the most common lady beetles; relatively elongate, they are usually orange with black spots or bands, but like many coccinellid species, may be extremely variable in colour pattern. For example, *H. moesta* is black on the coast, but is orange with black spots in the Interior. *H. apicalis* Casey is common on sagebrush in Interior valleys. *Anatis* (3 species) are British Columbia's largest lady beetles – *A. rathvoni* (LeConte) is 10 mm long. The distinctive *Calvia quatuordecimguttata* (Linnaeus) is introduced continent-wide; it is either pink-red and densely spotted with black or has the reverse colour pattern. *Adalia bipunctata* (Linnaeus) (Two-spotted Lady Beetle), one of our most familiar beetles, is a frequent invader of houses in the autumn. Since the mid-1990s, another introduced species that enters houses, *Harmonia axyridis* (Asian Lady Beetle), has exploded in abundance on the south coast. Many of the 12 *Coccinella* species in British Columbia are common and widespread; examples include *C. novemnotata* Herbst, *C. trifasciata* LeConte and *C. transversoguttata richardsoni* Brown.

#### Family CORYLOPHIDAE (Minute Hooded Beetles, Minute Fungus Beetles) [Fig. 68]

The corylophid body is variable in shape, but mostly is broadly ovate and moderately to strongly convex; some are more elongate and oblong. They are glabrous to lightly setose and are often shiny. They range in length from 0.5 to 2.2 mm; coloration is mostly uniform – yellow brown or red brown to black -- sometimes marked with paler patches. The head is usually hidden from above by an expanded, hood-like pronotum (only partly concealed in *Orthoperus*). The frontoclypeal suture is absent. Antennae are 9- to 11-segmented with a 3-segmented club. The elytra are rounded apically or truncate, often exposing the tip of the abdomen. The tarsal formula is 4-4-4; segments 1 and 2 are large, 3 is tiny, 4 is slender.

Both adults and larvae eat fungus spores. They live in and around forest litter, rotting vegetation and compost, under bark, in flowers, bird nests and dung.

Almost 300 species of corylophids are described worldwide and about 60 (10 genera) of these live in North America. British Columbia records seven species in three genera. *Clypastraea* contains four species in the province, three of which are strictly western; *C. lugubris* (LeConte) ranges from the Yukon to Ontario. *Clypastraea* has a distinct, shelf-like pronotum extending over the head. Ranging from 0.5 to 1 mm in length, *Orthoperus* species are among the smallest of all beetles. *O. atomus* (Gyllenhal) is an introduced Eurasian species known in Canada only from British Columbia; *O. scutellaris* LeConte is native. *Sericoderus lateralis* (Gyllenhal) is also introduced.

#### Family LATRIDIIDAE (Minute Brown Scavenger Beetles, Mildew Beetles) [Fig. 69]

Species of Latridiidae (= Lathridiidae) are tiny, elongate-oval beetles ranging in length from 1 to 3 mm. They are red brown to brown, sometimes black. The body surface is glabrous to moderately setose, sometimes with waxy exudates, smooth and punctate or with ridges, bumps and depressions. The antennae are 10- or 11-segmented, the scape usually enlarged and the club is 2- or 3-segmented. The pronotum is almost always distinctly narrower than the base of the elytra, dorsally punctate or with ridges and/or depressions, the lateral edges smooth or finely toothed. The elytra are usually striate.

The tarsal segments are simple; the formula is 3-3-3.

The larvae and adults feed on the conidia of slime molds (e.g. many *Enicmus* species) and fungi. Generally, they live in and around dead or moldy vegetation and plant debris, rotten wood, logs and moss and under dead bark. Some species are associated with molds in stored food products.

The Latridiidae contains about 1050 known species; approximately 160 of these occur in North America. In British Columbia 34 species are described in 11 genera. Ten of these species are widespread in human stored products and are introduced in British Columbia, including *Corticaria gibbosa* (Herbst), *Dienerella filum* (Aube), *D ruficollis* (Marshall), *Thes bergrothi* (Reitter), *Latridius minutus* (Linnaeus), *Cartodere constricta* (Gyllenhal) and *Aridius nodifer* (Westwood). At least the last four also can live away from human influence; for example, *A. nodifer* has been found in Wood-rat (*Neotoma*) nests. All four species of both *Enicmus* and *Stephostethus* in British Columbia are native, as are seven of the nine *Corticaria* species. *Corticaria* and *Melanophthalma* (three species) are often collected on flowers.

#### Superfamily TENEBRIONOIDEA

#### Family MYCETOPHAGIDAE (Hairy Fungus Beetles) [Fig. 70]

Oblong to oval in shape, somewhat flattened, with setose body, 1.5-6.5 mm long; brown to black in colour, sometimes with average or reddish markings. Head short and

slightly deflexed; eyes large, and coarsely faceted; antennae 11-segmented, clavate with segments 7-11 enlarged, or with 2 or 3 apical segments forming a loose club.

Pronotum broader than head, laterally convex widened posteriorly; lateral margins carinate; posterior margin sinuate; scutellum arcuate. Legs with femora swollen; tibiae with slender apical spurs; tarsal formula 4-4-4 or 3-4-4, the first and fourth segment the longest; claws simple. Elytra entire, covering or virtually covering abdomen; striae punctate and intervals rugulose.

Adults, and larvae feed largely on fungi and are most commonly found under bark of rotting logs, on shelf fungi, or in moldy, decaying vegetable material.

Worldwide there are about 18 genera and 200 species. Five genera and 26 species are reported from the United States, with four genera and 15 species known from Canada. So far only two genera, *Mycetophagus* with five species and *Typhaea sterocrea* (L.) an alien species, are recorded from British Columbia. The latter is occasionally found in buildings, and can be abundant in stored products. In *Mycetophagus* the eyes are transverse and sinuate anteriorly, while in *Typhaea* they are more rounded and not sinuate anteriorly.

#### Family CIIDAE (Minute Tree-fungus Beetles) [Fig. 71]

Small to minute, elongate-oval, convex beetles, 0.5-6 mm long; brown to black in colour; glabrous or setose. Head subglobular, deflexed and largely hidden by pronotum; eyes oval, well developed, entire and strongly protuberant; without paired ocelli or neck; antennae 8-10 segmented, with last 2-3 segments forming a club. Pronotum rather quadrate, without basal pits or impressions; laterally sometimes carinate; often with anterior hoveus or tubercles; tarsal formula 4-4-4. Abdomen in males often with a median pubescent groove on first visible abdominal sternum.

Both adults and larvae feed on the mycelium and fruiting bodies of wood-rotting Basidiomycetes. Adults can often be found under bark, in dead wood or in the galleries of bark beetles.

Worldwide there are about 550 species in 40 genera. To date, 84 species in 13 genera are known from North America. So far 29 species in 11 genera are reported from Canada. There are 19 species in eight genera known from British Columbia. One species, the widely distributed North American *Cis fuscipes* Mellié is partly parthenogenetic. *Ennearthron spenceri* (Hatch) is only known from British Columbia in Canada, and is a species probably introduced from Japan.

#### Family TETRATOMIDAE (Polypore Fungus Beetles) [Fig. 72]

Oblong to oval in shape, strongly convex to somewhat flattened beetles, 2-17 mm long, with setose body; brown to black in colour, but sometimes with orange or reddish markings. Head short, triangular and slightly deflexed, with large emarginate eyes; surface punctate to rugo-punctate; antennae 11-segmented, clavate or with last 3-4

segments forming a loose club. Pronotum widest posteriorly; punctate and without elevated carinae; lateral margins carinate, smooth or crenulate; posterior margin entire or sinuate; prosternum with distinct process separating fore coxae; tarsal formula 5-5-4, segments without ventral lobes. Elytra entire, with apex rounded, but without strongly elevated carinae.

Adults browse on the surface of the fruiting bodies of higher fungi, and may be attracted to light. Larvae feed inside the fruiting bodies of higher fungi.

Worldwide there are 155 described species in 13 genera. Ten genera and 26 species are known from North America, with nine genera and 20 species reported from Canada. Only two species of Tetratominae, *Tetratoma concolor* LeConte and *Triphyllia elongatus* (LeConte), are known from British Columbia. In *Tetratoma concolor* the apical four segments of the antennae are dilated, whereas in *Triphyllia elongata*, only the end 3 segments are strongly dilated to form a loose club. There are three species of *Hallomenus* Panzer in the subfamily Hallomeninae in British Columbia, and four species in the subfamily Eustrophinae.

#### Family MELANDRYIDAE (False Darkling Beetles) [Fig. 73]

Body shape varying from elongate to ovate, 2-20 mm long; black to brown in colour, sometimes with contrasting markings. Head somewhat hypognathous, without being markedly constricted behind eyes, but may narrow somewhat; antennae 11-segmented, moniliform to filiform and serrated, sometimes with last 3-5 segments forming a distinct club. Pronotum somewhat quadrate, widening posteriorly; disc usually with postero-lateral pits; lateral margins carinate or ecarinate; prosternal process not reaching between fore coxae. Elytra covering all or most of abdomen; apex rounded or somewhat acute; surface punctate; tarsal formula 5-5-4, sometimes with penultimate segment lobed beneath.

Adults seem to live under bark, but are mostly nocturnal, and often can be found crawling on fungi or dead logs at night. Larvae are either carnivorous, fungivorous or xylophagous.

Worldwide there are about 430 described species. In North America there are 60 species in 24 genera. To date 23 genera and 43 species are known from Canada, with 14 genera and 20 species occurring in British Columbia. *Melandrya striata* Say is a species that occurs across Canada. Seven species are confined to British Columbia, and these like the species that occur across Canada occur on conifers or *Populus*. *Serropalpus barbatus* Schaller is a European species intercepted in packaging from Norway.

#### Family MORDELLIDAE (Tumbling Flower Beetles) [Fig. 74]

Beetles with a very distinctive wedge-shaped body, stream-lined with a humpback; 1.5 to 15 mm long; commonly black in colour, but sometimes brownish or bicoloured; if with setae, these often forming distinctive patterns. Head large and triangular in front view, sharply constricted behind eyes; hypognathous, and lying retracted flush with pronotum; surface smooth or rugo-punctate; antennae 11-segmented,

usually short and not extending backwards beyond thorax. Pronotum small, narrowed anteriorly; laterally arcuate; disc rugo-punctate. Hind femora enlarged for jumping; hind tibia with large apical spurs, the tibia frequently expanded apically; hind tibia and tarsi usually with subapical comblike or serrate ridges on lateral faces. Elytra narrowed posteriorly, leaving end of abdomen (pygidium) exposed. Abdomen with pygidium long and pointed.

Adults are phytophagous, feeding on pollen, and often encountered on flowers, especially those in the families Apiaceae and Asteraceae. They are good flyers, and when disturbed or captured, kick with the hind legs, making them bounce or tumble erratically, giving them the common name 'tumbling flower beetles'. Larvae are primarily herbivores, feeding on live stems, decaying wood and fungi.

Worldwide there are about 1500 species, some 205 of which occur in the United States. In Canada there are six genera and 66 species, with four of these genera and 18 species reported from British Columbia. There is a single species of *Tomoxia* Costa, namely *T. borealis* (LeConte), seven species of *Mordella* L., nine species of *Mordellistena* Costa and one species of *Glipostenoda* Ermisch, the widely distributed *G. ambusta* (LeConte). *Mordella marginata* Melsheimer occurs across Canada.

#### Family RIPIPHORIDAE (Ripiphorid Beetles) [Fig. 75]

Very distinctive beetles, those in British Columbia with a number of characteristics not typical of the whole family. Only the genus *Ripiphorus* Bosc d'Antic is known in this province, so the description below give structures typical for the subfamily Ripiphorinae and tribe Ripiphorini.

Body length is typically 2.5-11 mm. Head large, prominent, antero-posteriorly compressed and greatly deflexed; eyes oval and not holoptic; vertex distinctly raised above level of anterior margin of pronotum; antennae inserted on head dorsal to eyes, 10 to 11 segments, with basal segment short and annular; male antennae biflabellate, female antennae unipectinate. Pronotum large and distinct, without posterior lobe. Elytra reduced to scale-like convex plates, not extending beyond thorax, and leaving hind wings exposed. Legs long and slender; tibia with two spurs at apex; tarsal formula 5-5-4, with basal segment on hind tarsus often enlarged with an obliquely truncate apex; claws pectinate. Abdomen strongly decurved and not telescoping.

Although the biology of local species has not been described in detail, larvae of the subfamily are parasitic on the larvae of bees and wasps.

Adults of *Ripiphorus* are probably short-lived and may be diurnal. Adults are typically found on flowers, where females lay their eggs. These hatch into active triangular larvae, which attach to bees visiting the flowers, and are then carried back to the nest. Here they burrow into host larvae and become endoparasitic. They may overwinter in this stage. Later, typically in the spring, they become ectoparasitic in the host nest, feeding on host. Once the bee larva is consumed, the beetle pupates, and sometime later emerges from the host nest cell.

Worldwide there are about 232 species of Ripidophoridae. So far 51 species in six genera are known from the United States. Ten species in three genera are reported from Canada. Only three species, *Ripiphorus californicus* (LeConte), *R. columbianus* W.J. Brown and *R. mutchleri* Rivnay are recorded from British Columbia, all confined to this province in Canada.

#### Family COLYDIIDAE (Colydiid or Cylindrical Bark Beetles) [Fig. 76]

Usually parallel-sided, slightly flattened beetles, 1.2 to 15 mm long; mostly brown to black in colour. Head visible from above, and without paired ocelli; antennal insertion concealed from above; antennae 10 or 11-segmented, with apex slightly clubbed, the club is one, two or three segments. Pronotum quadrate, lateral margins finely or strongly carinate; middle coxal cavities closed laterally. Elytra entire and completely covering abdomen; tarsal formula 4-4-4.

Adults are usually found under bark, in the galleries of wood-boring larvae, and in fungi. Adults and larvae of many species are predators of wood-boring insects.

Worldwide there are about 140 genera. So far 26 genera and 73 species are reported from North America, with eight of these genera with 16 species known from Canada. To date three genera and eight species are recorded from British Columbia. There is a single species of *Aulonium* Erichson (*A. longum* LeConte), a single species of *Corydium* Fabricius (*C. lineola* Say) and a single species of *Namunaria* Reitter (*N. pacificus* (Horn)). The other five species, including *Lasconotus complex* LeConte belong in the genus *Lasconotus* LeConte, characterized by having the apex of the fore tibia expanded and armed with a stout apical spine, the antenna with a 3-segmented club, and with rounded eyes and the lateral margin of the frons continuing above the eye as a supraorbital carina.

#### Family ZOPHERIDAE (Zopherid Beetles) [Fig. 77]

As treated here, the Zopheridae includes the Monommatidae (absent from British Columbia); the zopherids are frequently included in the Tenebrionidae. They are elongate, parallel-sided and flattened to oval and convex beetles ranging from 2 to 34 mm in length. The body is glabrous or clothed in setae, bristles or scales and dorsally is often rough and tuberculate. The antennae have 8 to 11 segments with the last 1-3 forming a club, which may be either vague or definite. The antennae are inserted under the margin of the frons in Nearctic species. The tarsal formula is 5-5-4 or 4-4-4.

Zopherids typically live under bark, in rotten wood or other decomposing plant material where, presumably, they eat mostly fungi. *Phellopsis* larvae feed on the fruiting bodies of polypore fungi and white fungi in logs; *Usechimorpha* tunnel in rotting wood in the presence of white rot fungi. Flightless adults occur in numerous lineages; all British Columbia species lack functional wings.

The family contains about 125 species worldwide; there are about 30 species in 9 genera in North America. Two species in two genera live in British Columbia and

Canada. The most common and widespread is the single North American species of *Phellopsis*, *P. obcordata* (Kirby); it ranges across the continent in old growth coniferous forests. This flat, brown, flightless beetle is elongate, has roughened and ridged, parallel-sided elytra, and is 10-22 mm long. Its elytra are so hard that it takes a strong pin to mount a specimen. *Usechimorpha barberi* Blaisdell is also brown and rough, but is under 5 mm long. In Canada it has been collected only on the Brooks Peninsula, on northwestern Vancouver Island, but ranges south on the coast to Oregon.

#### Family TENEBRIONIDAE (Darkling Beetles) [Fig. 78]

Difficult to easily characterize because of their great diversity, darkling beetles usually are hard-bodied, often flightless, often almost glabrous, brown or black beetles ranging in length from 1 to 80 mm (the largest British Columbia species is 30 mm long). The 11-segmented antennae are thread-like, bead-like, or sometimes clubbed; they arise beneath a lateral expansion of the frons, which often notches or divides the eyes into upper and lower parts. The pronotum is normally carinate laterally and the elytra are usually elongate-oval or almost parallel with distinct epipleura. The tarsal formula is 5-5-4, rarely 4-4-4 or 3-3-3. The tarsal claws in the Subfamily Alleculinae are comb-like.

Darkling beetles are especially diverse in arid and grassland regions, where they are associated with soil and sand; in forests, many species live under bark, in rotten wood, leaf litter and fungi and in the nests of mammals, birds and insects. Larvae and adults eat fungi, decaying plant matter, roots, seeds and cereal products. The larvae of some groups are predatory; for example, *Corticeus* species hunt bark beetles in their galleries. *Tenebrio*, *Tribolium* and other genera have become cosmopolitan pests of stored food products. *Eleodes* species, such as *E. hispilabris* Say and *E. novoverruculus* Boddy, have become pests of wheat, corn and other crops and *Blapstinus* species also can damage cultivated plants. Tenebrionid larvae are typically long and cylindrical to somewhat flattened, often heavily sclerotized -- many soil-dwelling species such as those of *Eleodes* are commonly called false wireworms.

The Tenebrionidae shows immense diversity, and is probably the fifth largest beetle family on earth; there are about 19,000 species in more than 2000 genera worldwide. The North American fauna consists of about 1200 species in 191 genera; British Columbia has 70 species in 31 genera. In British Columbia, perhaps the most familiar is *Eleodes*, a western group of about 130 kinds of medium-sized to large black beetles -- British Columbia has 15 species. One of the largest, *E. hispilabris* Say, is 17-23 mm long and has striate elytra; like many British Columbia *Eleodes* it ranges from the grasslands of the southern interior south to Oregon. More stocky, rotund and smaller species include *E. novoverruculus* Boddy of the interior and *E. rotundipennis* LeConte, the most widespread of the genus in British Columbia, living both in the interior and on the coast. Reaching 30 mm in length and looking like a big, smooth *Eleodes*, *Coelocnemis californica* Mannerheim lives under logs in forests across southern British Columbia. *Coniontis ovalis* LeConte is the only one of 48 North American species in the genus that inhabits Canada, where it is restricted to British Columbia; it is oval, black, about a centimetre long and is common under stones and logs across the southern part of the province. Like many tenebrionids, the three British Columbia species of *Platydema*

live in fungi and the four *Corticus* species live under bark. Our *Tenebrio* (mealworms) and *Tribolium* (flour beetles) species occur mainly in stored foods; most are introduced from Europe. In the classification used here, beetles of the Family Lagriidae have been transferred to the Tenebrionidae; *Paratenetus fuscus* LeConte, the sole British Columbia species, ranges transcontinentally in the boreal forest. Likewise, the Alleculidae (comb-clawed beetles), found mainly on foliage and flowers or under bark, are now considered Subfamily Alleculinae in the Tenebrionidae; there are 12 species recorded in British Columbia. Only 3 of the approximately 100 *Hymenorus* species in North America occur in the province; our most common alleculine, *Isomira comstocki* Papp, is frequently collected on flowers.

#### Family PROSTOMIDAE (Jugular-horned Beetles) [Fig. 79]

Prostomids are elongate, parallel-sided and flat, more or less glabrous and shiny. They vary in colour from yellow to brown and red-brown and are 5 to 10 mm long. The head is large and prognathous with large, strongly projecting mandibles. The 11 antennal segments are bead-like; the last 3 form a weak, elongate club. The pronotum is elongate and lacks distinct lateral carinae. The elytra have punctate striae and strongly angled shoulders. The tarsal segments are simple; the formula is 4-4-4.

Larvae and adults live in decaying logs.

The prostomids comprise a small family of only 20 species in two genera. They have sometimes been included in the Cucujidae. *Prostomis* ranges from western North America to Europe, eastern Asia, Africa and Australia. *Dryocora* lives in Australia and New Zealand. The single nearctic species, *Prostomis mandibularis* (Fabricius) ranges from British Columbia south to northern California.

#### Family OEDEMERIDAE (False Blister Beetles) [Fig. 80]

Oedemerids are elongate, slender and soft-bodied beetles, slightly flattened to convex dorsally, and 5 to 20 mm long. They are yellowish to pale brown to black, sometimes shiny or metallic, and often are coloured with yellow, orange or red. Their vestiture is variable, but the body is usually finely to moderately setose. The head is usually elongate, narrower than, or as wide as, the prothorax, and is somewhat deflexed. The antennae are 11-segmented and normally thread-like or sawtoothed. The prothorax lacks lateral carinae and is longer than broad; it is wider at the front or in the middle than at the base, where it is narrower than the elytra. The elytra are sometimes finely ridged, completely covering the abdomen in North American species, but exposing one or more abdominal segments in some others. The tarsal formula is 5-5-4, with the second to last segment bilobed.

Larvae live in wet and decaying wood, and many species are typical of ocean coastlines where they breed in driftwood. *Nacerda melanura* (Linnaeus), the Wharf Borer, is a cosmopolitan species that can damage wharves, pilings and other wood around water. Other species breed in forest logs, stumps and roots, especially of conifers. Adults frequently gather on flowers and some are attracted to lights. Like the Meloidae (blister

beetles), many oedemerids contain cantharadin as a deterrent to predators; the blistering caused by this chemical has given them the name “false blister beetles”.

About 1500 species of oedemerids in 115 genera are recognized throughout the world and 90 of these species (17 genera) are recorded in North America. British Columbia has 10 species in 7 genera. *Calopus angustus* LeConte, a 20 mm-long, yellow-brown species, ranges transcontinentally; in British Columbia the larvae tunnel in Western Redcedar, Subalpine Fir and in the rotted roots of willows. The introduced *Nacertes melanura* (Linnaeus) develops in rotting wood in water. Similarly, on sea beaches under waterlogged wood, look for *Copidita quadrimaculata* LeConte; adults are black and up to 20 mm long. *Ditylus gracilis* LeConte lives in Alaska and coastal British Columbia, where it is recorded breeding in dead Western Hemlock wood. Reaching 21 mm in length, it is black with a purple-green metallic lustre. *D. quadricollis* LeConte lacks the metallic sheen of its relative; it ranges across British Columbia, breeds in logs of various conifers and, as an adult, is common around logs and on flowers. The three British Columbia species of *Asclera* are restricted in Canada to the western Cordillera; they are often found on flowers such as those of *Ceanothus*, elderberry and willows. *A. discolor* LeConte is yellow with a black head, *A. excavata* LeConte is black with a red prothorax and *A. nigra* LeConte is all black.

#### Family STENOTRACHELIDAE (False Longhorn Beetles) [Fig. 81]

The Stenotrachelidae was formerly known as the Cephaloidae; the common name of the family refers to the superficial resemblance of some species to the true longhorned beetles (Cerambycidae). The body is slender, elongate (6 to 20 mm long), usually convex dorsally and covered with fine short setae; the colour ranges from yellow or pale brown to black. The head is elongate, narrowing behind the eyes to form a neck. The 11-segmented antennae are thread-like (the last 1-3 segments occasionally weakly enlarged) and inserted under a small frontal ridge in front of the notched eyes. The pronotum is usually bell-shaped, wider basally than apically, without a lateral carina (*Cephaloon*) or distinctly margined. The elytra gradually taper apically; they are finely punctate and never striate. The legs are long and slender; the tarsal formula is 5-5-4, with each segment simple and unlobed. Claws are simple or comb-like (*Cephaloon*) and bear a ventral membranous lobe.

The biology of stenotrachelids is poorly known. Adults sometimes appear on flowers or foliage and larvae are mostly known from decomposing logs and stumps.

There are only 20 described species (6 genera) in the Stenotrachelidae and all live in the temperate parts of the Northern Hemisphere. North America has 10 species in 4 genera; 5 species in 3 genera are recorded in British Columbia. Most false longhorns seen in British Columbia belong to the three species of *Cephaloon*. The adults are yellowish varying to black, range from 8 to 15 mm in length and are sometimes found on flowers. *C. bicolor* Horn and *C. pacificum* Van Dyke range from coastal British Columbia to Oregon. *C. tenuicorne* LeConte is an interior species. *Stenotrachelus aeneus* (Fabricius) is widespread across the subalpine and boreal forests of Canada. *Anelpistus canadensis*

Mank is apparently a British Columbia endemic known only from the interior of the province.

#### Family MELOIDAE (Blister Beetles) [Fig. 82]

Blister beetles are mostly elongate and slender with long legs; the body is soft and leathery and usually has sparse, short, fine setae (in *Epicauta* setae are dense, covering the integument). Body length ranges from 3 to 70 mm (mostly 6 to 25 mm in British Columbia); colour varies from black or black and red to metallic green or violet; from brown or grey to yellow and orange. The head is broad, deflexed, almost always wider than the pronotum and constricted behind to form a short neck. The normally 11-segmented antennae are thread-like or bead-like with the middle segments sometimes enlarged in males. In some genera such as *Nemognatha* the maxillae form a long, nectar-sucking tube. The pronotum is narrow and not carinate laterally. The elytra are wider at the base than the pronotum and are usually rolled longitudinally; they are sometimes short, exposing the abdomen. The tarsal formula is 5-5-4; the tarsal claws have a ventral blade.

Adult blister beetles eat the leaves, flowers and nectar of various plants, especially those in the aster, legume and tomato families. Adults of some species of *Epicauta* damage crops such as potatoes and tomatoes; in British Columbia, *E. oregona* Horn and *E. puncticollis* Mannerheim are known culprits. When adults are disturbed, they release a blood-borne defensive chemical called cantharidin by bleeding from leg joints and other places. Cantharidin causes external blistering and internal hemorrhaging in many animals. Most larvae (all British Columbia species) are parasitoids of either grasshopper eggs (*Epicauta*, *Linsleya*) or the immature stages and stored food in the nests of wild bees. Although the larvae of most species attacking bees find the nests by searching them out, some genera, such as *Nemognatha* and *Meloe*, reach nests by attaching themselves to bees visiting flowers. First instar larvae of parasitoid groups are active, but after settling in with the food source, the subsequent instars are grub-like.

The Meloidae live in all parts of the world except New Zealand and Antarctica; there are 2500 described species in 120 genera, with most of the diversity in dry regions. In North America 410 species are placed in 22 genera; British Columbia has 25 species in 7 genera.

The eight species of *Meloe* are among British Columbia's largest blister beetles, some reaching 30 mm long. They are black and cannot fly; their short elytra overlap at the base. Some, such as *M. barbarus* LeConte, which ranges on the coast from British Columbia to Oregon, are restricted to British Columbia in Canada. Others, the common *M. angusticollis* Say among them, range transcontinentally. *Lytta* contains four species in British Columbia; *L. vulnerata* LeConte is often found on flowers of the Aster Family in the interior; it is black with the pronotum and rear of head red. Also an interior species, *L. cyanipennis* LeConte is metallic green-blue and up to 20 mm long; *L. viridana* LeConte ranges from the Peace River region east across the Great Plains. Most of the seven British Columbia species of *Epicauta* are small and black; *E. oregona* Horn, common in the southern interior, is up to 15 mm long and has dense grey pubescence.

*Linsleya sphaericollis* (Say), brassy green to black, frequents flowers of *Lupinus*, *Melilotus* and lilac in the dry interior valleys. The striking, mostly yellow-orange *Nemognatha lutea* LeConte congregates on thistle flowers where it sucks nectar from the tubular flowers.

#### Family MYCTERIDAE (Palm and Flower Beetles) [Fig. 83]

Mycterids are strongly diverse in appearance; the body varies from elongate, robust and convex dorsally to parallel-sided and flattened. They range from 2.5 to 9 mm long. The head is exposed and varies from round to elongate, often with a distinct rostrum (*Mycterus*), sometimes distinctly constricted behind the eyes (*Hemipeplus*). The 11 antennal segments are more or less bead-like or slightly elongate, gradually widening apically (the last one is constricted at the middle); they are sawtoothed and flattened in *Mycterus* males. The pronotum is bell-shaped (*Mycterus*) to somewhat heart-shaped (*Hemipeplus*) and lacks lateral carinae. The elytra are elongate, parallel-sided to ovate; apical binding patches on ventral surface are often visible dorsally as an area of contrasting colour. The tarsal formula is 5-5-4. Males have a protuberance or tuft of setae on one or several abdominal sterna.

Little is known about the habits of mycterids, although larvae are usually found under the bark of dead trees. *Hemipeplus* species feed on grasses and palms. *Mycterus* adults are usually collected on flowers, especially those of *Ceanothus*, *Daucus* and *Yucca*.

The Mycteridae are distributed worldwide, with about 160 species recognized in 30 genera. Three North American genera contain 12 species, 3 of which live in British Columbia.

*Lacconotus pinicolus* Horn and *L. pallidus* Van Dyke are restricted to British Columbia in Canada; they range into the American southwest. *Mycterus concolor* LeConte is also strictly western. Both genera have single eastern Canadian representatives.

#### Family BORIDAE (Conifer Bark Beetles) [Fig. 84]

These uniformly brown beetles are elongate, parallel-sided and 8 to 25 mm long; dorsally they are convex, coarsely punctate and mostly glabrous. The head is parallel-sided with rather short, 11-segmented antennae whose bases are hidden by the laterally expanded frons. The antennal segments are bead-like and the last three are expanded into a club. The pronotum has distinct lateral carinae; the elytra are elongate, parallel-sided and rounded apically. The tarsi are slender, not lobed or expanded beneath; the tarsal formula is 5-5-4.

Larvae live under the bark of dead coniferous trees.

The Boridae is a tiny family (often placed in the Pythidae or Salpingidae) split into north temperate (three species in two genera) and south temperate (one species)

groups. *Lecontia discicollis* (LeConte), the sole species in British Columbia, is a boreal forest beetle that ranges transcontinentally and south in the western mountains to Arizona and Mexico. *Boros* contains two species, one in Eurasia and the other in the boreal forests of North America east of the Rocky Mountains.

#### Family PYTHIDAE (Dead Log Beetles) [Fig. 85]

Adult pythid beetles have an elongate body, usually about three times longer than wide, (6 to 22 mm long), the integument covered with distinct punctation and indistinct vestiture. The colour ranges from red-brown to black, sometimes with a metallic green or purple tinge. The head is usually rather elongate with the mandibles often clearly visible from above. The 11-segmented antennae are bead-like or thread-like, with the last 3 or 4 segments forming a slightly developed club; sometimes last three segments are elongate. The pronotum is round or quadrate, wider than long and widest at midlength; with distinct (*Pytho*) or indistinct paired depressions. The elytra are elongate, more or less parallel-sided, and cover the abdomen; they bear convex longitudinal ridges (*Pytho*) or only scattered punctures. The tarsal formula is 5-5-4; tarsi lack lobes or expansions.

The larvae of *Pytho* live under the bark of dead coniferous trees, whereas *Sphalma quadricollis* Horn prefers deciduous species. *Priognathus monilicornis* (Randall) has been found in the rotting sapwood of conifer logs. These taxa apparently feed on decaying wood and associated material. Judging from mandible structure, adults may be predators, although *Sphalma* probably eats wood.

This small family contains only about 50 species, only 7 (4 genera) of which inhabit North America; British Columbia has 5 species in 3 genera. The three British Columbia species of *Pytho* (*P. americanus* Kirby, *P. niger* Kirby and *P. seidlitzi* Blair) are transcontinental in the boreal coniferous forest; they have distinctive paired depressions on the pronotum. *Priognathus monilicornis* (Randall) is the sole member of the genus and is also a boreal and western montane species. *Sphalma quadricollis* Horn is restricted to coastal British Columbia in Canada and ranges south to California.

#### Family PYROCHROIDAE (Fire-coloured Beetles) [Fig. 86]

Pyrochroids are elongate, rather soft-bodied, somewhat flattened beetles, ranging from 4 to 20 mm in length. The surface is normally covered with dense, semierect setae; colour varies from yellow to red to black; often the body is dark and the prothorax is red. The head is constricted behind the usually notched, forming a neck; the 11-segmented antennae are thread-like to comb-like in females, sawtoothed to plumose in males and are inserted in the eye notch. The pronotum is narrower than the elytra, oval or almost square and without margins. The elytra are more or less parallel-sided, often widened slightly apically. The long, slender legs have a 5-5-4 tarsal formula; the penultimate tarsal segment is small and lobed below.

Larvae, which eat mostly fungi, usually live under bark or sometimes in decaying wood of both coniferous and deciduous trees. *Pedilus* larvae develop in decaying vegetation, often in damp areas. Adult fire-coloured beetles are often found on

vegetation, especially at night; some species are attracted to lights. *Pedilus* adults frequent shrubs and flowers, feeding on pollen and nectar.

About 200 fire-coloured beetle species are recorded worldwide; about 50 of these live in North America. British Columbia supports 8 species in 3 genera. As defined here, the family includes the beetles often placed in the Subfamily Pedilinae of the Pedilidae. Three *Dendroides* species live in British Columbia; the males have striking, plumose antennae. *D. ephemeroides* (Mannerheim) ranges from Alaska to California and lives under loose bark, especially of cottonwoods, alders and maples. *D. marginatus* Van Dyke and *D. picipes* Horn occur only in British Columbia in Canada; they also range south to California. *Schizotus cervicallis* Newman is a transcontinental boreal species; it is often associated with decaying logs around wetlands in northern forests. There are 30 species of *Pedilus* in North America; the four British Columbia species are restricted to the province in Canada. They are often attracted to hawthorn flowers.

#### Family SALPINGIDAE (Narrow-waisted Bark Beetles) [Fig. 87]

Variable in form, members of the Salpingidae are difficult to characterize succinctly. Adults are usually elongate to ovate, subcylindrical to flattened, superficially carabid-like and 1.5 to 7 mm long. The cuticle is usually punctate dorsally and the vestiture is variable, ranging from the meagre to the distinctive decumbent setae of the Othniinae, often arranged in contrasting patterns. The head is quadrate to strongly rostrate; the 11-segmented antennae are bead-like or thread-like, the terminal 3 to 5 segments often widened into a club. The pronotum is usually narrower basally than the base of the elytra; the lateral margins are smooth or carinate. The elytra often bear distinct striae (In the British Columbia fauna, *Aegialitis*, *Sphaeriestes* and *Rhinosimus*). The tarsal formula is 5-5-4; the tarsi are not expanded or lobed; the apical segment in *Aegialitis* is longer than the others combined.

Little is known about the biology of salpingids. Most live under conifer bark, on foliage or in plant litter. The adults of the Subfamily Othniinae are assumed to be predators; species of the Aegialitinae are intertidal rock dwellers.

About 300 described narrow-waisted bark beetle species are arranged in about 45 genera and are distributed around the world in the tropics and temperate regions. In North America, approximately 20 species are known in 8 genera; 7 of these species (in 4 genera) are recorded in British Columbia. *Sphaeriestes alternatus* (LeConte) is restricted to British Columbia in Canada; *S. virescens* (LeConte) ranges transcontinentally. All three species in the genus *Rhinosimus* live in British Columbia; they have a distinctive rostrum or beak. *Aegialites californicus* Motschulsky lives along the shore of the Pacific Ocean. With its flattened body and enlarged tarsal claws, it is well adapted for living in rock crevices in the intertidal zone. *Elacatis lugubris* (Horn), bronzy black and about 5 mm long, occurs in the British Columbia interior; it is the province's only representative (and the sole Canadian species) of the Subfamily Othniinae, the so-called false tiger beetles.

## Family ANTHICIDAE (Ant-like Flower Beetles) [Fig. 88]

Somewhat ant-like in form, and ranging from 1.7 to 12 mm in length, anthicids are elongate, convex dorsally and with the elytra much broader than the head and pronotum. The beetles are variably punctate, have decumbent and erect setae and are coloured from black, brown or rust to yellow, sometimes with patches or bands of contrasting colour on the elytra. The head is deflexed and strongly constricted behind to form a neck; the 11-segmented antennae are thread-like and sometimes vaguely clubbed. The eyes are not notched. The pronotum is oval or quadrate, usually widest in the front half and without lateral carinae; in many species (in *Notoxus* in British Columbia) a pronotal horn extends over the head. The elytra are elongate, the margins mostly almost parallel. The tarsal formula is 5-5-4; the penultimate tarsal segment is lobed.

Adults live under debris and leaf litter or on flowers and foliage; some are attracted to lights at night. Many western North American species live in arid areas, especially on alkali flats and sand dunes. Larvae live in soil and decaying vegetation. These beetles are scavengers and opportunistic predators of small invertebrates (an eastern *Anthicus* species eats *Corydalus* (dobsonfly) eggs); some eat fungi or plant exudates.

Worldwide, about 3000 anthicid species are described in 100 genera. Thirty-two genera contain 231 species in North America; about 40% of the species belong to only two genera – *Anthicus* and *Notoxus*. British Columbia has 34 species in 12 genera. Of the 45 Nearctic *Anthicus* species, 13 are known in British Columbia. They often come to lights at night. *A. cervinus* LaFerté-Sénéctère is common in seabeach drift; *A. lecontei* Champion is a common interior species sometimes found on flowers. The five British Columbia species of *Notoxus* (47 in North America), all western in distribution, are attracted to blister beetles and their cantharidin, which is a deterrent to predators. The anthicids obtain the noxious chemical from the blister beetles and sequester it for their own protection. *N. pictus* Casey, a common species of the British Columbia interior, is yellow with brown elytral bands. *Amblyderus obesus* Casey and *A. pallens* LeConte burrow into sand. *Omonadus floralis* (L) and *O. formicarius* (Goeze) are alien, but transcontinental species. *Ischyropalpus nitidulus* (LeConte) is the most common of three British Columbia species; adults of the genus can be common pollen feeders on flowers. *Ischalia vancouverensis* Harrington is a pretty red beetle with the antennae and elytral tips black. It and the rest of the genus have long been placed in the Pyrochroidae; adults and larvae eat fungi on decomposing wood.

## Family ADERIDAE (Ant-like Leaf Beetles) [Fig. 89]

Sometimes called the Euglenidae, the ant-like leaf beetles are 1-4 mm long, often densely setose, and with the head broader than long, basally constricted and deflexed. The eyes are notched, coarsely faceted and setose. The 11-segmented antennae can be thread-like, somewhat clubbed or comb-like. Quadrate to oval, the pronotum has rounded margins and is basally narrower than the elytra. The tarsal formula is 5-5-4, the first segment usually very long, the penultimate one small so that the tarsi often appear 4-4-3. The abdomen has five visible sterna, but the first two are fused.

Adults of this poorly known family are generally found on flowers and foliage, especially under the leaves of broadleaved plants. Larvae live in rotten wood, leaf litter, under bark and in insect nests.

About 50 genera and 1000 species of the Aderidae are described worldwide; the fauna is widespread, but mainly tropical. In North America 48 species in 11 genera are recorded. The fauna is poorly known in western North America and only one species is reported from British Columbia – *Aderus populneus* (Panzer), an introduction from Europe.

#### Family SCRAPTIIDAE (False Flower Beetles) [Fig. 90]

False flower beetles are elongate, parallel-sided to ovate beetles, slightly flattened to convex dorsally and with the surface distinctly punctate or sculptured. They range in length from 1 to 13.5 mm and are often uniformly black, brown or yellowish; some have contrasting colour patterns. Members of the Scaptiidae have historically been placed in the Melandryidae, Mordellidae and other related families; its two subfamilies are rather different in appearance. The Anaspinae (in British Columbia the genus *Anaspis*) have the rear of the head sharply narrowed, lack conspicuous dorsal setae and the elytra usually have distinct transverse ridges. The Scaptiinae (in British Columbia the four other genera) are soft-bodied, strongly setose beetles with deeply notched eyes. The 11-segmented antennae are usually thread-like, sometimes comb-like (male *Pectoma*) and sometimes clubbed. The pronotum is widest behind and laterally carinate only in the rear half. The tarsal formula is 5-5-4.

Adults, especially of *Anaspis*, can be abundant on flowers, notably those of the Rosaceae and Apiaceae. Larvae live in rotting wood, under loose bark or in leaf litter.

An estimated 4500 species (30 genera) of scaptiids are named worldwide. There are 46 described species in 13 genera in North America, and 16 of these species (in 5 genera) are recorded in British Columbia. The largest genus in the province is *Anaspis*; all 11 species known in Canada live in British Columbia and only four of these range east of the Rocky Mountains. *A. rufa* Say, a red-brown, transcontinental species, is probably the most common in British Columbia. Other common species are *A. atrata* Champion, *A. duryi* Liljeblad, *A. rayi* Hatch and *A. seposita* Liljeblad. *Allopoda californica* Schaeffer is restricted to British Columbia in Canada; *Canifa pallipes* (Mannerheim) is a transcontinental species collected in the British Columbia interior from Ponderosa Pine. *Pectoma hoppingi* Hatch is the only species in the genus; it ranges in the mountains from British Columbia to Arizona. In British Columbia it is known from Lodgepole Pine and Subalpine Fir. *Pentaria fuscata* (LeConte) and *P. trifasciata* Melsheimer occur in the British Columbia interior; both range into eastern Canada.

#### Superfamily CHRYSOMELOIDEA

#### Family CERAMBYCIDAE (Longhorn Beetles) [Fig. 91]

Very variable in shape, but usually with very long antennae, often longer than body. These beetles vary from 3 to 150 mm in length, are often brownish, but can have bright and varied colouration. Head lacks beak, and is slightly to strongly deflexed; antennae usually 11 segmented, but a few have 10 segments, while others may have 20-25 or more segments. The pronotum is variable in shape, and the elytra are usually not abbreviated. Legs in most species have the femora somewhat swollen, and the tibiae usually have apical spurs; tarsal formula 5-5-5, but often appearing as 4-4-4 because of the minute fourth segment lying hidden in the cleft of the bilobed third segment.

Adult longhorn beetles generally feed on wood, roots, leaves or pollen. Flower-feeding adults can often be found on blossoms and are important pollinators. Longhorn larvae bore into wood and roots. The host wood may be living or decayed. Some species are known to totally destroy commercial timber. However, cerambycids play an important role in forest ecology, because they help in the decomposition of dead and dying trees.

There are about 20,000 described species worldwide, with over 900 of these in some 300 or more genera in eight subfamilies occurring in North America. So far 354 species are recorded from Canada, with 145 of these occurring in British Columbia. The pine sawyer (*Ergates spiculatus* (LeConte)) is shiny brown, 39 to 65 mm long, and is the largest beetle in British Columbia, often encountered by the public on the coast. It characteristically has the sides of the pronotum mutlispinose, and breeds in dead *Pinus*, *Abies* and *Pseudotsuga*, frequently ruining fire-killed Douglas-fir before salvage operations can be carried out.

A similar shiny brown beetle, the California prionus (*Prionus californicus* Mots.) occurs frequently in the interior. This is 25 to 55 mm long, has 12-segmented antennae and has only 1, 2 or 3 spines on the sides of the pronotum. It breeds in the roots of living deciduous trees, and the life cycle typically takes 3 to 5 years to complete. A striking species on the coast is the California or banded laurel borer (*Rosalia funebris* Motschulsky). This is black, covered with a dense black and white pubescence, and breeds in California laurel or alder. In the interior, the bright red adults of the milkweed borer (*Tetraopes femoratus* LeConte) can often be seen on milkweed plants. This is a warningly coloured species, able to sequester cardenolides (heart poisons) from the milkweed plant. *Centrodera spurca* LeConte is a typical shaped cerambycid, and as the common name yellow Douglas-fir borer suggests, is a pest of Douglas-fir.

Perhaps the most important cerambycids in British Columbia, with respect to forestry, are members of the genus *Monochamus*, in particular the native spotted pine sawyer (*M. clamator* LeConte) and the white spotted sawyer (*M. scutellatus* (Say)). These are very important because they are the vectors of the pinewood nematode (*Bursaphelenchus xylophilus* (Steiner et Buhner) Nickle), a nematode that infects pine and thus negatively impacts the lumber industry, because its presence in timber precludes the export of the latter.

Although there are no overseas alien longhorn beetles listed as established in British Columbia, recent research has shown that a large number of alien species

regularly are entering the province in dunnage, particularly in dunnage from Asia. Species intercepted so far include *Arhopalus unicolor* (Gahan), *Callidium coriaceum* Paykull, *Ceresium flavipes* (Fabricius), *Trichoferus campestris* (Faldermann), *Megopis sinica* (White), and *Monochamus alternatus* Hope. *Monochamus alternatus* is another possible vector of the pinewood nematode. Cerambycids intercepted from Norway include *Callidium coriacum*, *Molorchus minor* (L.), *Pogonocherus fasciculatus* (DeGeer), *Semanotus undatus* (L.), and *Tetropium fuscum* (Fabricius).

Of particular interest is the interception of the brown spruce longhorn beetle (*Tetropium fuscum*), a species that became established in an around Point Pleasant Park, a 75 ha heritage park in the Halifax Regional Municipality in Nova Scotia. This longhorn woodborer is native to northern and central Europe and western Siberia, where it typically attacks dead and dying trees. In Halifax, this beetle attacked primarily living, apparently healthy red spruce (*Picea rubens* Sarg.), but also black spruce (*P. mariana* (Mill.) BSP), white spruce (*P. glauca* (Moench)Voss) and Norway spruce (*P. abies* (L.) Karst). In Halifax, all infested trees were removed in an attempt to eliminate this pest in North America, as it could attack all native species of spruce, and possibly also fir, pine and larch. Although intercepted in solid wood packaging in Vancouver, the brown spruce longhorn beetle fortunately has not become established in British Columbia.

Similarly, an Asian longhorned beetle species *Anaplophora glabripennis* (Motchulsky), that is native to northeast Asia, and is a serious pest of hardwood trees in China, became established in New York in 1996, Chicago in 1998, and in an industrial area on the Toronto-Vaughan boundary, Ontario in 2003. This beetle attacks live hardwoods, especially maples (*Acer* spp.), and could spread to many hardwood species across Canada. It has been intercepted multiple times in British Columbia, being imported in wood packing material in shipments of metal pipe, and wooden spools used for shipping cable or wire rope, but is not established here. Non-indigenous species can establish in British Columbia, as demonstrated by the fact that *Phymatodes testaceus* (L.), a European species present in eastern Canada (Ontario and Quebec) for many years, is now established in urban forests around Vancouver. It may eventually spread into the adjacent forests.

#### Family BRUCHIDAE (Bean Weevils) [Fig. 92]

Compact, oval in shape, 1 to 10 mm long, usually dull grayish or brownish in colour. Head small, deflexed, and closely applied to thoracic venter; antennae 11-segmented, apically usually somewhat clavate. Pronotum prominent, flat to quite convex, wider than long. Elytra smooth or striate, covered with setae and scales, somewhat shortened, with rounded tip, and leaving end of abdomen (pygidium) exposed. Hind femora usually compressed and more or less swollen; tarsal formula 5-5-5, with first segment elongate and fourth segment very small.

Bean weevils have a remarkable ability to feign death, by falling from their resting place, and then applying the head, antennae and legs close to the body, and lying very still. Adults are commonly found on flowers or foliage.

Larval stages of beetles in this family live in the seeds of legumes, mostly peas and beans, and are often pests. Such larvae live inside the legume seeds, often completely consuming the seed before pupating.

Worldwide there are about 1350 species, with about 760 of those in 149 genera known from the United States. There are 9 genera and 19 species reported in Canada, with five genera, *Kytorhinus* (1 species), *Megacerus* (1 species), *Acanthoscelides* (5 species), *Bruchus* (2 species) and *Bruchidius* (2 species) recorded in British Columbia. Five of these 10 species are non-native. The cosmopolitan bean weevil (*Acanthoscelides obtectus* (Say)) attacks the common bean, cow pea and many other legumes. It is an important pest because it can breed indoors in dried beans. The cosmopolitan pea weevil (*Bruchus pisorum* (Linnaeus)) is also a great pest, feeding on field and garden peas. Adults lay eggs on the maturing pods, and larvae bore into the seeds before they become hard. The introduced vetch bruchid (*Bruchus brachialis* (Fahraeus)) has been separately introduced into Ontario and British Columbia. It is a pest of vetch, and was first recorded in this province in Grand Forks in 1953. Of the other introduced species, *Bruchidius cisti* (Fabricius) is only known from British Columbia in Canada, while *B. villosus* (Fabricius) which has been known from Ontario for some time, has recently been discovered in seeds of Scotch broom (*Cytisus scoparius*) in Victoria.

#### Family MEGALOPODIDAE (Megalopodid Leaf Beetles) [Fig. 93]

Elongate, parallel-sided, 3.3 to 4.5 mm long, shiny black or black and pale beetles; strongly punctate, the punctures with stout setae. Head exserted hypognathous and without rostrum; eyes large and prominent; antennae 11-segmented, segments 5-11 subserrate. Pronotum laterally strongly angled near middle; mesonotum with stridulatory file composed of a single broad patch. Legs stout and pale; tarsal formula 5-5-5, with segment 4 minute and hidden in the strongly bilobed third segment; tarsal segments 1-3 with expanded ventral pads, densely covered with adhesive setae. Elytra entire, apically rounded.

Little is known about the adults in this family in North America, previously treated as a subfamily of the Chrysomelidae larvae are leaf miners, in willow and poplar.

Only the subfamily Zenglophorinae occurs in North America, with 55 species known worldwide, and 9 in North America. Seven species of *Zenglophora* are reported from Canada. Six of these occur in British Columbia, one of which *Zenglophora scutellaris* Suffrian is introduced and occurs across Canada to Quebec, and is commonly called the poplar leaf-mining beetle.

#### Family ORSODACNIDAE (Orsodacnid Leaf beetles) [Fig. 94]

Elongate, parallel-sided, and somewhat flattened; 4.5 to 7 mm long, very variable in colour, black to yellow, orange or red, uniform or bicoloured pattern of spots on elytra; dorsally punctate, the punctures with very short setae. Head short, hypognathous and without rostrum; antennae 11-segmented, extending backward, to just beyond pronotum. Pronotum narrower than elytra, laterally arcuate; mesonotum without stridulatory file.

Elytra entire, and apically rounded. Legs with femora moderately and equally swollen; tarsal formula 5-5-5, with fourth segment minute and more or less hidden in bilobed third segment; tarsal segments 1-3 with ventrally expanded pads, these densely covered with single or spatulate adhesive setae.

This family was previously considered a subfamily of the Chrysomelidae. Worldwide there are about 30 species, four of which occur in North America.

Only one species, *Orsodacne atra* (Ahrens), occurs across Canada and in British Columbia. Adults fed on pollen and other flowering parts of flowering plants, with willow and maple hosts in the Pacific Northwest. The larva of this species and its habits are unknown.

#### Family CHRYSOMELIDAE (Leaf Beetles) [Fig. 95]

This is a very large family of small to medium sized (1 to 17 mm) beetles, often brightly coloured or with striking patterns. The shape is highly variable, elongate-cylindrical to oval-convex or depressed. Head is short, usually hypognathous, exposed or hidden from dorsal view; antennae are usually 11-segmented and are generally short to medium in length. Pronotum is usually broader than head, but highly variable in shape, laterally usually margined and sometimes broadly explanate. Elytra are usually entire and apically rounded; surface is smooth to rugose, impunctate to strongly punctate. Legs usually short to moderate in length, the hind femur usually moderately swollen and sometimes distinctly enlarged; tibiae are slender and usually without apical spurs; tarsal formula usually 5-5-5, with fourth segment minute and more or less hidden between lobes of fourth segments (rarely tarsal formula truly 4-4-4); segments 1 to 3 of tarsus usually lobed or with expanded ventral pads, that on the third segment usually strongly bilobed; tarsal pads densely covered with spatulate or bifid adhesive setae.

Chrysomelids are phytophagous, the adults feeding on leaves. Larvae may also feed on leaves, but many are subterranean, attacking roots and underground stems; a few are leaf miners. Many are pests.

Worldwide there are at least 35,000 described species, and probably some 60,000 in total. Some 195 genera in 8 subfamilies occur in North America. Currently 569 species are reported in Canada, with 181 noted from British Columbia. These species in the province fall into seven subfamilies.

In the Donacinae, which have non-emarginate eyes and simple claws, the larvae are aquatic and attach to and feed on submerged stems or roots of plants. The main genera are *Donacia* (10 species), *Neohaemonia* (1 species) and *Plateumaris* (10 species).

There are two introduced species of *Crioceris* in the subfamily Criocerinae, characterized by X-shaped grooves between the eyes. *Crioceris asparagi* (L.) is the asparagus beetle, and *C. duodecimpunctata* (L.) is the spotted asparagus beetle. As the common names imply, both are asparagus pests.

The Hispinae, with opisthognathous head and a true 4-4-4 tarsal formula, contain exposed leaf feeding or leaf-mining larvae. There are two grass-feeding species of *Anisostena*, the western North American *Sumitrosis inaequalis* (Walker) and *Bracycoryna hardyi* (Crotch) and two species of *Microrhopala*, one of which, the Canada-wide *M. vittata* (Fabricius) is known as the golden rod leaf miner. The most striking member of the subfamily Hispinae is the introduced, uniform pale *Cassida flaveola* Thunberg, with explanate sides to the pronotum and elytra, supposedly adapted to blend into the vegetation, without casting a shadow. A related species, *C. rubiginosa* Muller has been intentionally introduced into North America for the biological control of introduced thistles, but this species so far has not been found in British Columbia, although it occurs from Alberta to New Brunswick.

The subfamily Chrysomelinae is well represented in British Columbia with two species of the Rosacea-feeding flightless, dark-coloured, tenebrionid-like *Timarcha*, and some 39 species of the often brightly coloured members of the tribe Chrysomelini. Included are five species of the oval, metallic, shiny *Phaedon*, 10 species of alder, willow and poplar-feeding *Chrysomela*, and seven species of *Calligrapha*, including the dogwood-feeding *C. philadelphica* (L.) and the holly hock beetle (*C. sigmoidea* LeConte): all *Calligrapha* are showy, pale with striking black spots or dashes. The notorious, yellow and black striped Colorado potato beetle (*Leptinotarsa decemlineata* (Say)), common in the southern interior of the province, also belongs in this subfamily.

*Chrysolina hyperici* (Förster), an Atlantic European species released in British Columbia in 1952, and subsequently distributed to many places in the southern interior, has reduced St. John's wort (*Hypericum perforatum*) to acceptable levels in these places. Also, *C. quadrigemina* (Suffrian), which ranges from North Africa to Denmark, likewise first released in British Columbia in 1952 and then distributed to many places in the province, has reduced St. John's wort populations to low levels, or is extensively damaging this plant in arid sites.

In the subfamily Galerucinae, which are chiefly leaf and flower feeders, included are six species of the genus *Trirhabda*, pale species with pubescent elytra including *T. lewisi* Crotch on rabbitbrush, *T. borealis* Blake and *T. canadensis* (Kirby) on goldenrod, and *T. pilosa* Blake on big sage. The Holarctic *Galerucella nymphaeae* (L.) is the water lily leaf beetle.

The European *Galerucella californiensis* L. released for the biological control of purple loosestrife (*Lythrum salicaria* L.) in British Columbia in 1993-1997, has become established and populations in the Chilliwack and Vancouver area have demonstrated 90-100% of plants attacked. The elm leaf beetle (*Xanthogaleruca luteola* (Müller)) is a native of Europe, introduced into the eastern United States in the 1830s and now in eastern Canada, also appeared in the Pacific Northwest around Portland about 1911 or 1912. It now occurs in British Columbia, and like elsewhere, damages all species of elm, with introduced European species being the most susceptible. Adults emerging in the spring feed on opening buds and newly flushed foliage, with severe leaf feeding resulting in a "shotgun blast" appearance. Larval feeding skeletonizes the lower leaf surface, and

damaged leaves turn brown, dry up and drop off the tree, some trees being completely defoliated by mid-summer.

The tribe Alticini in the Galerucinae contains the 47 species of flea beetles in the province. Adult flea beetles have enlarged hind femora adapted for jumping, hence the common name. Larvae of flea beetles are leaf or stem miners, or subterranean root feeders, many species being partial to members of the Cruciferae. Most (10 species) in British Columbia belong to the genus *Phyllotreta*, including the crucifer flea beetles (*P. lewisi* (Crotch)), the introduced cabbage flea beetle (*P. cruciferae* (Geoze)), and the introduced striped flea beetle (*P. striolata* (Fabricius)) that attacks turnips and radishes. There are eight species of *Altica*, including the rose flea beetle (*A. probata* Fall), and in the genus *Epitrix*, there are two major pests, the western potato flea beetle (*E. subcrinita* (LeConte)) and the tuber flea beetles (*E. tuberosa* Gentner).

However, five alien flea beetles (*Aphthona cyparissiae* (Koch), *A. cwxalinae* Weise, *A. flava* Guillebaume, *A. lacertosa* Rosenhauer, and *A. nigrisutis* Fondras) have been introduced into British Columbia since 1978, in attempts to control the introduced European weed leafy spruce (*Euphorbia esula* L.) The larvae of these beetles are root feeders, while the adults feed on leaves. All species seem to have become established, and in some localities are providing good control, but may not be totally effective in shrubby riparian areas and under full forest canopy.

The root flea beetle *Longitarsus quadriguttatus* Pontoppidan from Austria, was introduced into British Columbia in 1998 for the biological control of houndstongue (*Cynoglossum officinale* L.), and have survived.

The subfamily Eumolpinae contains six species of *Syneta*, including the western fruit beetle (*S. albida* LeConte), two species of *Chrysochus*, which includes the blue-coloured milkweed beetle (*C. cobaltinus* LeConte), the introduced grape pest *Bromius obscurus* (L.), and four species of *Glyptoscelis*, one of which, *G. artemisiae* Blake occurs on sagebrush, but frequently occurs on fruit trees in irrigated orchards.

The subfamily Cryptocephalinae contains four species of *Cryptocephalus*, with *C. sanguinicollis* Suffrain usually on *Salix*, but also on soft fruit, and three species of *Diachus*, among which is the bronze willow beetle (*D. auratus* (Fabricius)).

## Superfamily CURCULIONOIDEA

### Family NEMONYCHIDAE (Pine Flower Snout Beetles) [Fig. 96]

These are weevils with a distinct rostral process on the head, with body elongate-convex in shape, brown to black and 3.0 to 5.5 mm long. Antennae are straight and not elbowed, but have the last three segments forming a weak, loose club. The pronotum is rather barrel-shaped, and the elytra lack an inner subcostal flange.

Adults are rarely collected, but when found are in association with the male pollen-bearing flowers of *Pinus* species, the adults and larvae being pollen feeders.

These insects have in the past been included in the Curculionidae. Five genera and 15 species are known from North America, with three genera and eight species reported in Canada (monographed by Bright 1993), six of which occur in British Columbia. The species *Acromacer bombifrons* (LeConte) and *Pityomacer pix* Kuschel occur in both Alberta and British Columbia. Three of the species of *Cimberis* (*C. bihirsuta* Hatch, *C. compta* (LeConte) and *C. dicipiens* Kuschel) are confined to British Columbia in Canada, while the other (*C. elongata* (LeConte)) occurs in provinces to the east. All have been collected on species of *Pinus*, but nothing is known of the life cycle or habits of all of these species.

#### Reference

Bright, D.E. 1993. The Weevils of Canada and Alaska: Volume 1. Coleoptera: Curculionoidea, excluding Scolytidae and Curculionidae. The Insects and Arachnids of Canada. Part 21. Research Branch, Agriculture Canada Publication 1882: 217 pp.

#### Family ANTHRIBIDAE (Fungus Weevils) [Fig. 97]

These are primitive weevils, greatly resembling snout beetles, but the beak is broad and the antennae are not geniculate. The body shape is quite diverse, being elongate and depressed to oval and convex, 0.4 to 16 mm long. The beetles are quite setose, with setae often scale-like. The head is large, with rostrum if present, broad and flattened; antennae are 11-segmented, with apical three segments forming a club. The pronotum anteriorly is usually narrower than the head, with setae directed anteriorly. Elytra have the apices always locking into a longitudinal groove in the base of the pygidium. Legs have somewhat swollen femora, and a 5-5-5. tarsal formula, although this appears 4-4-4, owing to the very small fourth segment, not visible in dorsal view.

Adults are often collected by beating dead or diseased vegetation, or by sweeping in weedy areas. Adults feed on fungi, pollen, or even bark. Larvae feed on plant stems, fungi or wood.

Worldwide there are about 360 genera and 4,000 species. Some 30 genera and 88 described and 32 undescribed species are reported in North America. So far, seven genera and 18 species are reported in Canada and monographed by Bright (1993). Only three genera and four species are known from British Columbia. *Araecerus fasciculatus* (DeGeer) is an introduced species, known as the coffee bean weevil, and can damage and be a pest of stored plant materials, including seeds, and can be common in warehouses. *Trigonorhinus annulatus* (Carr) has been found on sagebrush infected with a fungus disease in Alberta, and *T. sticticus* (Boheman), which occurs across Canada, breeds primarily in smut fungi, especially of corn, wheat, and wild grasses. The fourth species, *Tropideres fasciatus* (Olivier) also occurs elsewhere in Canada and has been reared from *Betula occidentalis*. This latter anthribid is always associated with a fungus, usually on a variety of woody plants.

## Reference

Bright, D.E. 1993. The Weevils of Canada and Alaska: Volume 1. Coleoptera: Curculionoidea, excluding Scolytidae and Curculionidae. The Insects and Arachnids of Canada. Part 21. Research Branch, Agriculture Canada Publication 1882: 217 pp.

## Family ATTELABIDAE (Leaf and Bud Weevils) [Fig. 98]

These are primitive weevils with straight antennae. The head either has the rostrum short and apically widened, or long and elongate. The body is short and compact or rather elongate, and 2-3-8.2 mm long; antennae are 11-segmented, with apical three segments forming a club. The thorax is rather barrel-like and elytra separately and broadly rounded at apices, more or less exposing a pygidium. Legs are either subequal in size or the forelegs are enlarged; tarsal formula is 4-4-4.

There are two subfamilies in this family previously called the Rhynchitidae. The Attelabinae are leaf-rollers, the females being the leaf rollers, with the larvae developing in the leaf rolls. In the Rhynchitinae, larvae develop in buds or fruit or are leaf-miners.

Worldwide there are 97 genera and 1,914 species. In North America, a total of 11 genera and 51 species are recorded, with nine of these genera and 13 species reported in Canada, and monographed by Bright (1993). So far, there are no members of the subfamily Attelabinae reported in British Columbia. However, we have three species of Rhynchitinae contained in two genera. *Auletobius congruus* (Walker) has been recorded as injuring strawberry blossoms at Salmon Arm. Of the two species of *Merhynchites*, the rose curculio (*M. bicolor* (Fab.)) is a bright red and black beetle, that has several colour forms. It occurs on thimbleberry and wild rose, frequently attacking the flowers of blackberries, raspberries and cultivated roses, the larvae developing in the fruit of the latter. Little is known about the other species (*M. wickhami* (Cockerell)) in British Columbia.

## Reference

Bright, D.E. 1993. The Weevils of Canada and Alaska: Volume 1. Coleoptera: Curculionoidea, excluding Scolytidae and Curculionidae. The Insects and Arachnids of Canada. Part 21. Research Branch, Agriculture Canada Publication 1882: 217 pp.

## Family BRENTIDAE (Pear-shaped Weevils) [Fig. 99]

These are, as the common name implies, 'pear-shaped', 1.0 to 5.5 mm long in our species, generally pale brown to black in colour. The head has a rostrum that is moderately to very long, usually narrow and cylindrical; antennae are non-geniculate and straight, 9 to 11-segmented, with end three segments forming a compact club. The pronotum is rather barrel-shaped. The legs characteristically have long cylindrical trochanters, with the femur attached at its apex.

Adults usually feed on leaves. The larvae feed on leaves and stems, causing galls, or develop within the seeds of plants.

Previously often called the Apionidae, this family with over 1,500 species worldwide, is represented in North America by some 19 genera and about 140 species, with the taxa difficult to identify. To date three genera and 36 species are recognized in Canada, and are monographed by Bright (1993). Only the genus *Apion sensu lat* is present in British Columbia, with 12 species noted so far. The hollyhock weevil (*A. longirostre* Olivier) is an introduced species, native to southeastern Europe and Asia Minor: the host, as the common name implies is hollyhock. *Apion pennsylvanicum* Boheman is a common species that occurs across Canada, and in British Columbia is reported from wild parsnip; *A. proclive* LeConte has been reared from the seedpods of lupine. At least two species in this family have been introduced into the western United States as biological control agents for gorse (*Ulex europaeus* L.) and Scotch broom (*Cytisus scoparius* (L.) Link), but so far none have been released in British Columbia.

#### Reference

Bright, D.E. 1993. The Weevils of Canada and Alaska: Volume 1. Coleoptera: Curculionoidea, excluding Scolytidae and Curculionidae. The Insects and Arachnids of Canada. Part 21. Research Branch, Agriculture Canada Publication 1882: 217 pp.

#### Family CURCULIONIDAE (Weevils or Snout Beetles) [Fig. 100]

Most beetles in this family can be immediately recognized by the elongate rostrum or snout on the head, bearing geniculate antennae and compact antennal club. Their body shape is very variable, oval to elongate, slightly flattened to distinctly convex. Most are covered with appressed or recumbent scales, sometimes with a distinct metallic sheen. The pronotum is rather barrel-shaped, and the tarsal formula is 5-5-5, but the fourth segment is small and hidden between the lobes of the third segment.

This family now includes two taxa, the Scolytinae and Platypodinae, that previously were given family status. It should be noted that the rostrum is virtually absent in the Scolytinae and Platypodinae.

The latest tabulation for this family in the Nearctic lists 2,388 species in 249 genera, placed in 18 subfamilies. Most groups of this family are phytophagous, with the larvae almost always feeding internally in plant tissue of various kinds: many weevils are host-specific, and some are economic pests. Xylomycetophagous members of the Scolytinae and Platypodinae feed on ambrosia fungus.

So far 814 species in the family Curculionidae are reported in Canada. The subfamily Scolytinae is monographed by Bright (1976), and the Platypodinae by Bright (1993). Some 396 species of curculionids are recorded in British Columbia. With this diversity, it is impossible to adequately summarize the provincial fauna. However, some of the commoner pest species can be enumerated. Many of these are alien introduced species of European origin.

There are at least 33 such introduced species, in seven subfamilies. Most are in the Ceutorhynchinae and Otiorhynchinae. Well-known introduced pests in the Ceutorhynchinae include the cabbage curculio (*Ceutorhynchus rapae* Gyllenhal) and the cabbage seedpod weevil (*C. obstrictus* (Marsham)). The cabbage curculio is a pest of cabbage, turnip, horseradish, cauliflower and other Brassicaceae. The cabbage seedpod weevil, which was first reported in North America in Vancouver in 1931, has larvae that develop in the seedpods of these same plants.

In the Otiorhynchinae, major introduced pest species include the black vine weevil (*Otiorhynchus sulcatus* (F.)), the larvae of which feed on the roots of many plants, including strawberries and cranberries, the clay-coloured weevil (*O. singularis* (L.)) which is a problem to many home gardeners and nurseries because the adults feed on the leaves of azalea, laurel, holly, iris, raspberry and rhododendrons. The strawberry root weevil (*O. ovatus* (L.)), which has been known from British Columbia since 1894, attacks many plants, and is our commonest root weevil, especially attracted to strawberries. This weevil is now found throughout much of British Columbia, has invaded many ecosystems, even occurring in the alpine areas. These and other species of *Otiorhynchus* are especially interesting because all adults are wingless, and species in British Columbia are parthenogenetic. *O. sulcatus* populations in North America and most of Europe are parthenogenetic as well as flightless.

Other introduced pest species that belong to other subfamilies include the pea leaf weevil (*Sitona lineatus* (L.)), the sweet clover weevil (*S. cylindricollis* (Fahraeus)) and the granary weevil (*Sitophilus granarius* (L.)), a pest of unmilled grain.

Not all long-nosed weevil pests are introduced; some are native species. Included in the latter category are the apple curculio (*Anthonomus quadrigibbus* (Say)), the plum curculio (*Conotrachelus nenuphar* (Hebst)), and the strawberry weevil (*Anthonomus signatus* Say). As well there are pests of conifers, including the Douglas-fir weevil (*Pissodes fasciatus* LeConte) and the white pine weevil (*P. strobi* Peck). There are 11 species of the genus *Pissodes* in British Columbia, all of which breed on conifers. Two of them are twig weevils, breeding in the terminal shoots and seriously deforming or killing young trees. The remainder are bark weevils, usually breeding under the bark of weakened, and decadent trees.

Because weevils are so good at attacking plants, many have been used by biologists in biological control of alien noxious weeds. The root weevil *Cyphocleonus achates* (Fahraeus), native to central and southern Europe and Asia Minor was introduced into British Columbia in 1987-1999 for the biological control of both diffuse knapweed (*Centaurea diffusa* Lamark) and the spotted knapweed (*C. biebersteinii* DC). Where established they have caused considerable damage to the taproot interior of these alien weeds. More recently, the European weevils *Larinus minutus* Gyllenhal and *L. obtusus* Gyllenhal have also been established in the province to control these same plants. Not only have these become established, but they appear to have eliminated these knapweeds in some areas of the interior.

Another European seed-head attacking weevil *Larinus planus* (Fabricius) has also been introduced into British Columbia, this time in an attempt to control *Cirsium arvense* (L.) Scop., commonly called the Canada thistle, although it probably was originally native to south-eastern Europe and the eastern Mediterranean. Releases have been made in various parts of the province, but only those in the Kamloops and Nelson Forest Regions seem to have become established. *Larinus planus* is widely established in coastal British Columbia, and is commonly recorded in Lindgren funnel traps. Although this weevil spreads rapidly, it evidently has had limited success in controlling this noxious thistle.

The European stem-boring weevil *Mecinus janthinus* Germar has been released into British Columbia throughout the 1990s, for the biological control of Dalmatian toadflax (*Linaria dalmatica* (L.)) has been highly successful, and has caused local reductions in the density of this alien weed.

Also, the stem boring weevil *Mogulones (Ceutorhynchus) cruciger* Herbst from Hungary and Serbia was released for the biological control of Houndstongue (*Cynoglossum officinale* (L.)) a rangeland weed in British Columbia in 1997-1999 and is having a significant impact.

Returning to the Curculionidae as pests, the most important species on conifers belong to the groups without a long rostrum, namely the Scolytinae and the Platypodinae. The Scolytinae are the well-known bark beetles. Most of the Canadian species attack forest trees, especially conifers, and can cause considerable damage, killing trees and ruining timber. Both the larvae and the adults form galleries under bark, these galleries often being quite distinctive for the taxon. Species of *Ips* and *Dendroctonus* in particular are significant pests because they are also vectors. Best known perhaps is the native Mountain Pine Beetle (*Dendroctonus ponderosa* (Hopkins)) because of its recent devastation of over 7 million hectares of pine forest in the interior of the province. Such extreme devastation is thought to be related to fire suppression and climate change which respectively have led to greater host availability and lower winter mortality: extreme cold winters essential for curtailing the spread of the beetles, having been absent over the last few years. Also important as native pests are the Douglas-fir beetle (*D. pseudotsugae* Hopkins) and the spruce beetle (*D. rufipennis* (Kirby)).

The smaller European elm bark beetle (*Scolytus multistriatus* (Marsham)) is an alien species common in British Columbia, and is of interest because it is a vector of the Dutch elm disease: the disease is not here in British Columbia, yet the vector is established on the coast, and in the interior from the Okanagan to Prince George.

As with the cerambycids, there are numbers of alien European and Eurasian bark beetles getting to the province in commerce, particular in dunnage. Among species recently intercepted are *Ips typographus* (L.), *Pityogenes chalcographus* L., *Pityophthorus micrographus* L., and *Polygraphus poligraphus* L.

The eight-spined spruce bark beetle (*Ips typographus*) is one of the most serious pest of spruce in its native range of Europe and Asia, and adults have been trapped and

detected in dunnage and wood packaging in British Columbia. Although it is not established here, it could become a serious forest pest if it does.

However, studies recently have shown that other non-indigenous species of Scolytinae have become established in urban forests in the lower mainland. These include *Trypodendron domesticum* (L.), *Xyleborus pfeili* (Ratzeburg), *Xyleborinus alni* (Niisima), *Xylosandrus germanus* (Blandford), and *Xyloterinus politus* (Say). Of these, *Xyleborinus alni*, *Xylosandrus germanus* and *Xyloterinus politus* have been detected in natural forest habitats. *Xyloterinus politus* is an eastern species that occurs naturally from Manitoba to Nova Scotia: it is an alien from the east.

The only member of the Platypodinae in Canada is *Platypus wilsoni* Swaine. Confined to British Columbia, it infests wood of weakened trees, where it mines galleries. The larvae feed on the ambrosia fungus that grows on the gallery walls. Adults of the Platypodinae can be separated from the Scolytinae in that they have the basal segment of the tarsi, as long as the combined length of the terminal four segments: in the Scolytinae, the first segment is not longer than segments 2 or 3.

#### References

- Bright, D.E. Jr., 1976. The Bark Beetles of Canada and Alaska: Coleoptera: Scolytidae. The Insects and Arachnids of Canada. Part 2. Research Branch, Canada Department of Agriculture Canada Publication 1576: 241 pp.
- Bright, D.E. 1993. The Weevils of Canada and Alaska: Volume 1. Coleoptera: Curculionoidea, excluding Scolytidae and Curculionidae. The Insects and Arachnids of Canada. Part 21. Research Branch, Agriculture Canada Publication 1882: 217 pp.

## Glossary

### A

- Abdomen. The hindmost of the three main body divisions of an insect.
- Allometric. Change of proportions with increase of size.
- Ambrosia. The fungus cultivated by wood-boring beetles of the family Curculionidae subfamily Scolytinae.
- Annulate. Formed in ring-like segments or with ring-like markings.
- Antenna. (pl., antennae). Pair of segmented appendages located on the head and usually sensory in function - the 'feelers'.
- Antennal cleaner. Comb-like structure for cleaning the antennae.
- Antennal club. The more or less enlarged distal articles of a clubbed antenna.
- Antennal fossa. Cavity in which antenna is located.
- Antennal insertion. Area of attachment of antennae to head capsule.
- Anterior. Concerning or facing the front, towards the head.
- Anus. The posterior opening of the digestive tract.
- Apex. The point where the costal vein and the outer margin of the forewing meet.
- Apical. At or concerning the tip or furthest part of any organ: apical cells, for example are at the wing-tip.
- Appendage. Any limb or other organ.
- Appendiculate. Having a small appendage.
- Aquatic. Living in water.
- Arcuate. Curved or shaped like a bow.
- Asymmetrical. Organs or body parts not alike on either side of a dividing line or plane.

### B

- Basal. Concerning the base of a structure - that part nearest the body.
- Biflabellate. Condition where each side of antenna has flabellate processes.
- Biological control. The control of pests by employing predators, parasites, or disease; the natural enemies are encouraged and disseminated by man.
- Bioluminescent. Capable of light production.
- Bipectinate. Feathery, with branches growing out on both sides of the main axis: applied mainly to antennae.

### C

- Campodeiform. (applied to a larva) Grub-like, flattened and elongated with well-developed legs and antennae.
- Canaliculate. Canal-like
- Canthus. The process more or less dividing eyes into an upper and lower part.
- Capitate. With an apical knob like enlargement.
- Carina. A ridge or keel.
- Carnivorous. Preying or feeding on animals.
- Cervical. Concerning the neck region, just behind the head.
- Clypeus. Lowest part of the insect face, just above the labrum.

Comb. A group of spines on the leg of an insect specifically used for cleaning other parts of the insects body.

Compound eye. An eye consisting of many individual elements or ommatidia each of which is represented externally by a facet.

Contiguous. Touching.

Cordiform. Like a cord.

Costal margin. The front edge of the wing.

Costate. With one or more longitudinal ribs.

Crenulate. With scalloped margin.

Cupule. Cup-shaped structure.

Cuticle. The outer noncellular layers of the insect integument secreted by the epidermis.

## D

Dentate. Toothed, possessing teeth or teeth-like structures.

Denticulate. Bearing very small tooth-like projections.

Detritivore. Feeding on detritus.

Discrimen. A median longitudinal sulcus of the pterothorax, marking an invagination of the sternum.

Dorsal. On or concerning the back or top of an animal.

Dorso-ventral. Running from the dorsal (upper) to the ventral (lower) surface.

Dorsum. The upper surface or back of an animal.

## E

Ectoparasite. A parasite that lives on the outside of its host.

Elbowed Antenna. Antenna, in which there is a distinct angle between two of the segments - usually between the 1st and 2nd segments, in which case the 1st segment is usually much longer than the others.

Elytral humeri. Basal exterior angles of elytra.

Elytron. (plural elytra) The tough, horny forewing of a beetle.

Emarginate. With a distinct notch or indentation in the margin.

Empodium. A spine or lobe-like process of the ventral sclerite between the claws.

Epimeron. The posterior part of the side wall of any of the three thoracic segments.

Epipleuron (pl. epipleura). The deflexed or inflexed portion of the elytron, laterally when elytra are closed.

Exarate Pupa. A pupa in which all the appendages, legs etc., are free and capable of movement.

Excavate. Hollowed out: applied to the coxae of many beetles, which are hollowed out to receive the femora when the legs are folded.

Explanate. Having a flat extension.

## F

Facetted. With facets, the outer cuticular elements of light receptive elements of the compound eye.

Femur. The 3rd (counting out from the body) and often the largest segment of the insect leg.

Filiform. Thread-like, applied especially to antennae.

Flabellate. With projecting flaps on one side, applied especially to antennae.

Flagellum. The distal (furthest away from the body) part of the antenna, beyond the 2nd segment.

Fossorial. Adapted for digging.

Frons. Upper part of the insect face, between and below the antennae.

Frontoclypeal suture. The suture between the frons and the clypeus.

Fusiform. Tapering gradually at both ends: spindle-shaped.

## G

Galea. the outer branch of the maxillae, the inner one being the lacinia.

Gena. The cheek - that part of the head below and behind the eye.

Geniculate. Abruptly bent or elbowed (see Elbowed Antenna).

Glabrous. Without setae.

Granulate. Appearing as if made up of granules.

Gula. Ventral part of the head capsule.

## H

Head. The anterior body region of insects which bears the mouthparts, eyes, and antennae.

Holoptic. With the eyes touching or almost touching on the top of the head.

Humeral Angle. The front basal part of the wing, close to its attachment to the body.

Hydrofuge. Water repelling.

Hypognathous. Having a vertical head and face with the mouth-parts at the bottom.

Hypomeron. Inflexed portion of the pronotum, beneath the lateral margin.

## I

Interfacetal. Between the facets of the compound eye.

Interstriae. Between the striae of the elytron.

## J

Joint. Strictly speaking, an articulation between neighbouring parts, such as the femur and tibia of the leg, but the word is commonly used as a synonym of segment - meaning any of the divisions of the body or its appendages.

## L

Labial palp. Segmented appendage on labium.

Labium. The 'lower lip' of the insect mouth-parts, formed by the fusion of two maxilla-like appendages.

Lamellate. Possessing thin plates.

Larva (pl. larvae). Immature stage of insect that has a complete metamorphosis.

Lentic. Still water.

Ligula. Collective name for the inner and outer pair of lobes, fused or not, on the labium.

Lotic. Running water.

## M

**Mandible.** The jaw of an insect.

**Mandibulate.** Having mandibles suited for biting and chewing.

**Maxilla.** (plural maxillae) One of the two components of the insect mouth-parts lying just behind the jaws.

**Maxillary palp.** Segmented appendage on maxilla.

**Maxillary.** Concerning or to do with the maxillae.

**Membranous.** Thin and transparent.

**Mentum.** Basal sclerite of labium.

**Mesepimeron.** Posterior division of the lateral sclerite of the mesothoracic segment.

**Mesepisternum.** Anterior division of the lateral sclerite of the mesothoracic segment.

**Mesonotum.** Dorsal sclerite on the mesothoracic segment.

**Mesoscutum.** Shield-shaped second, or middle part of the mesonotum.

**Mesosternum.** The ventral surface or sclerite of the mesothorax.

**Mesothorax.** Second or middle thoracic segment.

**Metasternum.** Ventral sclerite of the metathoracic segment.

**Metathorax.** Third or posterior thoracic segment.

**Metepisternum.** Anterior division of the lateral sclerite of the metathoracic segment.

**Moniliform.** (of antennae) Composed of bead-like segments, each well separated from the next.

**Moniliform.** Arranged like a chain of beads.

**Mycangium** (pl. mycangia). A special pocket-shaped receptacle used to carry symbiotic fungi.

## **N**

**Nearctic.** Northern hemisphere of the New World.

**Notopleural suture.** Suture separating the pronotum and the proepisternum.

**Notosternal suture.** Suture separating the prosternum for propleuron.

## **O**

**Ocellus.** (Plural Ocelli) One of the simple eyes of insects, usually occurring on the top of the head.

## **P**

**Palp.** A segmented leg-like structure arising on the maxilla or labium. Palps have a sensory function and play a major role in tasting food.

**Pectinate.** Having branches which arise from the main axis like the teeth of a comb: usually applied to antennae.

**Pedicel.** The 2nd antennal segment.

**Perforate.** Having pores.

**Pheromone.** A substance secreted by an animal which when released externally in small amounts causes a specific reaction, such as stimulation to mate with or supply food to a receiving individual of the same species.

**Phytophagous.** Feeding upon plants.

**Plastron.** In aquatic insects, a film of air on the outside of the body, providing an extensive air-water interface for gaseous exchange.

**Predator.** An animal that attacks and feeds on other animals, usually smaller and weaker than itself.

**Proepisternum.** Anterior division of the lateral sclerite of the prothoracic segment.

**Prognathous.** Having a more or less horizontal head, with the mouth-parts at the front.

**Proleg.** One of the fleshy, stumpy legs on larvae.

**Pronotum.** The dorsal surface or sclerite of the 1st thoracic segment.

**Propleuron (pl. propleura).** Lateral region of the prothoracic segment.

**Prosternum.** Ventral surface of the 1st thoracic segment.

**Prothorax.** First or anterior thoracic segment.

**Pubescent.** Covered with short, soft setae.

**Punctate.** Covered with tiny pits or depressions.

**Pupa. (pl., pupae).** The 3rd stage in the life history of beetles and other insects undergoing a complete metamorphosis during which the larval body is rebuilt into that of the adult insect; a non-feeding and usually inactive stage.

**Pygidium.** The abdominal terga left exposed by the elytra.

## Q

**Quadrat.** Square or rectangular.

## R

**Radial cell.** A wing cell bordered anteriorly by a branch of the radial vein.

**Radial vein.** The first important longitudinal vein in the wing, behind the costal margin.

**Reticulate.** Covered with a network pattern.

**Rostrum.** Elongated snouts of weevils.

**Rugose.** With many wrinkles or ridge.

## S

**Scale.** A flattened seta.

**Scape.** The 1st antennal segment, especially if it is longer than the other segment.

**Sclerite.** Any of the individual hardened plates which make up the exoskeleton.

**Sclerotization.** The hardening and darkening processes in the cuticle (involves the epicuticle and exocuticle with a substance called sclerotin).

**Securiform.** Having the form of an axe or hatchet.

**Segment.** One of the rings or divisions of the body, or one of the sections of a jointed limb.

**Serrate.** Toothed like a saw.

**Seta. (pl., setae).** A bristle or hair-like process of the integument.

**Spatulate.** Spoon-shaped.

**Spine.** A multicellular, thorn like process or outgrowth of the integument not separated from it by a joint.

**Spinose.** Spiny.

**Spiracle.** One of the breathing pores - openings of the tracheal system - through which diffusion of gases takes place. They usually occur on the third thoracic segment and all the abdominal.

**Spur.** A large and usually movable spine, normally found on the legs.

**Sternopleural suture.** Suture separating sternum from pleural sclerite.

- Sternum. The plate or sclerite on the underside of a body segment.
- Striae. Grooves running across or along the body: applied especially to the grooves on beetle elytra.
- Striate. With parallel, fine, longitudinal, impressed lines or furrow.
- Stridulation. The production of sounds by rubbing two parts of the body together.
- Stridulatory file. The file of sound producing skeletal elements.
- Strigulate. With numerous short and fine transverse line, either raised or impressed.
- Striole. A rudimentary stria.
- Sub-apical. Situated just before the tip or apex.
- Subcosta. Usually the first of the longitudinal veins behind the front edge of the wing, although it is often missing or very faint: abbreviated to Sc.
- Subcostal. Anterior submargined part of wing.
- Subgena. Narrow lateral margin of the head capsule below the gena.
- Submoniliform. Somewhat similar to a chain of beads.
- Subserrate. With small teeth or notches.
- Supraorbital. Situated above the eye.
- Suture margin. Line of juncture of elytra.
- Suture. A groove on the body surface which usually divides one plate or sclerite from the next: also the junction between the elytra of a beetle.

## T

- Tarsus. (pl., tarsi). The insect's foot: primitively a single segment but consisting of several segments in most living insects.
- Temple. Part of head capsule above and behind eyes.
- Tergum. The dorsal surface of any body segment.
- Testaceous. Brownish-yellow.
- Thorax. The middle of the three major divisions of the insect body. The legs and wings (if present) are always attached to the thorax.
- Tibia. (pl., tibiae) The fourth leg segment between the femur and the tarsus.
- Tomentose. Covered with tomentum.
- Tomentum. A form of pubescence composed of short, matted, woolly setae.
- Trochanter. The second segment of the leg, between coxa and femur: often very small and easily overlooked.
- Trochantin. Free sclerite located at base of leg, providing moveable point of articulation for coxa.
- Truncate. Ending abruptly: squared off.
- Tubercle. A small knob like or rounded protuberance.

## U

- Uncus. A hook-like process on the distal inner margin of the maxillary lobe.
- Urogomph(s). In larval Coleoptera, usually paired processes from the posterior end of the tergum of the ninth abdominal segment, either jointed and movable by muscles, or unjointed and unmovable.

## V

- Vertex. The top of the head, between and behind the eyes.

**X**

Xylomycetophagous. Cultivation and utilization of a symbiotic fungus as a food source.  
Xylophagous. Wood consumers.

**Alphabetical Index of Coleoptera Families**

Order COLEOPTERA	Page
Family ADERIDAE (Ant-like Leaf Beetles) [Fig. 89]	83
Family AGYRTIDAE (Primitive Carrion Beetles) [Fig. 15]	37
Family AMPHIZOIDAE (Trout-stream Beetles) [Fig. 8]	32
Family ANOBIIDAE (Deathwatch, Furniture and Spider Beetles) [Fig. 48]	59
Family ANTHICIDAE (Ant-like Flower Beetles) [Fig. 88]	83
Family ANTHRIBIDAE (Fungus Weevils) [Fig. 97]	91
Family ARTEMATOPODIDAE (Artematopodid Beetles) [Fig. 37]	52
Family ATTELABIDAE (Leaf and Bud Weevils) [Fig. 98]	92
Family BORIDAE (Conifer Bark Beetles) [Fig. 84]	80
Family BOSTRICHIDAE (Bostrichids and Powder-post Beetles) [Fig. 47]	58
Family BOTHRIDERIDAE (Bothriderid Beetles) [Fig. 64]	68
Family BRACHYPTERIDAE (Short-winged Flower Beetles) [Fig. 53]	62
Family BRENTIDAE (Pear-shaped Weevils) [Fig. 99]	92
Family BRUCHIDAE (Bean Weevils) [Fig. 92]	86
Family BUPRESTIDAE (Metallic Wood-boring Beetles) [Fig. 30]	48
Family BYRRHIDAE (Pill or Moss Beetles) [Fig. 31]	49
Family BYTURIDAE (Fruitworm Beetles) [Fig. 63]	67
Family CANTHARIDAE (Soldier Beetles) [Fig. 43]	55
Family CARABIDAE (Ground Beetles) [Fig. 4]	29
Family CERAMBYCIDAE (Longhorn Beetles) [Fig. 91]	84
Family CERYLONIDAE (Minute Bark Beetles) [Fig. 65]	68
Family CHRYSOMELIDAE (Leaf Beetles) [Fig. 95]	88
Family CIIDAE (Minute Tree-fungus Beetles) [Fig. 71]	72
Family CLAMBIDAE (Minute Beetles) [Fig. 28]	47
Family CLERIDAE (Checkered Beetles) [Fig. 50]	60
Family COCCINELLIDAE (Lady Beetles, Ladybird Beetles) [Fig. 67]	69
Family COLYDIIDAE (Colydiid or Cylindrical Bark Beetles) [Fig. 76]	75
Family CORYLOPHIDAE (Minute Hooded Beetles, Minute Fungus Beetles) [Fig. 68]	70
Family CRYPTOPHAGIDAE (Silken Fungus Beetles) [Fig. 60]	65
Family CUCUJIDAE (Flat Bark Beetles) [Fig. 57]	64
Family CUPEDIDAE (Reticulated Beetles) [Fig. 1]	28
Family CURCULIONIDAE (Weevils or Snout Beetles) [Fig. 100]	93
Family DERMESTIDAE (Dermestid Beetles) [Fig. 46]	57
Family DERODONTIDAE (Tooth-necked Fungus Beetles ) [Fig. 44]	56
Family DRYOPIDAE (Long-toed Water Beetles) [Fig. 33]	50
Family DYTISCIDAE (Predaceous Diving Beetles) [Fig. 9]	33
Family ELATERIDAE (Click Beetles) [Fig. 40]	53
Family ELMIDAE (Riffle Beetles) [Fig. 32]	50
Family ENDOMYCHIDAE (Handsome Fungus Beetles) [Fig. 66]	69
Family EROTYLIDAE (Pleasing Fungus Beetles) [Fig. 62]	67
Family EUCINETIDAE (Plate-thigh Beetles) [Fig. 27]	46

Order COLEOPTERA	Page
Family EUCNEMIDAE (False Click Beetles) [Fig. 38]	52
Family GEOTRUPIDAE (Earth-boring Scarab Beetles) [Fig. 23]	44
Family GLAPHYRIDAE (Bumble Bee Scarab Beetles) [Fig. 25]	45
Family GLARESIDAE (Enigmatic Scarab Beetles) [Fig. 21]	43
Family GYRINIDAE (Whirligig Beetles) [Fig. 5]	30
Family HALIPLIDAE (Crawling Water Beetles) [Fig. 6]	31
Family HETEROCERIDAE (Variegated Mud-loving Beetles) [Fig. 35]	51
Family HISTERIDAE (Hister Beetles) [Fig. 12]	35
Family HYDRAENIDAE (Minute Moss Beetles) [Fig. 13]	36
Family HYDROPHILIDAE (Water Scavenger Beetles) [Fig. 10]	34
Family LAEMOPHLOEIDAE (Lined Flat Bark Beetles) [Fig. 58]	64
Family LAMPYRIDAE (Fireflies) [Fig. 42]	55
Family LANGURIIDAE (Lizard Beetles) [Fig. 61]	66
Family LATRIDIIDAE (Minute Brown Scavenger Beetles, Mildew Beetles) [Fig. 69]	71
Family LEIODIDAE (Round Fungus Beetles) [Fig. 16]	38
Family LIMNICHIDAE (Minute Marsh-loving Beetles) [Fig. 34]	50
Family LUCANIDAE (Stag Beetles) [Fig. 20]	42
Family LYCIDAE (Net-winged Beetles) [Fig. 41]	54
Family MEGALOPODIDAE (Megalopodid Leaf Beetles) [Fig. 93]	87
Family MELANDRYIDAE (False Darkling Beetles) [Fig. 73]	73
Family MELOIDAE (Blister Beetles) [Fig. 82]	79
Family MELYRIDAE (Soft-winged Flower Beetles) [Fig. 51]	61
Family MICROMALTHIDAE (Telephone-pole Beetles) [Fig. 2]	28
Family MONOTOMIDAE (Root-eating Beetles) [Fig. 55]	63
Family MORDELLIDAE (Tumbling Flower Beetles) [Fig. 74]	73
Family MYCETOPHAGIDAE (Hairy Fungus Beetles) [Fig. 70]	71
Family MYCTERIDAE (Palm and Flower Beetles) [Fig. 83]	80
Family NEMONYCHIDAE (Pine Flower Snout Beetles) [Fig. 96]	90
Family NITIDULIDAE (Sap Beetles) [Fig. 54]	62
Family NOSODENDRIDAE (Wounded-tree Beetles) [Fig. 45]	57
Family OCHODAEIDAE (Sand-loving Scarab Beetles) [Fig. 24]	44
Family OEDEMERIDAE (False Blister Beetles) [Fig. 80]	77
Family ORSODACNIDAE (Orsodacnid Leaf beetles) [Fig. 94]	87
Family PHALACRIDAE (Shining Flower Beetles, Shining Mold Beetles) [Fig. 59]	65
Family PROSTOMIDAE (Jugular-horned Beetles) [Fig. 79]	77
Family PTILIIDAE (Feather-winged Beetles) [Fig. 14]	37
Family PTILODACTYLIDAE (Ptilodactylid Beetles) [Fig. 36]	51
Family PYROCHROIDAE (Fire-coloured Beetles) [Fig. 86]	81
Family PYTHIDAE (Dead Log Beetles) [Fig. 85]	81
Family RHYSODIDAE (Wrinkled Bark Beetles) [Fig. 3]	29
Family RIPIPHORIDAE (Ripiphorid Beetles) [Fig. 75]	74
Family SALPINGIDAE (Narrow-waisted Bark Beetles) [Fig. 87]	82
Family SCARABAEIDAE (Scarab Beetles) [Fig. 26]	45
Family SCIRTIDAE (Marsh Beetles) [Fig. 29]	47

Order COLEOPTERA	Page
Family SCRAPTIIDAE (False Flower Beetles) [Fig. 90]	84
Family SCYDMAENIDAE (Antlike Stone Beetles) [Fig. 17]	39
Family SILPHIDAE (Carrion Beetles) [Fig. 18]	39
Family SILVANIDAE (Silvanid Flat Bark Beetles) [Fig. 56]	63
Family SPHAERITIDAE (False Clown Beetles) [Fig. 11]	35
Family SPHINDIDAE (Cryptic Slime Mold Beetles) [Fig. 52]	61
Family STAPHYLINIDAE (Rove Beetles) [Fig. 19]	41
Family STENOTRACHELIDAE (False Longhorn Beetles) [Fig. 81]	78
Family TENEBRIONIDAE (Darkling Beetles) [Fig. 78]	76
Family TETRATOMIDAE (Polypore Fungus Beetles) [Fig. 72]	72
Family THROSCIDAE (Throscid Beetles) [Fig. 39]	53
Family TRACHYPACHIDAE (False Ground Beetles) [Fig. 7]	32
Family TROGIDAE (Hide Beetles) [Fig. 22]	43
Family TROGOSSITIDAE (Bark-gnawing Beetles) [Fig. 49]	60
Family ZOPHERIDAE (Zopherid Beetles) [Fig. 77]	75

**Table 1. Order COLEOPTERA. List of Figures**

<b>Figure No.</b>	<b>Family</b>	<b>Species</b>	<b>Illustration details</b>
1	Cupedidae	<i>Priacma serrata</i> (LeConte)	Original
2	Micromalthidae	<i>Micromalthus debilis</i> LeConte	Redrawn after Arnett 2000
3	Rhysodidae	<i>Clinidium calcaratum</i> LeConte	Original
4	Carabidae	<i>Carabus nemoralis</i> Müller	Original
5	Gyrinidae	<i>Gyrinus affinis</i> Aubé	Original
6	Halipilidae	<i>Halipilus leechi</i> Wallis	Original
7	Trachypachidae	<i>Trachypachus gibbsii</i> LeConte	Original
8	Amphizoidae	<i>Amphizoa lecontei</i> Matthews	Redrawn after Arnett 2000
9	Dytiscidae	<i>Agabus seriatus</i> (Say)	Redrawn after Arnett 2000
10	Hydrophilidae	<i>Hydrobius fuscipes</i> (L.)	Original
11	Sphaeritidae	<i>Sphaerites politus</i> Mannerheim	Original
12	Histeridae	<i>Saprinus lugens</i> Erichson	Original
13	Hydraenidae	<i>Hydraena pacifica</i> Perkins	Original
14	Ptiliidae	<i>Acrotichis vicina</i> (Matthews)	Original
15	Agyrtidae	<i>Necrophilus hydrophiloides</i> Guérin-Méneville	Redrawn after Arnett 2000
16	Leiodidae	<i>Leiodes assimilis</i> (LeConte)	Redrawn after Arnett 2000
17	Scydmaenidae	<i>Scydmaenus</i> sp.	Original
18	Silphidae	<i>Nicrophorus marginatus</i> Fabricius	Redrawn after Arnett 2000
19	Staphylinidae	<i>Philonthus politus</i> (L.)	Original
20	Lucanidae	<i>Ceruchus punctatus</i> LeConte	Redrawn after Hatch 1953-71
21	Glaresidae	<i>Glaresis medialis</i> Gordon	Original
22	Trogidae	<i>Trox scaber</i> (L.)	Original
23	Geotrupidae	<i>Bolboceras obesus</i> (LeConte)	Original
24	Ochodaeidae	<i>Ochodaeus lusunis</i> Howden	Original
25	Glaphyridae	<i>Lichnanthe rathvoni</i> (LeConte)	Redrawn after Arnett et al. 2002
26	Scarabaeidae	<i>Dichelonyx vicina</i> (Fall)	Redrawn after Hatch 1953-71

<b>Figure No.</b>	<b>Family</b>	<b>Species</b>	<b>Illustration details</b>
27	Eucinetidae	<i>Eucinetus terminalis</i> LeConte	Redrawn after Arnett et al. 2002
28	Clambidae	<i>Clambus pubescens</i> Redtenbacher	Redrawn after Arnett et al. 2002
29	Scirtidae	<i>Cyphon brevicollis</i> (LeConte)	Original
30	Buprestidae	<i>Buprestis aurulenta</i> L.	Redrawn after Hatch 1953-71
31	Byrrhidae	<i>Eusomalia lecontei</i> (Wickham)	Redrawn after Hatch 1953-71
32	Elmidae	<i>Heterlimnius koebelei</i> (Martin)	Redrawn after Hatch 1953-71
33	Dryopidae	<i>Helichus striatus</i> LeConte	Redrawn after Hatch 1953-71
34	Limnichidae	<i>Limnichites punctatus</i> (LeConte)	Original
35	Heteroceridae	<i>Lantenarius brunneus</i> (Melsheimer)	Redrawn after Arnett et al. 2002
36	Ptilodactylidae	<i>Ptilodactyla serricollis</i> (Say)	Redrawn after Arnett et al. 2002
37	Artematopidae	<i>Macropogon testaceipennis</i> Motschulsky	Redrawn after Arnett et al. 2002
38	Eucnemidae	<i>Dirhagus pectinatus</i> (LeConte)	Redrawn after Hatch 1953-71
39	Throscidae	<i>Trixagus carinicollis</i> (Schaeffer)	Redrawn after Arnett et al. 2002
40	Elateridae	<i>Agriotes lineatus</i> (L.)	Redrawn after Hatch 1953-71
41	Lycidae	<i>Plateros lictor</i> (Newman)	Redrawn after Hatch 1953-71
42	Lampyridae	<i>Photuris pennsylvanica</i> (DeGeer)	Redrawn after Arnett et al. 2002
43	Cantharidae	<i>Podabrus prunosus</i> LeConte	Redrawn after Arnett et al. 2002
44	Derodontidae	<i>Laricobius laticollis</i> Fall	Redrawn after Hatch 1953-71
45	Nosodendridae	<i>Nosodendron californicum</i> Horn	Redrawn after Arnett et al. 2002
46	Dermestidae	<i>Anthrenus verbasci</i> (L.)	Redrawn after Arnett et al. 2002
47	Bostrichidae	<i>Melalgus confertus</i> (LeConte)	Redrawn after Hatch 1953-71
48	Anobiidae	<i>Ptinus fer</i> (L.)	Redrawn after Arnett et al. 2002
49	Trogossitidae	<i>Tenebroides corticalis</i> (Melsheimer)	Redrawn after Arnett et al. 2002
50	Cleridae	<i>Trichodes ornatus</i> Say	Original
51	Melyridae	<i>Malachius aeneus</i> (L.)	Redrawn after Arnett et al. 2002
52	Sphindidae	<i>Spindus americanus</i> LeConte	Redrawn after Arnett et al. 2002
53	Brachypteridae	<i>Brachypterus urticae</i> (F.)	Redrawn after Arnett et al. 2002
54	Nitidulidae	<i>Glischrochilus fasciatus</i> (Olivier)	Redrawn after Arnett et al. 2002
55	Monotomidae	<i>Rhizophagus dimidiatus</i> Mannerheim	Original

<b>Figure No.</b>	<b>Family</b>	<b>Species</b>	<b>Illustration details</b>
56	Silvanidae	<i>Oryzaephilus mercator</i> (Fauvel)	Original
57	Cucujidae	<i>Cucujus clavipes</i> F.	Redrawn after Arnett et al. 2002
58	Laemophloeidae	<i>Laemophleus biguttatus</i> (Say)	Original
59	Phalacridae	<i>Phalacrus penicillatus</i> (Say)	Original
60	Cryptophagidae	<i>Henoticus californicus</i> (Mannerheim)	Redrawn after Arnett et al. 2002
61	Languriidae	<i>Languria convexicollis</i> Horn	Original
62	Erotylidae	<i>Triplax antica</i> LeConte	Original
63	Byturidae	<i>Byturus unicolor</i> Say	Redrawn after Arnett et al. 2002
64	Bothrideridae	<i>Deretaphrus oregonensis</i> Horn	Redrawn after Arnett et al. 2002
65	Cerylonidae	<i>Cerylon castaneum</i> Say	Redrawn after Arnett et al. 2002
66	Endomychidae	<i>Lycoperdina ferruginea</i> LeConte)	Original
67	Coccinellidae	<i>Hippodamia tredicimpunctata</i> (L.)	Original
68	Corylophidae	<i>Sericoderus lateralis</i> (Gyllenhal)	Redrawn after Arnett et al. 2002
69	Latridiidae	<i>Melanophthalma americana</i> (Mannerheim)	Redrawn after Arnett et al. 2002
70	Mycetophagidae	<i>Mycetophagus californicus</i> Say	Original
71	Ciidae	<i>Cis fuscipes</i> Mellié	Redrawn after Arnett et al. 2002
72	Tetratomidae	<i>Tetratoma concolor</i> LeConte	Redrawn after Arnett et al. 2002
73	Melandryidae	<i>Melandrya striata</i> Say	Redrawn after Arnett et al. 2002
74	Mordellidae	<i>Mordella marginata</i> Melsheimer	Redrawn after Arnett et al. 2002
75	Ripiphoridae	<i>Ripiphorus californicus</i> (LeConte)	Original
76	Colydiidae	<i>Lasconotus complex</i> LeConte	Original
77	Zopheridae	<i>Phellopsis obcordata</i> (Kirby)	Original
78	Tenebrionidae	<i>Eleodes vandykei modificatus</i> Blaisdell	Original
79	Prostomidae	<i>Prostomis americanus</i> Crotch	Original
80	Oedemeridae	<i>Ditylus quadricollis</i> LeConte	Original
81	Stenotracheiidae	<i>Cephaloon tenuicorne</i> LeConte	Redrawn after Arnett et al. 2002
82	Meloidae	<i>Epicauta puncticollis</i> Mann.	Original
83	Mycteridae	<i>Mycterus concolor</i> LeConte	Redrawn after Arnett et al. 2002
84	Boridae	<i>Lecontia discicollis</i> (LeConte)	Original

<b>Figure No.</b>	<b>Family</b>	<b>Species</b>	<b>Illustration details</b>
85	Pythidae	Pytho niger Kirby	Redrawn after Arnett et al. 2002
86	Pyrochroidae	Dendroides ephemeroideus (Mann.)	Original
87	Salpingidae	Rhinosisimus viridiaeneus Randall	Redrawn after Arnett et al. 2002
88	Anthicidae	Ischyropalpus nitidulus (LeC.)	Original
89	Aderidae	Aderus populneus (Panzer)	Original
90	Scraptiidae	Anaspis rufa Say	Redrawn after Arnett et al. 2002
91	Cerambycidae	Centrodera spurca (LeC.)	Original
92	Bruchidae	Acanthoscelides obtectus (Say)	Redrawn after Arnett et al. 2002
93	Megalopodidae	Zeugophora scutellaris Suffrian	Redrawn after Arnett et al. 2002
94	Orsodacnidae	Orsodacne atra (Ahrens)	Redrawn after Arnett et al. 2002
95	Chrysomelidae	Calligrapha verrucosa (Suff.)	Original
96	Nemonychidae	Cimberis compta (LeConte)	Redrawn after Arnett et al. 2002
97	Anthribidae	Tropideres fasciatus (Oliv.)	Original
98	Attelabidae	Merhynchites bicolor (Fabricius)	Redrawn after Arnett et al. 2002
99	Brentidae	Trichapion centrale (Fall)	Redrawn after Arnett et al. 2002
100	Curculionidae	Lepesoma granicolle (LeC.)	Original