Insects of Skagit County

Lloyd Eighme

Insects of Skagit County

Lloyd Eighme

Cover photograph: *Lophocampa maculata*
Spotted Tussock Moth, larva

After this book's initial publication in 2009, Dr. Lloyd Eighme donated the manuscript to the Skagit County Master Gardener Foundation. Dr. Eighme passed away in 2021. The Foundation is releasing this 2022 update with gratitude for Dr. Eighme's work and his generous gift.

SCMGF
P.O. Box 2801
Mount Vernon, WA 98273

For more information about the Skagit County Master Gardener Foundation, visit **https://www.skagitmg.org/home/about-us/**.

Acknowledgments

The staff at the Washington State University Skagit County Extension office have been very supportive from the beginning of this project. Dyvon Havens, retired WSU Skagit County Extension Horticulturist, suggested that I put my writings about local insects in book form, and she has supported and encouraged me all the way. Ellen Cooley, former WSU Skagit County Extension Master Gardener Program Coordinator, provided guidance in my work with Master Gardeners and provided support throughout the project. Roz Spray, former Staff Assistant, helped me locate reference materials and spent many tedious hours translating my scribblings into readable text. Roz was very tolerant of my red pen and followed me through revision after revision from the beginning to the final copy. This book is the result of her hard work along with mine.

The many excellent bulletins on insects produced by WSU Extension faculty and staff have been a major source of information for me while I was writing this book. One individual in particular, Art Antonelli, a WSU entomologist, has written many of these bulletins, and he has shared generously with me from his office and also during his training sessions for Master Gardeners. Sharon Collman, from WSU Snohomish County Extension, read the manuscript and made helpful suggestions. Jane Billinghurst, a WSU Skagit County Extension Master Gardener and book editor, provided guidance in the final editing.

Many Master Gardeners in Skagit County have aided me in my work by their interest in the insects and by bringing specimens to me for the collection. A friend in Clear Lake, Cliff Mitterand, collected a large portion of our moth collection. Two Master Gardeners in particular, Rosalie Myers and Virgene Link, who volunteered as assistant curators of the insect collection, worked many hours at the Master Gardener clinic helping to identify specimens and prepare them for the collection and also assisted with preparing the index for the book.

How to Use This Book

The main incentive for writing this book has been to assist WSU Extension Master Gardeners in their role as educators of the public in proper ecosystem management for private gardens and yards by providing them with a book that focuses specifically on local insects. However, this book will also be useful for anyone who is interested in identifying the insects they find in their own backyards.

This text is really only a beginning. It documents a sample of the insects brought to the WSU Skagit County Extension Master Gardener plant clinics and of those collected in Skagit County by the author and his assistants. New information may demand a revision where errors in identification have been made. If you find errors, I encourage you to contact the WSU Skagit County Extension Master Gardener office (**https://extension.wsu.edu/skagit/mg/** or 360–428–4270). We would love to hear from you, and we welcome your help in making our collection and this book as comprehensive and error-free as possible.

It is my hope that this beginning will inspire and encourage curious people to search and to learn more about the fascinating insects in our own backyards.

Table of Contents

Introduction 9

Butterflies and Moths (Lepidoptera) 12
Butterflies 12
Whites (Pieridae) 12
Moths 13
Woollybears, Tiger Moths, and Fall Webworm (Arctiidae) 14
Tussock Moths (Lymantriidae) 17
Tent Caterpillars (Lasiocampidae) 17
Inchworms and Loopers (Geometridae) 19
Cutworms (Noctuidae) 19
Some Other Moth Families in Skagit County 20
Prominents (Notodontidae) 20
Thyatirids (Thyatiridae) 20
Hooktip Moths (Drepanidae) 20
Giant Silk Moths (Saturniidae) 21
Sphinx Moths (Sphingidae) 21

Micromoths (Microlepidoptera) 22
Clothes Moths (Tineidae) 22
Leafroller Moths (Tortricidae) 22
Plume Moths (Pterophoridae) 23
Snout Moths (Pyralidae) 23
Ermine Moths (Yponomeutidae) 23

Beetles (Coleoptera) 24
Ground Beetles (Carabidae) 24
Tiger Beetles (Cicindelidae) 26
Predaceous Diving Beetles (Dytiscidae) 26
Whirligig Beetles (Gyrinidae) 26
Carrion Beetles (Silphidae) 27
Round Fungus Beetles (Leiodidae) 27
Rove Beetles (Staphylinidae) 27
Feather-Wing Beetles (Ptiliidae) 28
Net-Winged Beetles (Lycidae) 28
Fireflies (Lampyridae) 28
Soldier Beetles (Cantharidae) 29
Flower Beetles (Melyridae or Malachiidae) 29
Soft-Bodied Plant Beetles (Dascillidae) 30
Checkered Beetles (Cleridae) 30
Minute Brown Scavenger Beetles (Lathridiidae) 30
Sap Beetles (Nitidulidae) 30
Lady Beetles (Coccinellidae) 30
Flat Bark Beetles (Cucujidae) 33

Handsome Fungus Beetles (Endomychidae) 33
Cylindrical Bark Beetles (Colydiidae) 33
Carpet or Skin Beetles (Dermestidae) 34
Spider Beetles (Ptinidae) 35
Furniture Beetles (Anobiidae) 36
Powderpost Beetles (Lyctidae) 37
Water Scavenger Beetles (Hydrophilidae) 37
Fire-Colored Beetles (Pyrochroidae) 37
Darkling Beetles (Tenebrionidae) 37
Click Beetles (Elateridae) 38
Pseudo-Click Beetles (Throscidae) 38
Metallic Wood or Flat-Headed Borers (Buprestidae) 39
Long-Horned Beetles and Round-Headed Borers (Cerambycidae) 40
Leaf Beetles (Chrysomelidae) 41
Weevils or Snout Beetles (Curculionidae) 43
Bark and Ambrosia Beetles (Scolytidae) 46
Stag Beetles (Lucanidae) 47
Scarab Beetles (Scarabaeidae) 47

Flies (Diptera) 49
House Flies (Muscidae) 49
Bottle or Blow Flies (Calliphoridae) 50
Flesh Flies (Sarcophagidae) 50
Tachinid Flies (Tachinidae) 51
Hover Flies (Syrphidae) 51
Mosquitoes (Culicidae) 52
Horse and Deer Flies (Tabanidae) 53
Snipe Flies (Rhagionidae) 53
Black Flies (Simuliidae) 54
Fruit Flies (Tephritidae) 54
Bot Flies (Oestridae) 55
Crane Flies (Tipulidae) 55
March Flies (Bibionidae) 56
Long-Legged Flies (Dolichopodidae) 57
Louse Flies (Hippoboscidae) 57
Dung Flies (Scathophagidae) 57
Fungus Gnats (Mycetophilidae and Sciaridae) 58

Dragonflies and Damselflies (Odonata), Caddisflies (Trichoptera), Stoneflies (Plecoptera), and Mayflies (Ephemeroptera) 59

Bees, Wasps, and Ants (Hymenoptera) 60
Bumblebees and Honeybees (Apidae) 60
Sweat Bees (Halictidae) 61
Acute-Tongued Burrowing Bees (Andrenidae) 62

Yellow-Faced Bees (Colletidae) 63
Digger Bees (Anthophoridae)....63
Leafcutter Bees (Megachilidae) 63
Thread-Waisted Wasps (Sphecidae)....64
Spider Wasps (Pompilidae)....70
Cuckoo Wasps (Chrysididae) 70
Sawflies (Tenthredinidae) 70
Gall Wasps (Cynipidae and Other Families)....72
Parasitic Wasps (Chalcidae, Braconidae, and Other Families)....73
Ichneumon Wasps (Ichneumonidae)....74
Yellowjackets and Wasps with Folded Wings (Vespidae) 76
Ants (Formicidae) 78

True Bugs (Hemiptera) 82
Bed Bugs (Cimicidae) 83

Aphids, Adelgids, Leafhoppers, Spittle Bugs, and Scales (Homoptera) 85
Aphids (Aphididae)....85
Adelgids (Adelgidae) 86
Leafhoppers (Cicadellidae) 87
Spittlebugs (Cercopidae)....87
Scales (Coccidae) 87

Springtails (Collembola) 89

Thrips (Thysanoptera) 90

Silverfish and Bristletails (Thysanura) 91

Lacewings (Neuroptera) 92

Grasshoppers, Crickets, and Katydids (Orthoptera) 93
Grasshoppers (Acrididae and Tetrigidae) 93
Crickets (Gryllacrididae and Grylloblattidae) 93
Katydids (Tettigoniidae)....94

Cockroaches (Blatteria) 95

Fleas (Siphonaptera) 97

Earwigs (Dermaptera) 98

Bark Lice (Psocoptera)....99

Termites (Isoptera) 100

Resources **101**

Bibliography **103**

Index **104**

Introduction

The need for a guide to the identification of insects to be used by Washington State University Skagit County Extension Master Gardeners was the main motivation for writing this book; however, a book such as this can be useful to anyone who is curious about the insects they see. Most books about insects cover a large geographical area such as the United States, and all too often the insects of Skagit County are not included in these books. Skagit County is located north of Seattle, Washington, and extends from the waters of Puget Sound east into the North Cascade mountains. Most of the species of insects found here are also found in other counties of the Puget Sound region, so this book will be useful for insect identification in surrounding areas.

There are so many different kinds of insects that it is necessary to organize them in some way so they can be referred to by name rather than as "insect number 509" or "insect number 13,726." Taxonomists, those people who study the naming of insects, have chosen to organize insects by their body structures. This method is as arbitrary as sorting a bucket full of rocks by size and color, but until someone comes up with a better and more useful method (perhaps by DNA code), we will continue to use the present taxonomic system.

First, all insects are sorted into 30 orders, 25 of which we have found in Skagit County. More than three-quarters of our insects are classified in just four of those orders, and we will consider 21 orders in this manual. If you learn to recognize just 10 orders, you will become an expert in your community because very few people know how to identify insects.

The easiest insect order to recognize is Lepidoptera, the butterflies and moths. They have prominent wings patterned with colorful scales. *Lepido* is a Greek word meaning scale and *ptera* means wing. Why don't we just call them scalywings? That would not mean anything to people who speak Japanese, Spanish, French, or any language other than English. Latin and Greek word roots have been selected by taxonomists as the universal language for scientific nomenclature. Order names like Lepidoptera are used in all languages.

Three other orders easy to recognize by their wings are beetles, flies, and bees. Beetles are in the order Coleoptera. In Greek, *coleo* means sheath and *ptera* means wing. The front pair of beetle wings are hardened and act as a shield to protect the delicate hind wings, which are used in flight. Flies are in the order Diptera, which means two wings, different from most other insects, which have four wings. Bees are in the order Hymenoptera, which includes wasps and ants, all of which have four membranous wings. Several other orders include insects with four membranous wings, but they are separated from Hymenoptera by other structural characteristics. So now you can recognize insects in four orders, which covers three-quarters of all insects. That is a good start!

Orders are further divided into families. Family names also have Latin and Greek roots, but most families have common names in English, and these will be included to make it easier to recognize them. Finally, the genus and species names bring you to the exact insect you are looking at.

The extreme variety and vast number of insects pose a challenge to anyone who wants to identify them to species, and you may wonder just how important it is to do so. To some people a little black beetle is just another little black beetle, and what difference does it make to know its specific name? One function of the Master Gardener program is to assist people in their efforts to control or manage insect pests in the house and garden. Many people are anxious to use as few chemicals as possible, so it is important for them to know which insects are harmful and which are beneficial. In many cases a beneficial insect can look very similar to one that is harmful. It is always satisfying to tell a homeowner that the insect he or she has brought in is not doing any damage so they need not try to eliminate it. But, in order to do that with certainty, we must be able to identify insects correctly, and that is the purpose of this book.

Insect identification is the first step in discovering what an insect does. Is it harmful or beneficial or just interesting? An insect that is considered harmful to us may be an important link in the food chain that makes up the complex ecosystem in which we live. Consider aphids as an example. Aphids can be damaging pests on our plants, but they are food for many predatory insects like lady beetles and small wasps. We welcome lady beetles to our gardens to help control the aphid population, but they will not eradicate the aphids. If they did, there would be no more food for them, and they would starve.

A complex ecosystem with many different kinds of insects is more stable and has fewer population explosions because the insects compete with each other for food and habitat. A greatly simplified ecosystem like a large field of corn contains fewer species, and a pest of corn can multiply rapidly with little competition. If we can identify the insects in our backyards, we might be able to do something to produce a more complex, stable ecosystem. We can then work toward integrated pest management rather than pest eradication.

The Skagit County insect collection at the WSU Skagit County Extension office has been developed during the past 10 years and consists of specimens brought in by clients and Master Gardeners. There are over 500 different kinds of insects identified at least to genus and many to species, but this is an ongoing project. Specimens are still being collected, mostly in gardens and yards, so there are hundreds of kinds of insects in the forests and hills that are not yet in our collection. All the insects included in this manual have been found in Skagit County. Master Gardeners manage the insect collection and are available at the weekly Master Gardener plant clinics to help identify specimens brought in by gardeners. For more information on WSU Skagit County Extension Master Gardener plant clinics and the Skagit County insect collection, refer to the resources section at the back of this book.

The WSU Extension bulletins on insects are our best and most accurate source of information, and they are added to and improved upon each year. The bulletins are available to the public at the Extension office and online (see the resources section); however, in many cases the insects illustrated are not quite the same as ours here in Skagit County. Also, many of the insects brought to us are not included in the bulletins because they are not considered pests to gardeners. We need to be able to identify all insects, pests or not, so we can help people de-

cide what to do about them. Recommendations for pesticides are not included in this book because they change each year. The WSU Extension *Pacific Northwest Insect Management Handbook* is revised each year and a copy is available for reference at the Extension office. It lists approved pesticides for control of insect pests.

The sequence of chapters in this book does not follow any taxonomic system. The largest and most common orders are presented first because these include insects that are frequently seen by gardeners. The chapter titles include a common name for the order followed by the technical name. Each chapter includes a general discussion of the order followed by a description of the families and an alphabetized list of the insects of that family that are included in this book. Common names are included when available, but many species of insects have not been given common names so the genus and species names will be useful for finding information about life cycles and food habits.

When information about an insect or help in its identification is needed, the first problem is where to find this information. Rather than search through information about thousands of species, it is easier to search through information about hundreds of species. A book on just Skagit County insects provides such a reference and that is what this book is intended to be. Most of the insects are illustrated with photographs, so they can be recognized without detailed descriptions. Many of the photographs are larger than life size to show characteristic details. The actual body length or wingspan of each insect is given in the species list and below each photograph.

Most of the photographs in the following pages were taken by the author and are of specimens collected in Skagit County. These photographs show the structural patterns that are most helpful in insect identification. Photographs of live insects in their natural habitats would be more attractive, but they would frequently not show the identifying structures we are looking for. Photographs reproduced from WSU Extension bulletins are so marked and are not necessarily of the same species of insects found in Skagit County.

Butterflies and Moths (Lepidoptera)

What is the difference between butterflies and moths? Most moths fly at night and are not often seen. Butterflies fly in the daytime, are readily seen, and are some of our most beautiful insects. When butterflies land, they fold their wings together in an upright position so you see the undersides of their wings. Moths fold their wings backward like a roof over their bodies so you do not see the undersides of their wings. Butterflies and moths start out as caterpillars and do most of their feeding and growing in that stage. Moth caterpillars are more often serious garden pests than butterfly caterpillars, and there are many more different kinds of moths than butterflies.

Butterflies

Most people can recognize and name at least a few of our common butterflies. There are about 50 different kinds of butterflies in the Pacific Northwest, but not all of those are found in Skagit County. There are excellent books that illustrate and describe them.

Whites (Pieridae)

The pretty white butterflies flitting up and down the rows of cabbages and broccoli in your garden are definitely undesirable guests. They are adults of the imported cabbageworm (*Pieris rapae*), which was introduced from Europe in 1858. The earliest records are from Quebec, Canada, but it spread rapidly and was in California by 1883. It is a persistent pest. It is often the first butterfly to appear in early spring, and it is with us until fall frost. It goes through three generations during the summer, increasing its numbers greatly each time. The females lay their eggs on many cruciferous plants, such as cabbage, broccoli, cauliflower, Brussels sprouts, mustard, and rape (a plant grown for its seed; the species name for the cabbageworm, *rapae,* probably refers to this plant).

Cabbageworm caterpillars are slow-moving, green "worms" with faint yellow stripes and smooth velvety skin covered with fine hairs. They tend to eat round holes in leaves rather than chewing in from the edge. They produce an abundance of fecal pellets that rattle down between the loose leaves of a developing cabbage head, producing contamination that is often more damaging than the holes in the leaves. The rapid-flying adult butterflies are white with black tips on the front wings. The females have two small black spots on the front wings, whereas the males have only one black spot on the front wings. Both sexes have one black spot on the front edge of the hind wings.

You may see another white butterfly with black spots, which is our native *Pieris napi* or mustard white. It will more likely be laying its eggs on native cruciferous plants like winter cress. It is usually seen in wooded areas on uncultivated, open spaces. If it does venture into your garden, it will likely be chased away by the imported cabbageworm butterflies, which are very aggressive. I have watched cabbageworm butterflies chase all other butterflies from my (their?) garden. That

makes me want to chase them, but they are too fast for me even with my butterfly net.

There are some biological controls against the cabbageworm, but none will completely eradicate this pest. One of America's first prominent entomologists, C.V. Riley, imported a braconid wasp parasite (*Apanteles glomeratus*) in 1883 in an attempt to control the imported cabbageworm butterfly. It helped, but not enough to eliminate the need for chemical pesticides. (See the section on parasitic wasps in the chapter on Hymenoptera for more information on how parasitic wasps help control pest populations.)

There are many other butterflies that you may see in Skagit County, but these are the only two that are potential pests in your garden.

***Pieris napi*. Mustard White**. Wingspan 1¾ inches. Larvae feed on plants of the mustard family. No photo.

***Pieris rapae*. Imported Cabbageworm**. Wingspan 1¾ inches. Larvae feed on crops such as cabbage, broccoli, and mustard. Photo p. 1.

Moths

Most of the moths that come to your garden fly at night so you do not see them. They lay their eggs on plants, and the eggs hatch into hungry caterpillars that you find chewing holes in leaves. Caterpillars are difficult to identify and also difficult to preserve. The adult moths are often illustrated in books, but it is necessary to know what their caterpillars look like and to learn which ones are likely to damage your garden.

A recent study of the night-flying moths of Skagit County has resulted in almost 200 different moth species in our collection. Not all of them have been identified to species, but recent publications from Oregon State University have made it possible to learn about their distribution and food habits. Some of them, such as the cutworm moths and the tent caterpillars, are garden and forest pests, but most of them do not cause any serious damage. The adult moths are not often seen because they fly at night and are short lived. The caterpillars are more obvious because they live longer and feed on the plants and trees in our gardens.

Our Skagit County insect collection contains only a fraction of the different kinds of moths to be found here because we have collected mostly in backyard gardens. There are many others in the forests and hills that we do not see in residential areas. A number of people have collected moths for us, but one individual, Cliff Matterand, who lives near Clear Lake, has collected more than 100 different kinds of moths at his porch light. It takes some persistence to check the wall near the light every morning early before the birds devour the moths. Thanks to Cliff Matterand's efforts over a period of several years, we have a good representation of the moths in the Clear Lake area, but only a small sample of moths from the rest of the county. Specimens can be killed and preserved if they are placed in the freezer as quickly as possible to prevent damage to the wings. When they are removed from the freezer, they need to be pinned and spread within 24 hours before

they become dry and brittle. We would welcome specimens from all parts of Skagit County to make our collection more complete.

Very few of the moths in our collection have common names, so we must use their genus and species names. The photographs in this book give you a glimpse of the variety and color to be seen in these little moths. They are even more fascinating if you study them under a microscope. All the intricate wing patterns are produced by the arrangement of colored scales, which is controlled by information coded in the DNA molecules of each species. We have much to learn about the life cycles and feeding habits of our Skagit County moths. Distribution maps and lists of plants used for food are more an indication of where entomologists have been than the actual distribution and habits of the moths.

Woollybears, Tiger Moths, and Fall Webworm (Arctiidae)

In the family Arctiidae, the fuzzy caterpillars of tiger moths are commonly known as woollybears. The most commonly seen woollybear caterpillar in Skagit County is the black one with orange in the middle. It is called the banded woollybear (*Pyrrharctia isabella*), and it will metamorphose into the Isabella tiger moth.

The fully grown caterpillars are often seen wandering in the yard and garden. They hatch from tiny eggs and grow by molting several times during the summer. They are not often seen until they are fully grown because they are small and hidden and they feed mostly on weeds, which is of no concern to gardeners. They are called general feeders because they eat almost any green plant, including grasses and stinging nettles. The mature caterpillars wander around looking for protected spots to make their cocoons and survive the winter. Those that do survive emerge as adult moths in the spring, and you may see them around your porch light at night. They have golden brown wings speckled with black spots. They are not unattractive, but they are nowhere near as colorful as their caterpillars.

The yellow woollybear caterpillar (*Spilosoma virginica*) does not look at all like its black-and-orange cousin. It is fuzzier and one solid color. Individuals vary from light cream to orange-yellow, but most are yellow, and they are all of the same species. They are also general feeders, but they are seen more frequently in the vegetable garden than the banded woollybear. This woollybear metamorphoses into the Virginia tiger moth.

Yellow woollybears are fond of the leaves of green beans and may even feed on the leaves of fruit trees. They are not usually abundant and may be tolerated or simply picked off and destroyed. The adult yellow woollybear moth also flies to lights at night and may be seen perched on the wall around the porch light when the sun comes up. This moth is snowy white with a few small black spots on the wings and some dark spots on the body. The underside of the head may have some orange color as if it has been drinking orange juice and hasn't cleaned its face.

You may wish to look up more information about these woollybears, and you may have trouble with common names. The black-and-orange one is correctly called the black-banded woollybear (as listed in the book of official common

names accepted by the Entomological Society of America), but it is also known by many common names. The yellow woollybear is also called the Virginia tiger moth because it was first described from a specimen collected in Virginia and given the species name *virginica*. The genus names have changed several times. The yellow woollybear was *Diacrisia virginica*, but now it is *Spilosoma virginica*. The banded woollybear was *Isia isabella*, but now it is *Pyrrharctia isabella*. So if you are looking in an old book and do not find a common name you recognize, you may have to look under the old genus names to find what you are looking for. Does that leave you thoroughly confused? Yes, so am I! Just as people's names have been changed and altered, so have insect names, and we will do our best to help you get them straightened out.

You can look at these woollybear moths in the Skagit County insect collection; however, the caterpillars are difficult to preserve so you will find very few of them. This is where good photographs are invaluable.

Another woollybear caterpillar in the family Arctiidae is the fall webworm (*Hyphantria cunea*). Many of our insect pests were imported from other countries, but this one is a native of North America. In fact, it hitched a ride to Europe and Asia, where it is now a pest also. It is not picky in its food habits and feeds on whatever broadleaf trees it can find, but it does not eat conifers. In our area, it seems to prefer black walnut, willow, and cottonwood, but it causes most concern when it attacks fruit trees.

The messy web nests of the fall webworm are usually less than 12 inches long. They are usually found at the tips of branches and look much like smaller versions of tent caterpillar nests. However, unlike tent caterpillars, which use their tents only for protection at night and during stormy weather, fall webworms enclose their feeding areas with webbing and do not venture outside them. When fall webworms eat all the leaves in their tent, they enlarge the tent to enclose more leaves. If you disturb the tent, they start making jerky movements in unison in an attempt to frighten away the enemy. These caterpillars are pale with a dark longitudinal stripe and long whitish hairs arising from knotty projections along their bodies, giving them an overall fuzzy appearance.

The fall webworm may have more than one generation during the summer in warmer climates. When the caterpillars mature, they crawl out of the tent and drop to the ground, where they spin cocoons in which to spend the winter as pupae. After the tree sheds its leaves in the fall, the ugly web tents are more obvious, which may be why they are called fall webworms.

The adult fall webworm moth emerges from its winter cocoon in the spring, after the leaves are on the trees. It lives only long enough to mate and lay eggs in a suitable host tree. The moths have white wings and at first glance they might be mistaken for the adult of the yellow woollybear. The webworm moths are smaller, however, with a wingspan of less than 1½ inches. Some, farther south, have black marks on the wings. They have some orange on the front legs and face, but not as much as the yellow woollybear moth and no orange or black spots on the body.

It is important to be able to distinguish between these moths because the fall webworm feeds on trees and the yellow woollybear feeds on weeds and gar-

den plants. If you see fall webworm moths flying to your porch light at night, do not spray your vegetable garden! The simplest way to control fall webworm on your backyard fruit trees is to cut off and destroy the web tents as soon as you see them. That may be all you need to do. If you see the tents on the trees in the fall after the leaves have dropped, it is too late. You will have to deal with this pest next spring. Read more about the fall webworm in WSU Extension Bulletin 0827, "Fall Webworm."

In addition to the woollybears, there are two more tiger moths in the family Arctiidae that are commonly found in Skagit County. Here again, both common names and genus names have been changed, so there will likely be some confusion if you try to find these tiger moths in the books.

The spotted tussock moth (*Lophocampa maculata*) has one of my favorite caterpillars. It is finely upholstered in colors that will remind you of the banded woollybear (black and orange), but it is embellished with white tufts in the black parts and contrasting black spots in the orange. It presents a comical sight as it crawls rapidly, waving its white tufts, black spots undulating as it moves. It feeds in a wide variety of deciduous trees including willow, oak, maple, birch, alder, and poplar. It is never found in large numbers on any one tree. Therefore the damage to the trees is usually minimal unless it attacks a small tree in your yard. Deciduous trees drop their leaves in the fall anyway, so maybe we can spare a few leaves each summer to feed this colorful little caterpillar.

Like other caterpillars of this family, the spotted tussock moth caterpillar makes a soft cocoon using its body hairs and silk produced by its salivary glands. It overwinters in the cocoon and emerges as an adult moth in the spring to mate and lay eggs for the next generation. The spotted tussock moth adult is a drab tan-colored moth with lightly defined darker blotches in the wings. It may be seen near porch lights in late spring or early summer.

The silver-spotted tiger moth (*Lophocampa argentata*), also a member of the tiger moth family, is capable of doing considerable damage to coniferous evergreen trees such as hemlock and fir. Therefore, it is considered an economic pest and may need to be controlled in our area. The caterpillars of the silver-spotted tiger moth live in groups. When a batch of eggs hatches in midsummer, the tiny caterpillars start feeding together on the host tree. Like most other caterpillars, they produce silk threads. As these caterpillars live and feed together, the threads form an ugly-looking mess that eventually covers the branch on which they are feeding. This messy "nest" provides some protection from birds and from insects that parasitize and feed on caterpillars.

The caterpillars continue to feed on the needles enclosed by the silken nest until they become dormant with colder winter temperatures. When the warmer temperatures of spring arrive, the caterpillars consume the remaining food within the nest and then disperse throughout the tree and feed individually until they are mature, usually some time in June. They then drop to the ground or return to the nest and spin cocoons from silk and body hairs. The adult moths emerge in a few weeks, usually in late summer, and lay egg masses on the tree's new growth. The eggs hatch in time for the caterpillars to build protective silken nests in which to spend the winter.

You will need to read WSU Extension Bulletin 1718, "Pest Management Options for Silver-Spotted Tiger Moth" to learn how this pest can be controlled. In 1954–55 an outbreak occurred in the forests of southern Vancouver Island, Canada, where it did considerable damage before being brought under control. Fir, hemlock, and spruce trees in people's yards are frequently attacked. Single isolated trees do not usually produce caterpillar populations that kill the tree, but even one ugly nest in a branch of a yard tree is undesirable.

Notice that the accepted common names of these two moths do not match their close relationship. One is called a tussock moth and the other a tiger moth, but they are both in the genus *Lophocampa*. The older name of the genus was *Halisodota,* which is still used in some books, so you may have to look under both names to find information about them. The species name *maculata* means spotted and *argentata* means silver spotted, which gives them their common names.

Hyphantria cunea. **Fall Webworm.** Wingspan ¾ inch. Larvae feed on leaves of broadleaf trees. Photo p. 1.

Lophocampa argentata. **Silver-Spotted Tiger Moth.** Wingspan 2 inches. Larvae feed on needles of hemlock, fir, and other conifers. Photo p. 1.

Lophocampa maculata. **Spotted Tussock Moth.** Wingspan 2 inches. Larvae feed on leaves of maple, alder, and other broadleaf trees. Photo p. 2.

Pyrrharctia isabella**. Banded Woollybear or Isabella Tiger Moth.** Wingspan 2 inches. Larvae feed on common weeds. Photo p. 2.

Spilosoma virginica. **Yellow Woollybear or Virginia Tiger Moth.** Wingspan 2 inches. Larvae feed on leaves of weeds and garden plants. Photo p. 2.

Tussock Moths (Lymantriidae)

Lymantriidae are closely related to Arctiidae.

Orgyia antiqua. **Rusty Tussock Moth.** Wingspan 1 inch. Larvae feed on leaves of broadleaf trees and conifers. Photo p. 3.

Tent Caterpillars (Lasiocampidae)

The nests of tent caterpillars are commonly seen in early spring after the leaves of the trees are fully formed. They feed on trees such as alder, birch, and maple, but they are also fond of the leaves of the fruit and shade trees in our yards. They do not usually kill trees because they finish feeding early, leaving trees time to grow new leaves. Their messy web nests spoil the appearance of trees, and in fruit trees the webbing interferes with the development of fruit.

The western tent caterpillar (*Malacosoma californicum*) is the one most commonly seen in our area. The female lays her eggs in a band of foam wrapped around a twig, and the foam hardens into a coat that protects the eggs from hungry predators throughout the winter. When the eggs hatch in early spring, the little caterpillars quickly build a nest of silk webbing to protect themselves. When the leaves that are enclosed in the nest are consumed, the nest is enlarged until the

caterpillars are large enough to venture forth in search of more leaves. After that, the tent is just a place to spend the night and wait out stormy weather. As many as 100 caterpillars from one nest can consume the leaves from a large part of a tree, and if there are several nests, the tree will look bare and dead until it grows more leaves.

Tent caterpillars are fully grown by late spring or early summer, when they drop to the ground or hide in rough bark to spin their cocoons. They spend two to three weeks in the cocoon, changing from caterpillars to moths by midsummer. The male moths are smaller and darker than the females, and they have slightly different wing patterns. Some of the moths survive several weeks after mating and laying eggs. I have collected them at my yard light as early as the middle of June and as late as the first week in August. There is usually only one generation per year in our area.

One method of control is to destroy the nests. If you do that during the day, the caterpillars will be out feeding on fresh leaves, so you need to wait until evening, when they will be home for the night. Birds help control tent caterpillars by eating them both as caterpillars and as moths. There are also many other predators, parasites, and diseases that keep the population in check, but sometimes the moths escape, and for several years they increase until it seems like they are going to strip every tree in the county. With more caterpillars for food, enemies increase also and in a few years the tent caterpillar population begins to dwindle. Cycles like that are common in the insect world.

The tent caterpillar family includes several other members that feed on the leaves of trees. The lappet moth (*Phyllodesma americana*) is common and widespread in our area, but because the caterpillars are solitary and do not build web tents, they are not thought of as tent caterpillars, but they are similar in food habits, feeding on tree leaves. Scattered through the trees, they consume a leaf here and there, but they are not considered harmful to the trees. Adult lappet moths are reddish brown, about the same size as tent caterpillar moths, but they have a distinctive shape when at rest as the outer edges of their wings are notched.

Another member of the family is *Tolype distincta*, a fuzzy little gray moth that is widespread in western North America. The caterpillars feed on evergreen trees, but they do not make web tent nests and are scattered, so they do not seriously harm the trees. The adult moths may be seen flying in late summer or early fall. I have collected them in September here in Skagit County.

Remember, tent caterpillars do their feeding in spring and early summer, so if you see web nests with live caterpillars at any other time of year, they are not likely to be tent caterpillars. They could be fall webworms on deciduous trees or silver-spotted tiger moths on conifers.

Malacosoma californicum. **Western Tent Caterpillar.** Wingspan 1½ inches. Larvae feed on leaves of alder, maple, apple, and other broadleaf trees. Photo p. 3.

Phyllodesma americana. **Lappet Moth.** Wingspan 1¼ inches. Larvae feed on leaves of alder, maple, and other broadleaf trees. No photo.

Tolype distincta. Wingspan 1 inch. Larvae feed on hemlock and fir. No photo.

Inchworms and Loopers (Geometridae)

This very large moth family is named for its caterpillars, which crawl by extending their head ends forward and holding on with their legs while pulling their long slender bodies into a loop, then moving forward with a looping action. The geometrid moths typically have wing patterns that include vertical wavy lines. We have specimens of 60 different species in the Skagit County insect collection. They feed mostly on the needles and leaves of trees. Many do not have common names.

One that is often seen in our forests is *Triphosa haesitata*. Its caterpillars feed on the leaves of the cascara tree, so we could call it the cascara looper. The hemlock looper (*Lambdina fiscellaria*) sometimes kills hemlock trees by defoliation. Another geometrid we see commonly in our area is *Euchlaena tigrinaria*, whose caterpillars feed on hazelnut and willow leaves. I have also found it on other shrubs and trees. Much needs to be done to determine which caterpillars produce which moths. The books we have do not illustrate the caterpillars for many of the moths we have collected in Skagit County. Someone needs to collect the caterpillars and feed them until they pupate and then keep them until the moths emerge. Photographs of the caterpillars, their food plant, and the adult moth would be valuable information for future publications.

Euchlaena tigrinaria. Wingspan 1½ inches. Larvae feed on hazelnut and other broadleaf trees. Photo p. 3.

Hydria undulata. Wingspan 1½ inches. Photo p. 4.

***Lambdina fiscellaria*. Hemlock Looper.** Wingspan 1¾ inches. Larvae feed on needles of hemlock. No photo.

Nemoria darwiniata. Wingspan 1¼ inches. Larvae feed on leaves of broadleaf trees. Photo p. 4.

Pero mizon. Wingspan 1¼ inches. Larvae feed on hazelnut and dogwood. Photo p. 4.

***Triphosa haesitata*.**Wingspan 1¼ inches. Larvae feed on leaves of cascara. Photo p. 4.

Cutworms (Noctuidae)

One of the largest families of moths in the order Lepidoptera is the family Noctuidae. To date, 650 species have been identified from Washington State and many of these occur in Skagit County. The name refers to the nocturnal habits of both the adult moths and the caterpillars. They are difficult to identify because they look so much alike, but it is important to know which is which because the caterpillars have different eating habits. Some are general feeders, eating almost anything green. Others are more specific like the western bean cutworm (*Loxagrotis albicosta*), which feeds on the roots of grasses and corn. If you plant your vegetable garden in an area that was previously used for grasses, grains, and corn you may find this cutworm feeding on your vegetables for a year or two.

Gardeners are often startled to find their small transplanted cabbage and broccoli plants snipped off right at the surface of the ground. Cutworms live in loose garden soil. They come out at night to feed, and as they wander over the surface of the soil, about the only thing they find to eat are those succulent green stems, and they can easily snip them off with their sharp mandibles.

Some cutworms climb up plants to feed on the tender new leaves. The cabbage looper (*Trichoplusia ni*) and the alfalfa semi-looper (*Autographa californica*) are common examples of cutworms that chew holes in the leaves of cole crops such as cabbage and broccoli. They are difficult to see when they are newly hatched, and they often feed on the undersides of leaves. As they get larger, they chew holes in the leaves and their fecal pellets rattle down into the developing cabbage heads making them unusable for us to eat.

WSU Extension Bulletin 1892, "Recognizing Economically Important Caterpillar Pests of Pacific Northwest Row Crops," is illustrated with color photos of the caterpillars and moths of the common cutworms of our area. Since cutworms are serious economic pests, they are being studied intensively, but much is yet to be learned about them and only the most common ones are covered in the literature.

Autographa californica. **Alfalfa Semi-Looper Moth.** Wingspan 1½ inches. Larvae feed on cabbage. No photo.

Behrensia conchiformis. Wingspan 1¼ inches. Photo p. 5.

Catocala aholibah. **Aholibah Underwing Moth**. Wingspan 2½ inches. Larvae feed on leaves of broadleaf trees. Photo p. 5.

Egira rubrica. Wingspan 1¼ inches. Photo p. 5.

Feralia comstocki. Wingspan 1¼ inches. Photo p. 5.

Loxagrotis albicosta**. Western Bean Cutworm.** Wingspan 1¼ inches. Larvae feed on beans and corn. No photo.

Trichoplusia ni**. Cabbage Looper.** Wingspan 1¼ inches. Larvae feed on cabbage. No photo.

Some Other Moth Families in Skagit County

Prominents (Notodontidae)

Clostera apicaulus. Wingspan 1¼ inches. Photo p. 5.

Thyatirids (Thyatiridae)

Habrosyne scripta. Wingspan 1½ inches. Photo p. 5.

Hooktip Moths (Drepanidae)

Drepana arcuata. Wingspan 1½ inches. Photo p. 6.

Giant Silk Moths (Saturniidae)

***Antheraea polyphemus*. Polyphemus Moth**. Wingspan 4 inches. Photo p. 6.

Sphinx Moths (Sphingidae)

***Smerinthus cerisyi*. Cerisy's Sphinx Moth**. Wingspan 2¾ inches. Photo p. 6.

Micromoths (Microlepidoptera)

There are hundreds of kinds of tiny moths, such as the codling moth that eats apples, the clothes moth in our closets, and the many little green "worms" that chew holes in leaves. Entomologists informally group these together under the general term "micromoths" and only those of economic importance are well known. Someone could spend a lifetime collecting, identifying, and learning about the micromoths of Skagit County.

We frequently see leaves with holes chewed in them early in the season while the leaves are young and tender. This is evidence of feeding by small caterpillars that finish their growth in early spring and then overwinter as pupae to emerge as small moths just as the leaves are growing. It does not take much leaf to feed these little caterpillars, so usually the leaf continues to grow in spite of the holes, and the plant or tree is not damaged except in appearance. Other micromoths, the leafrollers or leaf-tiers, use the leaf for protection as well as for food. Some eat only the soft part of the leaf, leaving the leaf veins as a skeleton of the leaf, so they are called leaf skeletonizers. Others chew tunnels in the tissue between leaf surfaces as they feed, and they are called leaf miners.

Some micromoths are household pests. The Mediterranean flour moth (*Ephestia* kuehniella) and the Indian meal moth (*Plodia interpunctella*) are both common in Skagit County. Their caterpillars feed on stored grain products, such as flour, dry cereals, and dry pet food. The clothes moth (*Tineola bisselliella*) is an ever-present threat to woolen fabrics.

Several micromoths are garden pests. The codling moth larva (*Cydia pomonella*) feeds on apples, and the apple ermine moth (*Yponomeuta mallinellus*) eats the leaves of the apple tree. A close relative of the codling moth, the pea worm moth (*Cydia nigricana*), lives inside pea pods and makes an ugly mess as it feeds on the green peas. You have probably seen a plume moth of the family Pterophoridae resting on the outside of a window at night. It is shaped like a capital letter T when its wings are tightly folded, but when they are unfurled, the wings are made up of delicate plumes. Most plume moth caterpillars feed on weeds, but one eats the buds of blackberries.

There are many other micromoths in Skagit County, and you are more likely to see the damage they cause from feeding rather than the little moths or caterpillars.

Clothes Moths (Tineidae)

Tineola bisselliella. **Webbing Clothes Moth**. Wingspan ½ inch. Larvae feed on woolen fabric. No photo.

Leafroller Moths (Tortricidae)

Choristoneura rosaceana. **Oblique Banded Leafroller**. Wingspan ⅝ inch. Photo p. 7.

Cydia nigricana. **Pea Worm Moth**. Wingspan ½ inch. Larvae feed on green peas in the pod. No photo.

Cydia pomonella. **Codling Moth**. Wingspan ½ inch. Larvae feed on apples, pears, and other fruits. Photo p. 7.

Plume Moths (Pterophoridae)

There are several different kinds in our area, and they are difficult to identify. No photo.

Snout Moths (Pyralidae)

Ephestia kuehniella. **Mediterranean Flour Moth**. Wingspan ½ inch. No photo.

Plodia interpunctella. **Indian Meal Moth**. Wingspan ½ inch. Larvae feed on stored grain products. Photo p. 7.

Ermine Moths (Yponomeutidae)

Yponomeuta mallinellus. **Apple Ermine Moth**. Wingspan ½ inch. Photo p. 7.

Beetles (Coleoptera)

There are more different kinds of beetles in the world than any other kind of insect, and that is also true in Skagit County. We have 170 different kinds of beetles in the Skagit County insect collection and there are many more to be added. Many of the beetles that are of economic importance are very small and difficult to identify without a microscope. Many of the photographs in these pages are taken through the microscope so the actual size is given in each case.

Beetles are in the order Coleoptera, which refers to their hardened wing-covers. The Greek word *coleo* means sheath and *ptera* means wing. Beetle larvae are called grubs. They are very small when first hatched. Most of their growth takes place during the grub stage, so that is when most of the feeding takes place. Most adult beetles eat very little because they do not increase in size. Beetle grubs are difficult to preserve and identify, so the adults are what are more commonly seen and collected. The presence of the adult beetle is an indication that there are larvae nearby. By collecting and identifying the adults, we can learn about the beetles' habits and what, if anything, needs to be done to control them.

One of the easiest ways to organize a large insect order like Coleoptera is by family. There are more than 100 families of beetles found in North America, and we have 43 families represented in our collection, most of them by only a few species. Some of the larger families like Carabidae, the ground beetles, and Cerambycidae, the long-horned beetles, are more common in our area, and we have many species in the collection with no doubt more to be added.

Ground Beetles (Carabidae)

Ground beetles live in moist places where there is a lot of organic matter. Your garden is that kind of place, and you will find many ground beetles there hiding under grass or plants. Both larvae and adults are predaceous, which means they capture and eat other creatures such as caterpillars, insect eggs and larvae, and even snails and slugs. That places them in the category of beneficial insects, which means they help us control pests. However, they are not selective and will capture and eat other beneficial insects as well. They are a part of the biological control system that helps keep all populations from expanding too rapidly. If the ground beetles were able to capture and eat all the caterpillars, slugs, and insects in their environment, they would starve.

Ground beetles lay their eggs under stones or leaf litter. When the larvae hatch, they remain under cover in the soil and leaf litter, where they find plenty of small insects or the eggs and larvae of other insects to eat. The larvae do not look like the adult beetles. They have short legs and elongated, segmented bodies. They are most active at night, the same time cutworms are chewing away. If it were not for the ground beetles, we would see much more damage from cutworms than we do. The ground beetle larvae eat more cutworms than the adult beetles because they are growing and require more food than the adults. Most ground beetle larvae complete their growth in one summer and change to their dormant pupal stage for the winter, emerging the next spring as beetles. Often the adults live for two to three years.

We have 10 species of ground beetles in the Skagit County insect collection, but that is only a small fraction of the many kinds that are out there in gardens, lawns, and woods. They are mostly active at night and hide during the day. When you work in your garden, you see them running for cover. You may be able to increase the ground beetle population in your yard by providing them with suitable habitat. Fortunately most good gardeners have a few weed patches and grassy areas adjacent to their clean gardens where ground beetles can hide and find food.

The following ground beetles are in the Skagit County insect collection. There are also some that we have not yet been able to identify. Few of them have common names.

Carabus granulatus. Length ¾ inch. Introduced to our area from the eastern United States. Common in damp woodlands. The species name, *granulatus,* refers to the pebbly texture of its wingcovers. Photo p. 8.

Cychrus tuberculatus. Length ¾ inch. Commonly seen where there are snails and slugs for it to feed on. The elongated front part of the body allows it to eat a snail in the shell. It also eats other small insects. Photo p. 8.

Harpalus aeneus. Length ⅜ inch. The genus name comes from the Greek word *harpaleos,* which means grasping, and probably refers to its predaceous habit. *Aeneus* is the Latin word for copper, and you can see its coppery sheen in the picture. Photo p. 8.

Lebia moesta. Length ¼ inch. This one is commonly seen in lawns and dense weeds, crawling up on the plants even during the day, where it feeds on insect eggs and small insects. No photo.

Notiophilus aeneus. Length $^{3}/_{16}$ inch. The name is from two Greek words: *notios* meaning wet and *philos* meaning love. *Aeneus* is a Latin word meaning copper. It could be called the copper-colored beetle that loves wet places. It lives in damp forest litter and feeds on small insects like springtails (Collembola). It is active both at night and during the day. No photo.

Pararguto r lustrans. Length $^{5}/_{16}$ inch. This little ground beetle is commonly found in dry leaf litter and under rocks, where it feeds on small insects. Photo p. 8.

Pterostichus castaneous. Length $^{5}/_{16}$ inch. The species name comes from the Latin word *castaneous,* which means chestnut brown. This small ground beetle is commonly found on damp ground. In addition to feeding on other small insects, it has been observed eating seeds. No photo.

Pterostichus vulgaris. Length ½ inch. This ground beetle was introduced to our area many years ago and is now very common on moist ground. Photo p. 8.

Scaphinotus marginatus. Length ¾ inch. Both adults and larvae of this nocturnal ground beetle eat snails and small slugs. They also eat caterpillars. This one is found from California to the Alaskan tundra. The genus name is from the Latin

and means boat-shaped back. The species name refers to a margin of color around the body. Photo p. 8.

Tiger Beetles (Cicindelidae)

We do not find as many different kinds of tiger beetles in Skagit County as there are on the drier side of the mountains. Most of them are colorful, in shades of iridescent blue and green with white markings. The larvae of tiger beetles live in small holes that they dig vertically in the ground. They are predaceous and reach out with their needlelike jaws to grab any insect that happens to run over their hiding place. The adults are good fliers and can also run rapidly to capture other insects for food. Their fearsome-looking jaws make me thankful they are not large creatures.

Omus dejeani. Length ¾ inch. This is a common tiger beetle in Skagit County and may be found in your garden. It is entirely black and resembles the large ground beetles. Found only on the Pacific Coast, it is predaceous, nocturnal, and flightless. Photo p. 9.

Predaceous Diving Beetles (Dytiscidae)

Ponds and streams are where these beetles live, and the adults have good wings and fly from one pond to another. They fly mostly at night, so they may be attracted to your yard light and end up on your porch instead of in the pond. Both the larvae and the adults are predaceous. The larvae are called water tigers because they attack and eat anything they can overpower, including tadpoles and minnows. The larvae breathe with gills, so they do not need to come to the surface, but the adults carry their air supply trapped between their folded wings and their bodies. They come to the surface periodically to get a fresh supply of air and can remain underwater for a considerable time.

Colymbetes exaratus. Length ⅝ inch. From the Greek word *kolymbos* or diver. Found in Skagit County ponds. Photo p. 8.

Dytiscus hatchi. Length ⅞ inch. From the Greek words *dyt* meaning diver and *iscus* meaning little. Found in Skagit County ponds and streams. Named in honor of Melville Hatch, a professor at the University of Washington who wrote a five-volume set on the beetles of the Pacific Northwest. The male and female of this species are quite different. The female has ridges on her back; the male is shiny smooth. The male also has suction pads on his front legs. Photo p. 8.

Rhantus hoppingi. Length ⅜ inch. From the Greek word *rhantos* or water sprinkler. A smaller version of *Dytiscus hatchi*. No photo.

Whirligig Beetles (Gyrinidae)

These tiny beetles live on the surface of ponds and, as their name implies, they move rapidly in irregular circles when disturbed. They feed mostly on dead insects floating on the surface, but they can dive and swim underwater, where they feed on dead animal matter. Their eyes are divided so that when they float on the

surface, the part of the eye below the surface sees underwater and the part of the eye above the surface sees above the water. The larvae breathe underwater with gills and feed on other aquatic insects.

***Gyrinus* sp**. Length $^{3}/_{16}$ inch. In our area adults may be seen on temporary ponds that dry up in summer, but they lay their eggs in permanent lakes and streams, where the larvae live. The adults fly from one pond to another. Photo p. 8.

Carrion Beetles (Silphidae)

These beetles are part of nature's clean-up crew. Their larvae dispose of dead birds and mice and even larger animals.

Necrophilus hydrophiloides. Length ⅜ inch. Occasionally found in damp compost piles, where it feeds on decaying vegetation. Also feeds on carrion and dead insects. Photo p. 9.

Necrophorus vespilloides. Length ½ inch. Sometimes called the burying beetle or sexton beetle (a sexton looks after graveyards). Commonly found with dead animals, where the female lays her eggs and the larvae feed. Photo p. 9.

Round Fungus Beetles (Leiodidae)

Most people are unaware of these tiny beetles, but they are an important part of our Skagit County ecosystem.

Agathidium jasperinum. Length ⅛ inch. No photo.

Sciodrepoides watsoni. Length ¼ inch. These little beetles are found in our area feeding on decaying fungi. No photo.

Rove Beetles (Staphylinidae)

This large family of beetles is well represented in Skagit County. We currently have 12 species in our collection, and there are probably at least twice that many that we have yet to collect and identify. They are mostly predators and scavengers and are considered beneficial in the garden because they capture and eat other insects. They vary greatly in size from $^{1}/_{32}$ inch to over 1 inch long. They run rapidly and usually stay hidden during the day, so they are not often observed. If you can get one to stop long enough to look at it, you will see that it has short wing-covers and a slender body. When disturbed, they often lift up the tail ends of their bodies like scorpions, but they have no stingers and are too small to hurt you. In our area, one species, *Pelecomalium testaceum,* is often seen on skunk cabbage blossoms, and I have seen it in large numbers in the blossoms of my apple trees. It is probably sipping nectar and might help in pollination, but only to a limited extent because it does not gather pollen like bees do. All the other rove beetles in the following list live in moist leaf litter or under vegetation, where both adults and larvae capture and eat small insects.

Aploderus linearis. Length ⅛ inch. No photo.

Deleaster concolor. Length ½ inch. Photo p. 10.

Micropeplus brunneus. Length ⅛ inch. Photo p. 10.

Oxytelus nitidulus. Length $^{3}/_{16}$ inch. No photo.

Parothius californicus. Length ⅛ inch. No photo.

Pelecomalium testaceum. Length $^{3}/_{16}$ inch. Photo p. 10.

Pseudohaida rothi. Length $^{3}/_{16}$ inch. Photo p. 10.

***Quedius (Distichalius)* sp**. Length ⅜ inch. No photo.

Tachyporus chrysomelinus. Length ⅛ inch. No photo.

Feather-Wing Beetles (Ptiliidae)

At less than $^{1}/_{32}$ inch long, these are considered to be the smallest of all beetles. The Greek word *ptilo* means feather, and as the name implies, the hind wings are plumed like feathers, but that feature is not readily visible because of the beetles' small size and because their hind wings are usually folded up beneath their hard wingcovers. These little beetles are common, but rarely seen because of their small size. They are most often found in decaying leaf litter, but may also be found under mammal dung, in moist, rotten wood, and in ant nests. They feed on fungal spores and decaying organic matter.

Acrotrichis castanea. Length $^{1}/_{32}$ inch. So far, we have found this one only in decaying leaf litter. It is part of the recycling crew. Photo p. 10.

Net-Winged Beetles (Lycidae)

The name net-winged refers to the surface of the wingcovers, which are covered in a network of small ridges. The bright colors of these beetles warn predators that they taste bad and so provide some protection from enemies. The adults visit flowers to feed on nectar. The larvae feed on decaying wood and fungi.

Dictyopterus hamatus. Length ½ inch. No photo.

Dictyopterus simplicipes. Length ⅜ inch. Photo p. 10.

Fireflies (Lampyridae)

Most people are surprised to learn that we have fireflies in Skagit County. Ours are similar to eastern fireflies in structure but different in color, and they do not make any light. Although they are commonly called fireflies or lightning bugs, these insects are neither flies nor bugs but beetles in the order Coleoptera and the family Lampyridae.

Our western firefly (*Ellychnia* sp.) is abundant in wooded areas and can also be seen in gardens and orchards throughout Skagit County. The adults are not strong fliers, but they do fly readily and are most active around fruit trees in bloom in the spring. They appear to be feeding on pollen and nectar, and they may do some pollinating even though they do not collect pollen like fuzzy bees do. They feed on small insects, and along with the lady beetles, they help control

aphid populations. The predaceous larvae live in leaf litter, where they feed on small insects, insect eggs, and other larvae.

Ellychnia greeni. Length ⅜ inch. The adults have reddish orange spots on the thorax. No photo.

Ellychnia hatchi. Length ⅜ inch. Similar to *E. greeni.* Photo p. 11.

Phausis rhombica. Length $^{3}/_{16}$ inch. Smaller and less colorful than *Ellychnia* sp. No photo.

Soldier Beetles (Cantharidae)

This is a large family of beetles that feed on other insects, especially aphids. We have identified only three species in one genus. There are many others, but they are difficult to identify. The adults feed on the nectar of flowers as well as on aphids.

One soldier beetle that was brought to me at a Master Gardener plant clinic for identification looked different from any I had seen before. It was the usual black color, but its feet were all white. That puzzled me, and I took it home for further study. I was able to key it out to the genus *Podabrus,* but no species was described with white feet. I began to wonder if this could be a new species of soldier beetle found only in Skagit County. Should we publish a description and name it *Podabrus blancopodia* (*blanco* meaning white and *podia* meaning feet)? The next week at clinic I asked the person who had brought me the white-footed soldier beetle to tell me where he had found it. He said it had flown to a rhododendron bush next to where he was painting his house. And what color was he painting his house? White! Mystery solved. The black soldier beetle had walked across fresh white paint.

Podabrus cavicollis. Length ¼ inch. Photo p. 11.

Podabrus pruinosus. Length ½ inch. Photo p. 11.

***Podabrus* sp**. Length ¼ inch. Photo p. 11.

Flower Beetles (Melyridae or Malachiidae)

The name Malachiidae, from the Greek word *malakia* or soft, implies soft wingcovers instead of the hard wingcovers of most beetles. The adults are commonly seen in flowers and are often dark green or metallic blue. They are probably sipping nectar and eating pollen. The larvae are mostly on the ground under cover and feeding on other insects, either dead or alive.

***Anthocomus* sp.** Length $^{3}/_{16}$ inch. No photo.

Malachius aeneus. Length ¼ inch. Introduced from Europe; first seen in British Columbia, Canada, in 1922. No photo.

Soft-Bodied Plant Beetles (Dascillidae)

Araeopidius monachus. Length ⅜ inch. This is the only member of this family that is currently in our collection, but there are probably others. There is very little known about them. They resemble click beetles and are thought to feed on decayed vegetation. No photo.

Checkered Beetles (Cleridae)

These are colorful beetles with contrasting light and dark spots. They are predaceous on other insects, both as larvae and as adults.

Enoclerus sphegius. **Red-Bellied Clerid**. Length ⅜ inch. It captures and feeds on bark beetle larvae and is considered an important part of the biological control of bark beetles. Photo p. 11.

Minute Brown Scavenger Beetles (Lathridiidae)

The small size of these beetles ($^{1}/_{16}$ inch) makes them difficult to find and identify. They are not uncommon and are mostly found in leaf litter or decaying plant material, where they feed on the spores of fungi. Only three species have been collected and identified in our Skagit County insect collection, but there are most likely many more yet to be found.

Corticaria valida. Length $^{1}/_{16}$ inch. No photo.

Melanophthalmus distinguenda. Length $^{1}/_{16}$ inch. No photo.

Melanophthalma pumila. Length $^{1}/_{16}$ inch. No photo.

Sap Beetles (Nitidulidae)

The name refers to the habit some sap beetles have of feeding on fermenting plant juices, but mostly they feed on decaying fruit and fungi.

Cateretes pennatus. Length ⅛ inch. This one is distinctive in that it is found on flowers, where it feeds on the developing seed capsule. No photo.

Lady Beetles (Coccinellidae)

Common names frequently refer to the habits or appearance of an insect, but the origins of many common names are unknown. Some books say the name ladybug has a religious connotation. Most people remember the children's rhyme, "Ladybug, Ladybug, Fly Away Home." Like many other common insect names, ladybug is a taxonomic error because this insect is a beetle, not a bug, but we call it a ladybug anyway because that is the name most people know.

One of the most widely known lady beetles is the one offered for sale in gardening catalogs. Its common name is the convergent lady beetle because of two converging white lines on the thorax behind the head. Its species name is *Hippodamia convergens,* which also refers to the converging white lines. The convergent lady beetle is collected during the winter, when it is found hibernating in clusters of thousands at the base of trees in the forest. In the spring, these lady

beetles are mailed to gardeners, who purchase them to control aphids on their rose bushes. The beetles' instinctive reaction when they wake from hibernation is to fly back to the gardens and fields they came from. Consequently, they may not stay where they are released, especially if there are no aphids around. Eventually, they settle down in a place with lots of aphids, where they lay their eggs.

Adult lady beetles do eat aphids, but not as many as the hungry, rapidly growing larvae. Unfortunately, most people do not recognize the ugly larvae as even related to lady beetles, and they often try to destroy them, thinking they are a dangerous pest. The pupae are also mistaken for something harmful because they are fastened to a leaf or fruit by a pointed structure that looks like a beak, but is actually the tail. Finally, when the adult lady beetles emerge from their pupae, people recognize them as their friends. You can do a lot of good by teaching people to recognize lady beetle larvae and pupae so they do not harm them.

There are more than 40 different species of lady beetles found in the Puget Sound Basin. We have collected and identified 15 species in Skagit County. Two common species here are the seven-spotted lady beetle (*Coccinella septempunctata*) and the western blood-red lady beetle (*Cycloneda polita*). At my place, I see the seven-spotted lady beetle mostly in the garden and the western blood-red lady beetle on my apple trees.

Each year people bring to the Master Gardener plant clinic a small beetle less than ⅛ inch long that they find on fruit trees, especially apple, wanting to know what it is and what it is doing. It is good to be able to tell them it is the 20-spotted lady beetle (*Psyllobora vigintimaculata*) and not to worry about it. Actually it does not feed on aphids, but rather it eats the mildew on leaves. It does not do any good, but it is not harmful either, so there is no need to try to get rid of it. I wonder how many people have sprayed their apple trees to destroy a harmless little ladybug. I mean lady beetle!

Many people ask about the lady beetles that invade their houses in the late fall when the weather turns cold. These lady beetles often come by the hundreds and crawl into everything. Most people recognize lady beetles as beneficial insects, and they are therefore reluctant to kill them, but they want to know where they come from and why they are in the house rather than out in the garden where they belong.

These house invaders are multicolored Asian lady beetles (*Harmonia axyridis*) imported from China and Japan to help control insect pests of trees. They were released many times from as early as 1916 in California and from 1978 to 1985 in Washington State, but they did not seem to survive in their new environment. In 1993, large populations of Asian lady beetles suddenly appeared in western Washington. It is not known whether these were from earlier introductions that took many years to become established or from more recent unintentional introductions through commercial freight shipments from Asia.

Our native lady beetles, of which there are at least 15 species commonly found in western Washington, are rarely seen in houses, whereas Asian lady beetles aggressively search for ways to get inside when the weather turns cold. In their Asian homelands, they fly to cliffs and rocky hillsides in the fall to hibernate in cracks and crevices, where they find some protection from enemies and ex-

treme cold. Here in Washington State, this instinctive pattern of behavior takes them to the south-facing walls of houses, where the sun provides some warmth in the shorter days of fall. I have observed hundreds of Asian lady beetles crawling on the south side of my two-story house on a sunny fall day. They are persistent in their search for small openings and even good window screens do not keep them out. Once inside, they crawl and fly everywhere looking for hiding places to spend the winter. They awaken in the longer days of spring and try to return to the forest. Only a small fraction of the invaders survive the extremely low humidity of our heated houses through the winter, but there are always enough left to make the occupants of the house think they are being invaded for a second time.

How can you tell if a lady beetle is one of our native species or the Asian? All lady beetles exhibit variability in color patterns, but *Harmonia axyridis* is the most extreme in this regard. It mimics most of our natives, including those with many spots, those with no spots, and almost everything in between. There is one characteristic, though, that only the Asian lady beetle has, and that is the preapical transverse elytral ridge! Do not let that awesome description discourage you. The close-up photograph of the tips of the wingcovers shows a small ridge that looks like it was pinched up between two fingers when soft and then hardened that way. That structure is just as variable in this species as its spots, so you may have to examine some specimens carefully under the microscope and even then use your scientific imagination to see a ridge. In other specimens the ridge may be so obvious you do not need the microscope to see it. There are other ways of recognizing the Asian lady beetle, but only if you are an expert in the field of insect morphology.

So, whether you call them ladybugs or lady beetles, these little creatures are an important part of our ecosystem, and we need to learn more about how to identify them and how to live with them.

Adalia annectans. Length $^{3}/_{16}$ inch. No photo.

Adalia bipunctata. **Two-Spotted Lady Beetle**. Length $^{3}/_{16}$ inch. No photo.

Calvia guttata. Length $^{3}/_{16}$ inch. No photo.

Coccinella nivicula monticola. Length ¼ inch. No photo.

Coccinella septempunctata. **Seven-Spotted Lady Beetle**. Length ¼ inch. Photo p. 12.

Coccinella subversa. Length $^{3}/_{16}$ inch. No photo.

Coccinella trifasciata. Length $^{3}/_{16}$ inch. No photo.

Cycloneda polita. **Western Blood-Red Lady Beetle**. Length $^{3}/_{16}$ inch. Photo p. 12.

Harmonia axyridis. **Multicolored Asian Lady Beetle**. Length ¼ inch. Photo p. 12.

Hippodamia convergens. **Convergent Lady Beetle**. Length ¼ inch. No photo.

Mulsantina picta. **Pine Lady Beetle**. Length ⅛ inch. No photo.

Psyllobora vigintimaculata. **20-Spotted Lady Beetle**. Length $^{1}/_{16}$ inch. Photo p. 12.

***Stethorus punctum*. Spider Mite Destroyer**. Length $^{1}/_{16}$ inch. This tiny black lady beetle feeds on mites, especially *Tetranychus,* the spider mite. It does not look like a lady beetle. Besides being so small, it is not shiny like most lady beetles but is covered with minute hairs. Photo p. 12.

Flat Bark Beetles (Cucujidae)

As the name implies, these beetles are strongly compressed from top to bottom making them flat and thin. This allows them to move freely in restricted places such as under the dead, loose bark of trees. Some are predaceous, feeding on bark beetles and other insects, and some feed on the wood or fungi found there. One that is of great economic importance feeds on stored grain.

Cucujus clavipes. **Red Flat Bark Beetle**. Length ½ inch. Predaceous on bark beetles and wood borers. Photo p. 13.

Dendrophagus glaber. Length ¼ inch. From the Greek words *dendro* meaning tree and *phagus* meaning eat, and the Latin word *glaber* or smooth. Photo p. 13.

Oryzaephilus surinamensis. **Saw-Toothed Grain Beetle**. Length ⅛ inch. From the Greek words *oryza* meaning grain and *philus* meaning loving. A widespread common pest of stored grain products, especially flour and milled grain products. The name saw-toothed refers to the jagged edges of the area between the base of the head and the wings. Photo p. 13.

***Oryzaephilus mercator*. Merchant Grain Beetle**. Length ⅛ inch. So similar to *O. surinamensis* that it is difficult to tell them apart. No photo.

Pediacus depressus. Length ¼ inch. Found under the bark of hemlock trees. No photo.

Silvanus bidentatus. Length ¼ inch. Found under bark feeding on fungi. No photo.

Handsome Fungus Beetles (Endomychidae)

Fungus beetles obviously feed on fungus, but why "handsome" is not clear. Some have colored spots on the wing covers. Some are host specific, feeding on only one kind of fungus, but most feed more generally on fungi.

Mycetina idahoensis. Length ¼ inch. First discovered in Idaho, but later found to be widespread as a fungus feeder. No photo.

Cylindrical Bark Beetles (Colydiidae)

A small family of fungus beetles.

***Namunaria pacificus*.** Length ⅛ inch. Feeds on tree fungi. No photo.

Carpet or Skin Beetles (Dermestidae)

These beetles are frequently brought to Master Gardener plant clinics from clients' houses, especially when they find large numbers of them crawling and flying around the kitchen. The name carpet beetle comes from the days when carpets were made of wool. The larvae prefer to eat animal products, and the sheep's wool in carpets provided them with an abundant source of food in a warm, protected environment. It was not uncommon for the person cleaning the carpets with a sweeper or vacuum cleaner to pick up tufts of carpet, leaving large bare spots. Most often that happened in protected places behind or under heavy furniture. The beetles were feeding on the underside of the carpet, undetected until the damage was done.

Carpets are now mostly made of synthetic fibers that are not eaten by beetles, but we still use the name varied carpet beetle (*Anthrenus verbasci*). This is the one we see frequently in our area, and it was found in Seattle as early as 1917. These beetles are attracted to any dried animal material for their food, so woolen garments or fabrics are subject to their attacks. Museums have to be constantly alert to protect animal skins. Our insect collection would be a delectable feast for these little beetles. That is why we must keep it properly fumigated and the door tightly closed to protect it. Without protection, our collection would soon be nothing more than powder on the bottoms of the drawers. Whenever carpet beetles are brought to the clinic, I feel uneasy until they are drowned in alcohol. I hope no one ever throws live carpet beetles in the waste cans!

Like many other insects, carpet beetles can adapt to various foods depending on what is available. The lack of woolen carpets in our homes has not stopped them. They readily eat dried food products, especially grains, flour, pasta, and dried pet foods. The larval stages consume the most food because they are growing. The adult beetles eat only enough to provide energy for movement because they do not increase in size after they emerge from the pupal stage. The larvae that hatch from eggs are very small and difficult to see. As they feed and molt, they grow to about $^{3}/_{16}$ inch long including bristles. The adults are about ⅛ inch long.

Several other kinds of carpet beetles are found in Skagit County. The larder beetle (*Dermestes lardarius*) or bacon beetle, as it is sometimes called, has been brought to Master Gardener plant clinics several times. Like the varied carpet beetle, it prefers animal material for food, but it readily eats grain products. It has been found in grain elevators and magpie nests near Pullman and in a butcher shop in Seattle. It appears to be well established in Skagit County and common in homes. Another species, *Dermestes maculatus*, is called the hide beetle, and it has been used to clean skeletons of vertebrate animals in the museum collection at Washington State University. I have not seen it yet in Skagit County. The black carpet beetle (*Attagenus piceus*) is not often found in houses in the Pacific Northwest but is more common on flowers and in grain elevators. It was found in Seattle as early as 1912; in Vancouver, British Columbia, in 1944; and it has been brought to the Master Gardener plant clinic since 2000. The warehouse beetle

(*Trogoderma inclusum*) frequents bird and tent caterpillar nests and has been found in Skagit County.

Carpet beetles can complete the life cycle from egg to adult in as little as four months with favorable conditions of food, moisture, and temperature. Unfavorable conditions such as lack of food, extremely dry conditions, or low temperatures slow them down, and they have been known to persist in the larval stages for as long as five years until conditions are sufficiently favorable to complete development to the adult form. That may complicate control methods. According to WSU Extension Bulletin 1257, "Carpet Beetles," sanitation is the first step in getting rid of them. As long as there is an available food supply, they will continue to multiply. Sometimes that food supply is difficult for us to find, even in the kitchen.

Once, my wife called me to come see the bug in the silverware drawer. What is a bug doing in the silverware drawer? There is nothing for it to eat there. It was the mature larva of a carpet beetle. As I stood there wondering where it could have come from, I noticed the fluorescent ceiling light fixture above had a few dead insects in the cover. Evidently the carpet beetle larva had fed on those dead, dry insects until ready to pupate, and looking for a more protected spot to go through its last developmental stage, it had dropped to the counter and into the silverware drawer. Did this mean we had a population of carpet beetles somewhere in the house? Not necessarily. The adults are good fliers, and it could have come to the house from a mouse nest or dead animal in the nearby woods. So, no matter how clean you keep your kitchen, you may still have carpet beetles. Knowing about their life cycle and how they live will help you to control them no matter where you find them.

Attagenus piceus. **Black Carpet Beetle.** Length ⅛ inch. No photo.

Anthrenus verbasci. **Varied Carpet Beetle.** Length ⅛ inch. Commonly found in kitchens or areas where food is stored. Photo p. 13.

Dermestes lardarius. **Larder or Bacon Beetle.** Length $^{5}/_{16}$ inch. Eats dried animal products. Photo p. 13.

Dermestes maculatus. **Hide Beetle.** Length ⅛ inch. No photo.

Trogoderma inclusum. **Warehouse Beetle.** Length ⅛ inch. No photo.

Spider Beetles (Ptinidae)

These little beetles somewhat resemble spiders with their long legs and round abdomens. They are widespread, but not often abundant and not commonly seen because of their small size. They have been found in Skagit County.

Ptinus clavipes. **Brown Spider Beetle**. Length $^{3}/_{16}$ inch. Feeds on any organic debris and cereals. Photo p. 13.

Ptinus fur. **White-Marked Spider Beetle**. Length $^{3}/_{16}$ inch. Feeds on cereals and dried animal products. Photo p. 13.

Furniture Beetles (Anobiidae)

This is a large and diverse family that includes much more than the furniture beetles, but they have in common the habit of chewing into hard materials such as wood and seeds.

The name drugstore beetle was applied to *Stegobium paniceum* many years ago when it was found feeding on poisonous products such as strychnine-treated wheat, belladonna, mustard plaster, and tobacco. Those things are not found in today's kitchens, but the larva of this beetle is not fussy in its eating habits and still finds plenty to eat. According to the literature, remains of the drugstore beetle were found in stone vases in the tomb of Egyptian King Tutankhamen that were sealed around 1100 B.C.E. It was also mentioned as the bread beetle or *Brotkaefer* in Germany in 1721, and in our own Pacific Northwest it has been in Seattle since 1913. Specimens brought to Master Gardener plant clinics are usually found in dried cereal products such as flour, pasta, and pet food.

The eggs laid by this little beetle are so small they are rarely noticed, and the larva that hatches from the egg to begin feeding is difficult to see because it burrows into the food. You might consider this insect beneficial as it pre-digests some of your food for you. (I prefer to do my own work, thank you!) In a warm kitchen, it develops rapidly, and in four to five weeks a few beetles can turn into hundreds. The adults move out in search of new food supplies, and that is when you see them crawling about in the kitchen or storage room.

The large grocery supply warehouses do everything possible to keep this pest out of stored food, but in spite of all their efforts you may occasionally bring infested packages of food home from the store. The source of beetles in the kitchen is often a package of flour, meal, or cereal that has been on the back shelf for a long time. Finding and eliminating the source may solve the problem.

Sometimes tracing the source takes some detective work. Sometimes the beetles appear from under the refrigerator or from behind the stove. Sometimes mice will carry food away and store it in strange places, and these stashes can be the source of beetles.One client was finding beetles in the bathroom. After some questioning, it was found that there was a sack of dry-pellet pet food in the bathroom and that was the source of the drugstore beetles.

If you find drugstore beetles in your house, do not despair. They can be eliminated. Chemical insecticides cannot be used on food, so other methods are needed. Read WSU Extension Bulletin 0973, "Cupboard Beetles," for suggestions.

Hemicoelus gibbicollis. **Anobiid Beetle**. Length ⅛ inch. Feeds on sapwood of both hardwoods and softwoods. Serious pest in our area. Photo p. 14.

Lasioderma serricorne. **Cigarette Beetle**. In stored products including tobacco. No photo.

Microbregma emarginatum. Length $^{3}/_{16}$ inch. Found in hemlock and spruce. No photo.

Ptilinus basalis. Borers in cottonwood, willow, ash, and myrtle. No photo.

Stegobium paniceum. **Drugstore or Bread Beetle.** Length ⅛ inch. Known to eat many things, including drugs. Commonly found in houses feeding on dried cereals and pet foods. Photo p. 14.

Vrilleta decorata. Length $^{3}/_{16}$ inch. Found in hardwoods. No photo.

Powderpost Beetles (Lyctidae)

The water-conserving digestive systems of these beetles allow them to thrive in wood and grain products with a very low moisture content. The name powderpost probably refers to their dry, powdery excrement. Most are wood borers, but some feed on stored grain.

These beetles feed on the sapwood of most hardwood lumber, but if they are abundant they may feed on the heartwood also. The sapwood contains more carbohydrate and they develop faster there. Sometimes one board in a hardwood floor is infested because it is partly sapwood. When the adult beetles emerge from the wood, they leave small holes from which the powder is ejected.

Lyctus brunneus. **Brown Powderpost Beetle**. Length $^{3}/_{16}$ inch. This species was introduced from Europe and Asia. It often infests bamboo products. Photo p. 14.

Lyctus cavicollis. **Western Lyctus Beetle**. Length $^{3}/_{16}$ inch. In hardwood lumber, tool handles, and bamboo shades. Photo p. 14.

Lyctus planicollis. **Southern Lyctus Beetle**. Length $^{3}/_{16}$ inch. Introduced to our area from the south. Similar to Western Lyctus. No photo.

Water Scavenger Beetles (Hydrophilidae)

The common name is somewhat misleading because those living in water do not usually scavenge but capture and eat other living insects. Most are aquatic as the family name implies: *hydro* means water and *phil* means love. The only member of this family in the Skagit County insect collection is a non-aquatic species often found in compost piles, where it feeds on decaying organic matter and animal manure.

Sphaeridium bipustulatum. **Compost Beetle**. Length ⅜ inch. Photo p. 14.

Fire-Colored Beetles (Pyrochroidae)

Many of these beetles are bright red, hence the name. People often see them when cutting firewood.

Dendroides ephemeroides. Length ½ inch. Found under dead bark of alder, maple, and cottonwood, where they eat fungi. Photo p. 14.

Darkling Beetles (Tenebrionidae)

This is a large and diverse family, mostly found in dry habitats, so we do not have very many in our moist climate. The specimens in our collection are mostly from stored food products, especially grain and flour.

***Palorus* sp.** Length ⅛ inch. A flour beetle. No photo.

Phellopsis porcata. Length ⅛ inch. Feed on dead plant material and fungi. Photo p. 15.

Tribolium destructor. Length ⅛ inch. Found in flour and other dried foods. Photo p. 15.

Click Beetles (Elateridae)

The common name refers to the actions of this beetle when it is turned over on its back. A spine on the underside of the body fits in a tight groove and when the front part of the body is forced back, the spine snaps (clicks) out of the groove with enough force to flip the beetle into the air, so it will come down right side up. The larvae of this large family are called wireworms because of their slender form, and some feed on roots and tubers causing damage to crops like potatoes. This is a large family of beetles with varied food habits, and many larval habits are still unknown. We have identified 12 species from Skagit County and there are no doubt many more to be collected and identified.

Ampedus behrensi. Length $^{7}/_{16}$ inch. Larvae under dead bark, especially cottonwood. Photo p. 15.

Ampedus phoenicopterus. Length ⅜ inch. Larvae under bark of dead fir. No photo.

Athous scissus. Length ¾ inch. In soil or rotten wood. No photo.

Athous vittiger. Length ⅜ inch. In soil or rotten wood. Photo p. 15.

Ctenicera opacula. Length $^{5}/_{16}$ inch. Larvae feed on small plants, bulbs, and flowers. No photo.

***Dalopius* sp.** Length ¼ inch. Photo p. 15.

***Elater* sp.** Length ⅜ inch. No photo.

Elathous nebulosus. Length ⅜ inch. No photo.

Hemicrepidius morio. Length ¾ inch. No photo.

Hemicrepidius pallidipennis. Length $^{5}/_{16}$ inch. Photo p. 15.

Limonius crotchi. Length ½ inch. Larvae are wireworms in potatoes. Photo p. 15.

Megapenthes caprella. Length ¼ inch. Photo p. 15.

Pseudo-Click Beetles (Throscidae)

Superficially these resemble click beetles, but they are anatomically different enough to be placed in a family of their own.

Pactopus hornii. Length $^{3}/_{16}$ inch. No photo.

Trixagus sereceus. Length ⅛ inch. No photo.

Metallic Wood or Flat-Headed Borers (Buprestidae)

Many of the beetles in this family are brightly colored, and they are often shiny. The larvae bore into the bark of trees and shrubs and feed on the nutritious sapwood, which can cause serious damage, especially in small trees.

Specimens of the golden buprestid (*Buprestis aurulenta*) are frequently brought to Master Gardener plant clinics. Metallic green and burnished copper better describe this colorful beetle. People are curious to know its name and what it does. Observant clients may already have connected this insect with fresh holes in their furniture or the walls of their house. They might have found wood dust below a hole or have watched the shiny beetle emerging from a freshly opened hole. Sometimes the evidence is circumstantial, such as finding the beetle on the windowsill near the hole in the wood of the window frame.

The female golden buprestid beetle lays her eggs in the bark of fir and pine trees, usually in a scar or break in the bark of a live tree or in a freshly cut log. The egg hatches into a white grub that feeds on the wood, chewing increasingly larger tunnels as it grows. The larvae grow slowly, especially if the wood is dry. There are records of larvae taking as long as 40 years to complete their life cycles and emerge from the wood as adults. So do not be surprised if these beetles show up in your house many years after it is built. Fortunately, the female beetle will not lay eggs on wood that is smooth and painted or varnished, so once the beetles emerge, just fill up the holes and keep the pretty beetle to show your friends.

We have several other members of this family in Skagit County. Out of the 700 species in North America, many live in the western forests and feed on a wide variety of trees. One that is of concern to gardeners is the Pacific flat-headed borer (*Chrysobothris mali*). Its species name refers to apple trees, and it is a serious threat to young apple trees, as well as other fruit trees and related ornamental trees and shrubs.

When trees grown in a protected nursery row are planted out in the sun, their stems may get sunburn. The injured bark gives off a chemical odor that attracts the flat-headed borer, and the females lay their eggs on those spots. The larvae chew into the stem and may girdle a young tree and kill it. Incriminating evidence of the evil work of this borer may be detected in the shape of the tunnel it makes. The head and body of the larva are flattened instead of round, so the tunnels it chews in wood are oval in cross section. The tunnels are usually tightly packed with boring dust arranged in ridges that form patterns something like fingerprints. The adult beetles are bronzy black and smaller than the golden buprestid, usually about ¼ inch long. They are not easy to see, so look carefully.

***Buprestis aurulenta*. Golden Buprestid.** Length ⅝ inch. The larvae bore into conifers like Douglas fir. Photo p. 16.

Buprestis laeviventris. Length ¾ inch. In dead or injured pine and fir trees. Photo p. 16.

***Chrysobothris mali*. Pacific Flat-Headed Borer**. Length ¼ inch. In fruit trees. No photo.

Long-Horned Beetles and Round-Headed Borers (Cerambycidae)

The name long-horned refers to the long antennae that are in many cases longer than the body. The larvae chew round tunnels in the wood, hence the name round-headed borers, as contrasted with the flat-headed borers in the family Buprestidae. This is one of the largest families of beetles, and it is well represented in Skagit County, partly because of our abundant forests and the shade trees in yards. These beetles are larger than bark beetles, but they rarely kill trees. They are found mostly in dead or dying trees, so they are recyclers, turning wood back to soil.

The greatly increased numbers and mobility of humans during the past millennium on planet Earth have brought changes to the ecosystem everywhere. We see that plainly in the insect world. Many of our worst insect pests are those imported from abroad. Increasingly we hear about foreign insect invaders that do great damage to our gardens, farms, and forests.

In September 1996 the Asian long-horned beetle (*Anoplophora glabripennis*) was discovered and identified from Norway maple trees growing along the streets of New York City. It is believed that those foreign beetles were imported in wooden packing materials, like pallet boards, from China in the late 1890s or early 1900s. The infestation of beetles in street trees was confined to a relatively small area of Brooklyn. Entomologists quickly checked out the pattern of wood distribution by firewood dealers and found a second area of infestation in Amityville, New York, about 40 miles away. Without the help of commerce, the beetles spread slowly, a few miles per year at the most. Commercial shipments from Asia, especially China, have now transported this dangerous pest even here to our West Coast. In 1992, the Asian long-horned beetle was found in Vancouver, British Columbia, in wood packing material with a shipment from China. In 1998 an infestation in Chicago was reported to have killed more than 1000 trees.

Several long-horned beetles have been brought to me for identification, but none of them was the Asian long-horned beetle, for which I am thankful. We have a native long-horned beetle that is quite common here in Skagit County and looks very similar to the Asian one. There are some subtle differences in structure and color that seem to be consistent and provide a reliable key to identifying them correctly. Our native long-horned beetle, the white-spotted sawyer (*Monochamus scutellatus*), does not pose a serious threat to our trees. It is attracted to conifers that are dying, stressed, or recently cut. It has several natural enemies in our ecosystem that help to regulate its numbers.

Anoplodera aspera. Length ½ inch. No photo.

Anoplodera crassipes. Length ⅜ inch. Very common in dead pine trees. Photo p. 16.

Anoplodera dolorosa. Length ⅜ inch. Larvae in Douglas fir. Photo p. 16.

Anoplodera (Ortholeptura) valida. Length ¾ inch. Larvae feed on dead conifer trees. No photo.

Anoplophora glabripennis. **Asian Long-Horned Beetle**. Length ¾ inch. Larvae feed on maples and other hardwood trees. No photo.

Asemum **sp.** Larvae in Douglas fir. No photo.

Desmocerus auripennis. **Golden-Winged Elder Borer**. Length ⅝ inch. Larvae feed in stems of elderberry. Photo p. 16.

Ergates spiculatus. Length 2 inches. Larvae in large evergreen trees. Photo p. 16.

Grammoptera filicornis. Length ¼ inch. Larvae in conifers. No photo.

Leptura obliterata. Length ⅝ inch. Very common in fir and hemlock lumber. Photo p. 17.

Monochamus scutellatus. **White-Spotted Sawyer**. Length ⅞ inch. Larvae in dead or dying fir and pine. Very similar in appearance to the Asian long-horned beetle (*Anoplophora glabripennis*) and often mistaken for it. Photo p. 17.

Necydalis diversicollis. Length ½ inch. Larvae in alder, oak, cascara, and willow. No photo.

Neoclytus conjunctus. **Western Ash Borer**. Length ½ inch. In oak, ash, pear, and madrone. Photo p. 17.

Pachyta armata. Length ⅝ inch. Larvae in hemlock. Photo p. 17.

Phymatodes nitidus. Length ¼ inch. Larvae in cedar and cypress. No photo.

Pidonia gnathoides. Length $^{5}/_{16}$ inch. No photo.

Pidonia scripta. Length $^{5}/_{16}$ inch. Photo p. 17.

Plectrura spinicauda. Length ⅝ inch. Larvae in alder, willow, and maple. Adult is flightless. Photo p. 17.

Rhagium inquisitor. **Ribbed Pine Borer**. Length ⅝ inch. In conifers. Photo p. 17.

Rosalia funebris. **Banded Alder Borer**. Length 1⅛ inch. In dead alder. Photo p. 17.

Ulochaetes leoninus. **Lion Beetle**. Length ⅝ inch. In dead fir and hemlock. Photo p. 17.

Leaf Beetles (Chrysomelidae)

The adult beetles in this family, and also some of the larvae, feed on the leaves of a wide variety of plants. Some are serious garden pests, and a few are employed as biological controls of weeds. The common potato beetle (*Leptinotarsa decemlineata*), a widespread pest that strips the leaves from potato plants, is not found in Skagit County; however, we do have many leaf beetles that can do considerable damage in our gardens. The larvae of some of the leaf beetles feed on the roots of plants.

A leaf beetle that is as small as a flea and can jump just as well is logically called a flea beetle. There are many different kinds, often named after the plant

they feed on, such as the potato flea beetle, the cabbage flea beetle, the rose flea beetle, the mint flea beetle, and the horsetail flea beetle (horsetail plant, not animal!). There is even one that feeds on poison oak.

The most serious flea beetle pests in our gardens are the western potato flea beetle (*Epitrix subcrinita*) and the tuber flea beetle (*Epitrix tuberis*). They make their presence known by chewing holes in the leaves when the potato plants first come up. The potato flea beetle adult chews the leaves; the larvae stay in the soil and feed on the roots of plants. The larvae of the tuber flea beetle prefer to feed on developing potatoes, which causes them to grow rough and irregular. Potatoes grow fast and a few flea beetles do not do much damage, but if there are many flea beetles, they eat the potato leaves as fast as they grow, and they may kill the plants or weaken them so they produce only a few small potatoes. If you have flea beetles on your potato plants, you can see them jumping when you touch the plant.

Flea beetles are commonly found feeding on weeds. They overwinter as adults in the weeds and ground litter, and move into your garden early in the season to feed on succulent new shoots from seeds you have planted. Many factors such as temperature, moisture, and predators and parasites affect flea beetle populations, and you may not see them in your garden for several years. When all conditions are right for them, they suddenly appear in large numbers and then you will need to do something to control them. Most vegetable plants in the garden are not seriously damaged by flea beetles once they get six or more full-sized leaves, so if you can protect your plants for the first few weeks, you may not have to do anything about the flea beetles, at least not until next year.

Altica ambiens. **Alder Flea Beetle**. Length $^{3}/_{16}$ inch. Feeds on alder, skeletonizing the leaves. Photo p. 18.

Altica tombacina. Length ⅛ inch. Feeds on leaves of dogwood. No photo.

Bromius obscurus. **Western Grape Rootworm**. Length $^{3}/_{16}$ inch. Larvae feed on roots; adults eat linear holes in leaves. No photo.

Calligrapha californica. **Tickseed-Leaf Beetle**. Length ¼ inch. Feeds on coreopsis (tickseed). Photo p. 18.

Chrysolina quadrigemina. **Klamath Weed Beetle**. Length $^{3}/_{16}$ inch. Introduced to control an imported weed called klamath weed that invaded pasture land and is toxic to cattle. Introduced from Australia in the 1940s, it has been effective in controlling the weed. Photo p. 18.

Chrysomela interna. Length ¼ inch. Feeds on alder leaves. No photo.

Criocerus asparagi. **Asparagus Beetle**. Length $^{3}/_{16}$ inch. Some damage to young spears; mostly feeds on the foliage. Photo p. 18.

Epitrix subcrinita. **Western Potato Flea Beetle**. Length $^{1}/_{16}$ inch. Larvae feed mainly on roots, not tubers. Photo p. 18.

Epitrix tuberis. **Tuber Flea Beetle**. Length $^{1}/_{16}$ inch. Larvae eat outer ¼ inch of tuber; adults eat leaves. Introduced in 1925. Photo p. 18.

Metriona bicolor. **Golden Tortoise Beetle**. Length $^{3}/_{16}$ inch. Found on morning glory and other plants. Photo p. 18.

Syneta albida. **Western Fruit Beetle**. Length $^{3}/_{16}$ inch. Adults feed on the leaves of many plants; larvae are root feeders. Photo p. 18.

Weevils or Snout Beetles (Curculionidae)

Many of these beetles are of economic importance because of the damage they do to agricultural crops. This is a very large family that is well represented in Skagit County. We have only a small fraction of them in our collection. They typically have mouth parts at the end of a snout, but in some the snout is not prominent. Larvae have sharp mandibles for chewing into wood and other parts of plants, including the roots. There are several different root weevils that are frequently brought to Master Gardener plant clinics. Some are serious garden pests and others are of no concern to gardeners.

Small fruits such as strawberries are severely affected by root weevil attacks. An excellent description of three common root weevil pests is in WSU Extension Bulletin 1388, "Small Fruit Pests: Biology, Diagnosis and Management." The strawberry root weevil (*Otiorhynchus ovatus*), the rough strawberry root weevil (*O. rugostriatus*), and the black vine weevil (*O. sulcatus*) are similar in appearance but different in size. All three are common in Skagit County and they have been here a long time.

I remember as a boy in the 1930s helping my father scatter pesticide on our strawberry patch in an attempt to protect our plants from the strawberry root weevil. The material was called "Go West" and looked like a mixture of bran and dried fruit. It smelled good, but I do not know what poison it contained. That was in Snohomish County, but I am sure the weevils were in Skagit County that far back also because they were imported from Europe before 1900. The strawberry root weevil was seen in Massachusetts as early as 1852, on Vancouver Island in 1894, and in western Washington by 1904. The black vine weevil was in Victoria, British Columbia, in 1891; on Orcas Island in 1901; and in Portland, Oregon, by 1911. The rough strawberry weevil was in New York City by 1891, Seattle in 1914, and British Columbia in 1922.

Adult root weevils feed on the leaves of plants. They are slow moving and most of them do not fly. Strawberry leaves of an infested plant have notches cut in the edges of the leaves. The weevils have sharp scissorlike jaws at the tip of the snout, which cut pieces of leaf small enough to be swallowed and digested. Rhododendron leaves are frequently notched by the larger black vine weevil. Several damaged leaves spoil the appearance of a rhododendron plant and are a warning sign that root weevils are present and may need to be controlled. The adult weevils emerge in April, May, or early June, so that is when you need to inspect your plants to see if the leaves are being notched. Eggs are laid in the soil three to four weeks after the adults emerge. All adults are females, and they can lay as many as 500 eggs during the early summer.

The larvae of root weevils do more damage to plants than the adults. They are C-shaped, white and legless, and live in the soil where they feed on the roots

of plants. It does not take many root weevil larvae to destroy the fine roots of a young strawberry plant, killing it soon after it is planted. Even after the plant is fully grown, the larvae can kill it by destroying the roots. The damaged plants wilt easily and in warm, dry weather they do not recover from wilting. Strawberry plants that are weakened by root weevils are more susceptible to diseases. The strawberry root weevil sometimes does severe damage to the roots of young evergreens in Christmas tree plantations.

Weevils sometimes crawl into the house looking for a place to spend the winter. They are unwelcome guests at my house, and if I see them, I hope they have not left a big family behind in my strawberry patch.

Many people are starving in some parts of the world because the food they should have eaten has already been eaten by the granary weevil (*Sitophilus granarius*) or its close relative the rice weevil (*Sitophilus oryzae*). The granary weevil is more common in cooler climates, and the rice weevil is more abundant in warmer climates. They both do well in heated buildings and feed on many kinds of grain that are grown for food for humans and livestock.

Like other weevils, they have long slender snouts with sharp jaws at the tip. They are small weevils, only about ⅛ inch in body length. The female granary or rice weevil chews a small hole in a kernel of wheat, corn, rice, or other grain and lays one egg in it. She then seals the opening with a gluelike substance. She can lay as many as 250 eggs in her lifetime of eight months. In a warm environment, the weevil can complete its growth from egg to adult in four weeks. Use your calculator to figure out how many weevils could come from one female in eight months. If she lays 30 eggs the first month and half of those are female and those 15 females each lay 30 eggs the next month, etc., etc., how many weevils would there be in the eighth generation?

When I was at Oregon State University for graduate study, I was employed as a research assistant in the Entomology Department, and one of my assigned tasks was to maintain cultures of various pests of stored grain to be used in experimental work. I would inoculate a gallon jar of clean wheat with 50 granary weevils and it was heavy as I lifted it up on the shelf. Three months later, when I took the jar down to renew the culture, it was light as a feather. What had been solid kernels of wheat were, by then, just empty hulls. Think about what happens to stored rice, corn, and wheat in warm, humid climates where large numbers of people depend upon grains for food. Without proper storage facilities to keep the grain dry and clean, the weevils probably eat more of it than the people do. People become accustomed to eating food with weevils in it. It has been said that the way to tell when foreign-service people need a furlough is when they refuse to eat their rice if it does not have a few weevils in it.

Granary weevils and rice weevils both have been brought to Master Gardener plant clinics by people wanting to know where these weevils come from and how to get rid of them. It is nearly impossible to process and store grain products, even in our temperate climate, without some infestation by these tiny weevils. You are likely to find them in your kitchen if you keep a package of flour or cereal on the shelf too long. They are most often found in whole kernel or coarsely cracked grains, where they lay their eggs and multiply. In milling and

storage areas, the adult weevils may wander into flour and other cereal products, but they are not as likely to survive and reproduce there.

Granary weevils do not have wings that are functional. Rice weevils do have wings, and they can fly considerable distances. For that reason, determining which species it is may help in figuring out where it came from and how to get rid of it. The rice weevil usually has two light spots on each wingcover and is slightly smaller than the granary weevil, which is uniform in color. Their food habits and life cycles are essentially the same.

For more information about these weevils read WSU Extension Bulletin 0973, "Cupboard Beetles." One of the easiest and safest ways to kill granary and rice weevils is by heating the infested food to 129 degrees Fahrenheit for 30 minutes or by freezing it at -1 degree Fahrenheit for at least five hours. You can eat it then if you want to, but maybe you would rather feed it to the animals.

***Brachyrhinus (Otiorhynchus) ovatus*. Strawberry Root Weevil**. Length $^{3}/_{16}$ inch. Feeds on roots of strawberry, weakening or killing plants. Photo p. 19.

***Brachyrhinus (Otiorhynchus) rugostriatus*. Rough Strawberry Root Weevil**. Length $^{5}/_{16}$ inch. Larvae feed on roots of strawberries and cranberries. Photo p. 19.

***Brachyrhinus (Otiorhynchus) singularis*. Clay-Colored Weevil**. Length ⅜ inch. Larvae feed on roots, and adults feed on leaves of trees and shrubs, including rhododendron. No photo.

***Brachyrhinus* (*Otiorhynchus*) *sulcatus*. Black Vine Weevil**. Length ⅜ inch. Larvae feed on roots of strawberries, cranberries, and rhododendrons. Adults feed on leaves. Photo p. 19.

***Ceutorhynchus* sp.** Length ⅛ inch. Larvae mine roots or collars of crucifers such as cabbage. Photo p. 19.

Gymnaetron tetrum. Length ⅛ inch. Introduced to feed on wild snapdragon. Photo p. 19.

***Pissodes* sp. Twig Weevil.** Length ⅛ inch. Found on terminal shoots of pine and spruce. Photo p. 19.

***Rhynchaenus salicis*. Flea Weevil**. Length $^{3}/_{16}$ inch. The adults have large hind legs for jumping. Larvae and adults feed on willow. Photo p. 19.

***Sitona lineatus*. Pea-Leaf Weevil**. Length $^{3}/_{16}$ inch. Adults eat leaves of peas; larvae eat root nodules on legumes. No photo.

***Sitophilus granarius*. Granary Weevil**. Length ⅛ inch. Adults lay eggs in holes chewed in kernels, and larvae eat the entire inside, leaving an empty hull. Common in untreated wheat. Photo p. 19.

***Sitophilus oryzae*. Rice Weevil**. Length ⅛ inch. Consumes large amounts of rice grown in tropics. No photo.

Steremnius tuberosus. Length $^{5}/_{16}$ inch. Feeds on dead spruce trees. No photo.

Bark and Ambrosia Beetles (Scolytidae)

The large family Scolytidae includes bark beetles, which are of great economic importance because of the damage they do to trees. Gardeners are concerned about bark beetles that feed on fruit trees. One of these is the shot-hole borer (*Scolytus rugulosus*), which was introduced to America from Europe. It is a common pest in our area. You rarely see it because the adult beetle is less than ⅛ inch long. What you do see are the small holes made in bark by the emerging adult beetles. By then the damage to the tree has already done by larvae feeding on the inner bark. After completing their growth, they emerge all at once as adult beetles through small holes they chew through the bark. A heavily infested branch looks like it was hit by a blast from a shotgun, hence the name shot-hole borer.

Many insects are strongly attracted to plants that are dying or stressed due to lack of water or any other factor that weakens the plant, causing it to give off a distinctive chemical odor. The shot-hole borer often attacks sick trees, but it may successfully invade a tree that is low on water or nutrients. If these beetles are not checked and manage to build up a large population in weakened branches or twigs on a healthy tree, they might successfully invade healthy wood and kill a tree.

The borers may complete two generations in one season. The first brood may be small, but the borer can grow from egg to adult in one month or less, depending upon the temperature. The female beetle chews a tunnel into the bark and lays 10 to 20 eggs in small niches in the sides of the tunnel. Females from the first brood may each make a new tunnel with eggs. That many tunnels in the inner bark of the tree can disrupt the flow of water and nutrients sufficiently to kill the tree or an infested limb. The mature larvae may bore into the wood to pupate and emerge as adults the following spring, starting a new population.

When small trees grown in dense rows in the nursery are planted out by themselves with no protection, their bark may get sunburn. The sunburned bark is attractive to shot-hole borers, and they may girdle the bark of the small stem, killing the tree. Some protection for the new stem, such as white latex paint or stem wrappers, can protect the new trees from shot-hole borers. All infested stems or twigs should be removed and burned. A healthy tree is less likely to be damaged by these borers.

There are two different groups of beetles in the family Scolytidae. There are the bark beetles, which tunnel and eat wood, and then there are the ambrosia beetles, which feed on fungus they cultivate in their tunnels. The European shot-hole borer (*Xyleborus dispar*) is an ambrosia beetle and should not be confused with *Scolytus rugulosus*. The European shot-hole borer does not feed on the bark or wood of the tree. The female makes a tunnel under the bark in which to lay her eggs, but the larvae feed on a special fungus that is planted in the tunnel by the female. A heavy infestation of the European shot-hole borer can kill a small tree by making many tunnels into the stem, cutting off the circulation and weakening the stem.

Much damage to forests and yard trees is done by these little beetles. Trees that are stressed by lack of moisture, root damage, or poor soil drainage are especially attractive to bark beetles and may be killed by them. Healthy trees are usu-

ally able to resist and are not seriously damaged. Bark beetles are often host specific, which means that each species attacks a single kind of tree. The larvae feed mostly on the soft, nutrient-rich sapwood just under the bark. Different species can often be identified by the host tree and the pattern of galleries left on the inner side of the bark. Ten different kinds of bark beetles have been collected for the Skagit County insect collection, and there are more to be added.

Alniphagus aspericollis. **Alder Bark Beetle**. Length ⅛ inch. Found in injured or dying trees. Photo p. 20.

Dendroctonus pseudotsugae. **Douglas Fir Bark Beetle**. Length ¾ inch. A serious pest in our forests. Photo p. 20.

Dryocoetes autographus. Length ⅛ inch. Feeds on several kinds of coniferous trees. Photo p. 20.

Gnathotrichus alni. **Alder Ambrosia Beetle**. Length $^{1}/_{16}$ inch. Does not eat wood. Carries fungus spores to grow for food in its burrows. No photo.

Gnathotrichus sulcatus. **Western Hemlock Wood Stainer**. Length ⅛ inch. Does not eat wood. Photo p. 20.

Hylurgops rufipennis. Length $^{3}/_{16}$ inch. Feeds on dying or weakened coniferous trees. No photo.

***Hylastes* sp.** Length $^{3}/_{16}$ inch. Feeds on dying or weakened coniferous trees. No photo.

Phloeosinus punctatus. **Western Cedar Bark Beetle**. Length $^{3}/_{16}$ inch. Found mostly in branches of cedar trees. Photo p. 20.

Phloeosinus scopulorum. **Rocky Mountain Juniper Bark Beetle**. Length ⅛ inch. Feeds on juniper trees on the San Juan Islands. Photo p. 20.

Scolytus rugulosus. **Shot-Hole Borer**. Length ⅛ inch. No photo.

Xyleborus dispar. **European Shot-Hole Borer**. Length ⅛ inch. Found in broadleaf trees, including fruit trees and yard trees. Photo p. 20.

Stag Beetles (Lucanidae)

You may have seen the huge stag beetles from the tropics, 2 to 3 inches long. Ours is remarkably similar, but only ½ inch long. It is common in Skagit County.

Sinodendron rugosum. **Stag Beetle.** Length ½ inch. Found in rotten alder and maple. Photo p. 20.

Scarab Beetles (Scarabaeidae)

This family includes the dung beetles like the sacred scarab of ancient Egyptian mythology rolling a ball of dung representing the Earth rotating on its axis. Our dung beetles are rolling a ball of dung for the larvae to feed on (not very sacred!). Most scarab larvae—like the Japanese beetle (*Popillia japonica*) that is such a

problem in the eastern United States—feed on the roots of plants.We are thankful this scarab beetle is not here—at least not yet!

Aphodius pardalis. Length $^{3}/_{16}$ inch. Larvae feed on cattle dung. Photo p. 21.

***Aphodius* sp.** Length ¼ inch. Found in cattle and horse dung. Photo p. 21.

Polyphylla decemlineata. **10-Lined June Beetle**. Length 1⅛ inch. Larvae eat roots but are not usually a problem. Photo p. 21.

Flies (Diptera)

There are many kinds of insects called flies. True flies, however, have only one pair of wings. Butterflies, dragonflies, mayflies, caddisflies, etc., have two pairs of wings and are not true flies. The order Diptera (*di* means two and *ptera* means wings) refers to two wings, which means the same as one pair of wings. This is one of the largest insect orders and contains over 100 families in North America. We will consider only 18 of the 32 families that we have found so far in Skagit County, particularly those that are to be seen in the Skagit County insect collection and may be of economic importance. Each family of flies for which we have specimens is represented by many species in Skagit County, and there is a large section of unidentified flies in our collection. It is difficult to know what an insect does and whether it is beneficial or harmful until it has been identified to species. Even then, many species have not been studied enough to know what they do. The gnats and midges are difficult to identify and are often overlooked because of their small size.

House Flies (Muscidae)

This family is best known for the common house fly (*Musca domestica*). Prior to the use of chemical pesticides, every home was plagued with flies during the warm summer months. You had to eat with one hand and shoo the flies away with the other. Sticky flypaper hanging from the ceiling quickly became covered with buzzing flies. Small farms provided ideal habitat for flies that lay their eggs in animal manure. Before the automobile, city streets littered with horse manure produced huge swarms of house flies. Spraying with DDT in the 1950s dramatically reduced the fly population, and proper disposal of garbage and sewage helped maintain that reduction. The common house fly is almost unknown in many places now.

The little house fly (*Fannia* sp.) is now more common than *Musca domestica*. It is often seen hovering and flying in circles in the middle of a sunlit room, rarely landing. The little house fly also breeds in filth and animal manure, but it is rarely as abundant as the common house fly. It is frequently a problem around chicken farms. This fly has soft mouthparts that act like a sponge to take up liquid food. It can regurgitate fluid onto soluble substances like sugar to dissolve it and then lap it up with its soft tongue.

Another fly that is more common in our houses now than the house fly is the cluster fly (*Pollenia rudis*). The cool fall weather brings it into the house looking for a warm place to spend the winter. It is larger than the house fly and a clumsy flier. It buzzes around windows and lights and is especially annoying inside a lamp shade. These flies often cluster together behind a curtain or picture frame; hence the name cluster fly. When warm spring weather arrives, they want outside again to lay their eggs in the soil. The maggots feed on earthworms. If you have lots of cluster flies, it could be an indication that you have lots of earthworms.

Two flies that are a pest of cattle and horses are the horn fly (*Haematobia irritans*) and the stable fly (*Stomoxys calcitrans*). The horn fly came from Europe

to the East Coast in 1887 and made its way to the West Coast in 1900. Now it is common over a large part of the world. The horn fly lays its eggs in fresh cow manure. It is a fierce biter and feeds on the blood of both cows and horses, but it does not usually bite people. The stable fly lays its eggs in fresh horse manure and also in decaying grass and straw. The adults, both male and female, are fierce biters, and they relish the blood of humans as well as farm animals. This fly seems to prefer biting through sleeves, pants, and stockings rather than bare skin (but do not try to escape it by shedding your clothing, because then the horse flies and mosquitoes will get you!). These biting flies closely resemble the common house fly and are often mistaken for it, but the house fly has a sponging mouth that takes up only fluid, whereas the horn fly and the stable fly each have a stiff horny proboscis that can penetrate the thick hide of animals.

***Fannia canalicularis*. Little House Fly.** Length ¼ inch. Photo p. 21.

***Haematobia irritans.* Horn Fly.** Length $^{3}/_{16}$ inch. Photo p. 21.

***Musca domestica*. Common House Fly.** Length ¼ inch. Photo p. 21.

***Pollenia rudis.* Cluster Fly.** Length ⅜ inch. Photo p. 21.

***Stomoxys calcitrans.* Stable Fly.** Length $^{3}/_{16}$ inch. No photo.

Bottle or Blow Flies (Calliphoridae)

Two very common flies around our homes and gardens are the blue bottle fly (*Calliphora vomitoria*) and the green bottle fly (*Phaenicia sericata*), both of which are often called blow flies. They are large flies with robust bodies and their abdomens are shiny metallic blue or green. They lay their eggs on dead or decaying animals, which the maggots utilize for food. The carcass of a dead animal crawling with maggots is a disagreeable sight, but consider what it would be like without these scavenger flies to dispose of dead animals for us. Adult blow flies may be a nuisance buzzing around us, but they do not bite.

***Calliphora vomitoria.* Blue Bottle Fly**. Length ⅜ inch. No photo.

***Phaenicia* sp**. **Blow Fly**. Length ½ inch. Photo p. 21.

Flesh Flies (Sarcophagidae)

This is a very large and widespread family of flies found everywhere and with differing habits. One commonly found in our area is the flesh fly (*Sarcophaga aldrichi*), which parasitizes tent caterpillars and no doubt plays a role in their biological control. The adult female fly gives birth to larvae rather than laying eggs. Some flies in this family parasitize grasshoppers. Many are scavengers and place their larvae on carrion and garbage. Some even parasitize beetles. Even though these flies are varied in habitat and lifestyle, they have a similarity in appearance such that once you correctly identify one, you will recognize many others in this large family.

I remember as a young boy when catching grasshoppers, one very large grasshopper seemed to be easier to catch than the others. I put it in a jar and

planned to do something with it later. When I looked again, the grasshopper was dead and there was a large gray fly in the jar. I knew I did not put a fly in the jar and it was doubtful anyone else did. The only answer was that the fly came out of the grasshopper. I looked it up in a book and learned that it was a parasitic fly called a flesh fly. Grasshoppers were pests, so I considered this fly a friend even though to me it was ugly!

Sarcophaga aldrichi. **Flesh Fly.** Length ⅜ inch. No photo.

Tachinid Flies (Tachinidae)

This is a very large family with about 1300 species in North America alone, and it requires a specialist to identify them to species. They do have some characteristics in common, however, which enable us to at least recognize them as tachinid flies. That is important because tachinid flies are parasites that play a large role in regulating insect populations, and they should be protected from pesticides as much as possible. When tachinid flies are brought to Master Gardener plant clinics, it is important to be able to advise people not to kill them. They are mostly similar in size and appearance to the common house fly, but they have more stout bristly hairs on the abdomen. They develop as larvae inside the bodies of other insects, including caterpillars, beetles, earwigs, and grasshoppers. One species attacks codling moth larvae and several parasitize tent caterpillars.

Tachinidae. Tachinid Fly. Length ⅜ inch. Caterpillar parasite. Photo p. 22.

Hover Flies (Syrphidae)

I remember as a young boy working with my father in the woods on a warm summer day being greatly puzzled by a delicate, high-pitched singing sound that I could not locate or identify. Some years later, while I was resting on a log by the trail, I heard the same singing sound very close to me. Resting on the log right beside me was the singer: a fly with black-and-yellow stripes. The song started at about E-sharp near the top of the scale and gradually progressed upward until it was beyond my range of hearing. Now I finally knew that this musician was a hover fly, one member of a large family of flies, many of which can hover in a stationary position in the air before darting away.

The family Syrphidae includes hover flies and flower flies, many of which sip nectar from flowers and resemble bees, both in appearance and actions. People are often frightened when a hover fly that looks like a bee or a yellowjacket lands on their arm wanting to lick up salty perspiration. It has neither a stinger to sting with nor jaws to bite with, and it has the two wings of a fly not the four wings of a bee. Most people do not care about such details and brush it away as quickly as possible. Several kinds of hover flies lay their eggs near colonies of aphids, and the fly larvae feed voraciously on aphids often destroying all the aphids on one plant. These hover flies are just as beneficial to us as lady beetles.

The larva of a hover fly is about ½ inch long, usually brown or green. It looks like a small caterpillar except it does not have a distinct head, and the front portion of its body can be elongated to reach out and capture aphids. Adult hover

flies are often called flower flies because they feed on pollen and nectar and are commonly seen visiting flowers. They are often pollinating flowers as they fly from one blossom to the next in search of food.

Watch for hover flies in your garden and learn to distinguish them from yellowjackets and bees. Yellowjackets do not hover at all and bees are clumsy compared to hover flies, which can remain motionless in the air. Now that you know they cannot sting or bite, consider them your friends and invite them to help you control aphids in your garden.

This large family of flies is difficult to identify to genus and species. I have tentatively identified the following in Skagit County and hope to get some help from a dipterologist so we can learn more about their habits. The only one illustrated here is in the genus *Syrphus*.

Criorhina luna. Length ⅝ inch. No photo.

Eristalis tenas. Length ½ inch. The larva (called a rat-tailed maggot) lives in polluted water. No photo.

***Eumerus* sp**. **Bulb Fly**. Length ½ inch. Larvae feed on decayed portion of bulbs. No photo.

Eupeodes volucris. Length ⅜ inch. Larvae eat aphids. No photo.

***Melanostoma* sp**. Length ¼ inch. Larvae have been seen capturing and eating flies. No photo.

Sericomyia chalcopyga. Length ½ inch. No photo.

***Sphegina* sp**. Length ⅜ inch. No photo.

Syrphus arcuatus. Length ½ inch. Larvae eat aphids. Photo p. 22.

Mosquitoes (Culicidae)

Mosquitoes have been more harmful to humans than any other insect because of the diseases, such as malaria and yellow fever, that they transmit. We have large populations in Skagit County of the anopheles mosquito, which transmits malaria, but fortunately the ones here are not infected with the malaria plasmodium, which requires a certain amount of heat to complete its life cycle in the mosquito.

A female mosquito requires a nutritious meal of blood in order to produce a viable batch of eggs. The males sip only a bit of water or plant juices. Not all mosquitoes bite people. Some species feed only on small mammals or reptiles. There are many different species of mosquitoes in our area, but only a few are commonly seen or recognized by most people. Because of their economic importance, mosquitoes have been studied in great detail and only a mosquito expert can correctly identify them to species.

The larvae (wigglers) of mosquitoes are aquatic and filter microscopic particles of food from the water with their mouthparts. Some thrive in polluted water; others survive only in clean water. Some, such as the snowmelt mosquitoes and the tree-hole mosquitoes, need only a small amount of water to complete their life cycles from egg to adult. Eggs may be laid at the edge of a receding pool, where

they remain dormant until the next year when the pool is filled again. Some species overwinter as adults, hiding in protected spots and coming out on any warm day throughout the winter. Most mosquito wigglers have to come to the surface for air, but some have gills for breathing while submerged. A few have a needle-like breathing tube used to puncture underwater stems of aquatic plants that contain air. The emerging adult mosquito takes off from the surface film of the water.

Dragonflies and damselflies consume large quantities of mosquitoes as food. Their larvae are equipped with special mouthparts to capture mosquito wigglers, and the adults capture mosquitoes on the wing. If it were not for the large population of dragonflies and damselflies in Skagit County, we would have many more mosquitoes than we do. Bats also help to reduce the mosquito population.

Horse and Deer Flies (Tabanidae)

Most of us have been bitten at least once by a horse fly. They are very persistent around swimmers and sun bathers, and although they make their presence known by loud buzzing as they fly, they can make a soft landing on bare skin without you knowing they are there. Their mouthparts are razor sharp and work like a tiny pair of surgical scissors to cut out a small piece of skin to start a flow of blood, which the fly laps up with her mouthparts. The tough hide of a horse is no barrier to her scissors. You know you have been bitten by a horse fly when you feel the burning sensation caused by the anticoagulant she injects into the wound to keep the blood flowing. The male is not interested in blood and feeds on the nectar of flowers. Horse flies are most active on warm, sunny days and are not as likely to bite you on a cool, cloudy day or when you are in the shade.

The horse flies in Skagit County are of several species and vary in size from ⅜ to ¾ inch long. The eyes make up a large part of the head and are shiny iridescent green. The large horse flies are sometimes called greenheads. If you look closely at a live or freshly killed specimen, you may see a rainbow of colors in the eye, which disappears soon after it is killed.

Our large horse flies are probably in the genus *Tabanus*. The smaller ones are often called deer flies. They have spotted wings and are mostly in the genus *Chrysops* or the genus *Apatolestes*. The smaller ones are also vicious biters and just as aggressive as the larger ones. The larvae of horse flies are predaceous and live in damp soil, where they feed on small earthworms and insect larvae. The increasing numbers of horses kept as pets has brought an increase of horse flies in our area.

***Apatolestes* sp**. **Deer Fly.** Length ⅜ inch. No photo.

***Chrysops* sp**. **Deer Fly**. Length ⅜ inch. Photo p. 22.

***Tabanus* sp**. **Horse Fly**. Length ¾ inch. Photo p. 22.

Snipe Flies (Rhagionidae)

These flies are common in Skagit County and they are vicious biters. They are usually seen in moist areas with dense vegetation, but in our cool, moist climate they may be widely scattered. Both larvae and adults feed on small insects. The

larvae live in damp, decaying leaves. The adult flies often bite people on the legs and frequently bites produce itchy, oozing sores that are slow to heal.

The two species of snipe flies most often seen here are *Rhagio costatus* and *Symphoromyia* sp. *Rhagio* is the larger one, about ½ inch long, brownish-yellow, with some yellowish color on the wings and a body that tapers to a point with dark spots on the abdomen. It resembles a horse fly, except for the pointed abdomen. *Symphoromyia* is similar, but slightly smaller and darker in color. Both seem to prefer human blood when they can get it. Of course, very few of them find humans, so they feed on small insects.

Rhagio costatus. Length ½ inch. Photo p. 23.

***Symphoromyia* sp**. Length ⅜ inch. Photo p. 23.

Black Flies (Simuliidae)

We can be thankful that black flies are not as abundant in Skagit County as they are in many places throughout the world. In parts of Alaska and Canada, these small biting flies are a scourge to humans and wild animals. They are about ⅛ inch long and have a hump behind the head, which may account for the common name of buffalo gnat. In our county, they are more common at higher elevations, but they may be found anywhere. I have taken specimens on Sauk Mountain, as well as in the valley.

The larvae are aquatic and are most often found in fast-flowing streams, where they fasten themselves to rocks with silk threads. Their food consists of small plant and animal material that they filter out of the running water with brushlike mouthparts. Sometimes the larvae are so abundant they give the rocks a black velvety appearance. They construct silken cocoons for pupation and emerge as adults by drifting to the surface to fly away in dense swarms. Adult black flies are most active in the spring and early summer, and may greatly annoy fishermen and hikers.

***Prosimulum* sp**. **Black Fly.** Length ⅛ inch. Photo p. 23.

Fruit Flies (Tephritidae)

A large number of flies are called fruit flies, but only a few of them are of great economic importance. In Skagit County we are particularly concerned about the apple maggot (*Rhagoletis pomonella*), which has recently invaded our apple trees. We also have the cherry fruit fly (*Rhagoletis cingulata*) and the walnut husk fly (*Rhagoletis completa*). WSU Extension Bulletins 1068, "Cherry Fruit Flies," and 0932, "Insect and Mite Control in Home Orchard Tree Fruits and Nuts," describe these flies. They are a difficult pest for backyard gardeners to control, and many gardeners are destroying their apple, cherry, and walnut trees. It is very disappointing to find your favorite apples invaded by maggots. Cherries infested with cherry fruit fly make a disgusting mouthful, and walnuts infested with husk fly are difficult to extract from the mushy, blackened husk.

The Mediterranean fruit fly (*Ceratitis capitata*) is frequently imported from Hawaii in shipments of fruits and in the luggage of tourists. So far the Medi-

terranean fruit fly is being controlled by spraying large areas of infestation and it is not found in Skagit County. There are hundreds of species of fruit flies that feed on a wide variety of wild plants. Fortunately, most of them do not bother us.

Rhagoletis cingulata. **Cherry Fruit Fly**. Length ⅛ inch. No photo.

Rhagoletis completa. **Walnut Husk Fly**. Length ⅛ inch. No photo.

Rhagoletis pomonella. **Apple Maggot**. Length ⅛ inch. Photo p. 23.

Bot Flies (Oestridae)

These large, dark-colored flies are frequently mistaken for horse flies, but they do not bite. In fact, they do not eat anything during their short adult lifespan. They lay their eggs on the fur of large animals such as cows and sheep. The larvae that hatch from those eggs enter the animal's body and migrate to the skin, where they grow causing a lump called a warble. When mature, the larva exits the skin and drops to the ground, where it pupates in the soil to emerge later as an adult bot fly. Some species of bot flies infest squirrels and rabbits. There are several species in Skagit County. The one in our collection is in the genus *Cuterebra*.

***Cuterebra* sp**. **Bot Fly.** Length ⅝ inch. Parasite of rabbits and rodents. Photo p. 23.

Crane Flies (Tipulidae)

One of the largest families in the order Diptera (two-winged flies) is the crane fly family. The term *tipula* is a Latin word originally used to describe the long-legged water striders, but the entire crane fly family is characterized by long, spindly legs, so this term is appropriate for their family name.

There are more than 1500 species of crane flies in North America. I do not know how many different species we have in Skagit County, but I know of six and I am certain there are many more than that. There is a giant that is 3 inches across with wings and legs spread out. Then there are tiny ones less than ¼ inch across. Some are plain tan with no markings; some have white stripes on their bodies and mottled wings.

Crane fly larvae live in damp soil or leaf litter, where they feed mostly on decayed vegetation. Only a few feed on the live roots of plants, and one of those, the European crane fly (*Tipula paludosa*), was imported to the state of Washington from Europe and has been a pest here since 1970. Read WSU Extension Bulletin 0856, "European Crane Fly: A Lawn and Pasture Pest," for information on detection and treatment.

Most crane fly larvae are part of nature's compost system, recycling nutrients from dead vegetation back to the soil. Many crane fly larvae are aquatic. The adults are bothersome, flying to lights at night and coming into the house, but they do not bite or sting. They have been called mosquito hawks, giving the impression that they eat mosquitoes, but they rarely eat anything and live only a few days. Many of them are eaten by bats, mice, and birds, so they are an important link in the food chain. There is a winter crane fly that flies only during the winter months

and provides food for overwintering songbirds like the winter wren. There is a small wingless species (*Chionea*) that can be seen crawling on the surface of the snow. I hope that one day some of you skiers will bring me one for the Skagit County insect collection.

My childhood interest in insects was spurred on by books like *Grassroot Jungles* by Edwin Way Teale. When I read about the phantom crane fly (*Bittacomorpha occidentalis*), my imagination ran riot, and I wondered if I would ever get to see one of these elusive creatures. It was 50 years later, when I was working at our spring in the dense underbrush on a warm summer day, that I saw six small white spots moving in formation in front of my face. Was something going wrong with my eyes or was I suffering from heat exhaustion? As the six white spots moved slowly through the air from the dense shade into a shaft of sunlight, I could see better. Guess what it was. The phantom crane fly! Finally, after all those years I was seeing it. Its dark-colored body was not visible in the dim light; only the six white feet could be seen. I have seen others since then, so I know they are not rare, just rarely seen. I am still enjoying the thrill of discovery in the insect world, and there is so much yet to discover.

Bittacomorpha occidentalis. **Phantom Crane Fly**. Wingspan 1 inch. Photo p. 24.

Tipula paludosa. **European Crane Fly**. Wingspan 1½ inches. No photo.

Tipulidae. Common Crane Fly. Wingspan 1¾ inches. Photo p. 24.

March Flies (Bibionidae)

A few years ago, a reporter called me from the local newspaper with questions about flies that seemed to be invading the city of Mount Vernon. People were calling the newspaper office (they should have been calling Master Gardeners) wanting to know what was happening and where the swarms of flies were coming from. I could not tell from the description over the phone which one of hundreds of different kinds of flies they could be. The reporter believed it was an urgent situation and saw the chance of a good story, so she brought a specimen to my house so I could identify it and explain what was happening. It was early spring so I suspected it was the March fly, but I needed to see a specimen before I dared make a statement that would be published.

The March fly (*Bibio nervosus*) is not difficult to identify and this was indeed the fly she brought me. March flies are widespread in Skagit County, but why were they suddenly appearing in the city in swarms? The larvae are known to feed on the roots of grasses, and the adult flies emerge in early spring, hence the name March fly, even though it is usually April by the time we see them flying here. The day of the "great invasion" in the city of Mount Vernon was a warm spring day, and there was a strong wind coming from the southwest. March flies are weak flyers and are easily carried by the wind. There are some large areas of grass and sod southwest of Mount Vernon and that is most likely where the flies were coming from, but why in numbers greater than anyone remembered seeing before?

Insect populations fluctuate widely from year to year depending on many factors such as weather, predators, and available food. Sometimes populations build up gradually from year to year, but they can also explode suddenly as seems to have happened with the March flies. Fortunately these flies are only a nuisance since they neither bite nor sting and they live only a few days. Their flight involves mating, and frequently the males and females are seen coupled together in flight. In some parts of the country they are called love bugs. Sometimes they emerge in such dense swarms as to be a traffic hazard, covering windshields and making roads slippery.

Every year at apple-blossom time, I see March flies visiting the flowers to sip nectar. They might even pollinate some blossoms, but they are not considered an important insect for pollination. The larvae are not known to do serious damage by feeding on the roots of grass or other plants. This is another insect to go in the file as neither beneficial nor harmful, just interesting.

***Bibio nervosus*. March Fly**. Length ⅜–½ inch. Photo p. 24.

Long-Legged Flies (Dolichopodidae)

This is a large family of flies with more than 1200 North American species. They are often seen in wetlands and moist woods. The adults feed on small insects, and the larvae are found in wet soil and decaying wood. They are known to feed on bark beetles. These are small, colorful little flies, usually shiny green, with distinctive behavior patterns, such as mating dances.

Several species of long-legged flies have been recorded in our area, but so far I have collected only one species in Skagit County. If you see some small, shiny green flies, bring them in so we can learn more about them.

***Dolichopus* sp**. **Long-Legged Fly.** Length ¼ inch. Photo p. 24.

Louse Flies (Hippoboscidae)

Deer hunters often ask about the deer tick with wings. Ticks never have wings and are more closely related to spiders than to insects. What they see on the deer are not ticks. They are a strange kind of fly that looks like a tick and also bites like a tick. These flies feed on blood and do not hesitate to bite people and their bite is painful. They usually shed their wings when they land on a deer and then they look very much like a tick, except they have only three pairs of legs instead of the four pairs of legs that ticks have.

Lipoptena depressa. **Louse Fly**. Length ⅛ inch. Photo p. 24.

Dung Flies (Scathophagidae)

These furry yellow flies lay their eggs on animal droppings, which the maggots utilize for food. The adults are more likely seen around plants, where they capture and eat other flies. They also visit blossoms to sip a bit of nectar. I see them frequently on the blossoms of my plum tree. They might actually do some pollinat-

ing because their bodies are fuzzy and pollen sticks to them. They do not gather pollen for food like bees do, so any pollinating they do is accidental.

Scatophagidae. Dung Fly. Length ⅜ inch. Photo p. 24.

Fungus Gnats (Mycetophilidae and Sciaridae)

These small mosquito-like flies are commonly seen in damp wooded areas, gardens and greenhouses, and near house plants. The larvae feed on fungus and decaying vegetation, so that is why the adult flies are seen near compost piles and rich garden soil. They do not damage healthy growing plants. They can be considered beneficial recycling agents as they consume decaying plant material.

Sciaridae. Dark-Winged Fungus Gnat. Length $^{3}/_{16}$ inch. Photo p. 24.

Dragonflies and Damselflies (Odonata), Caddisflies (Trichoptera), Stoneflies (Plecoptera), and Mayflies (Ephemeroptera)

Ask a fly fisher what flies are, and he or she will likely name dragonflies, mayflies, caddisflies, and stoneflies. An entomologist will tell you that true flies are only in the order Diptera and the fisher's "flies" are only called that because they have wings. Most aquatic insects emerge from the water in their adult form, and you may see them in your yard and garden, even if you live some distance from the water. Caddisflies resemble moths and are often mistakenly treated as pests. If you learn to recognize these "flies," you can accept them as harmless or even beneficial.

Dragonflies should be welcomed and protected because they consume large quantities of mosquitoes and flies. They are strong fliers and find their food supply in many places. I have had dragonflies follow my lawn mower and feed on insects that fly up from the grass. Their six legs form a scoop to snatch insects out of the air, and their large jaws chew up their catch while they fly. Dragonfly larvae crawl on the bottoms of ponds and snatch mosquito larvae with their finger-like mouthparts. Damselflies are similar to dragonflies in habits and life cycle, just slower and smaller.

Caddisflies do all their feeding in the larval stage. The larvae are aquatic and live on the bottoms of ponds and streams. They resemble caterpillars and produce silk for cocoonlike structures to protect themselves while they hunt for food in their aquatic habitat. Different species of caddisflies use different materials to construct their cocoons or cases. Some cover their cases with sand particles or small pebbles; others use pieces of leaves or needles from trees that they find on the bottom of the pond. As the larvae grow, they enlarge their cases and continue to carry them with them as hiding places. When mature, the larvae use their cases as cocoons from which they eventually emerge as adult caddisflies.

These aquatic insects are excellent indicators of water purity and are used to classify streams and lakes in regard to pollution or chemical contamination.

***Aeshna multicolor*. Blue-Eyed Darner**. Wingspan 4 inches. Photo p. 25.

Trichoptera. Caddisfly. Wingspan 1 inch. Photo p. 25.

Bees, Wasps, and Ants (Hymenoptera)

It might seem that bees, wasps, and ants should not be included in the same order, but they do have several things in common. Most have stingers and other equipment to defend themselves and to protect their nests from invasion. Many of them have elaborate social systems in which special provision is made for the young. Many are aggressive in defending their territory. They also have structural details of body form that relate them taxonomically.

Several of the bees found in Skagit County dig holes in soft dirt to make nests in which to raise their young. We know very little about the role these ground-nesting bees have in our ecosystem. They are important as pollinators, and they may be an important link in the complex food chain that ties plants and animals together as producers and consumers. The first step in learning more about the ground-nesting bees in Skagit County is to collect and identify them. Beyond that, we should learn which flowers they are visiting, when they are active, and where they are nesting. Your observations could help us better understand and manage our ecosystem.

Some of the most complex insect life cycles are found in this order, especially in those that are parasitic on other insects. Many cases of biological control of insect pests involve tiny parasitic wasps that are difficult to identify but are well known to the specialists who study them.

In these pages we will deal primarily with the larger and more easily observed Hymenoptera. This is one of the largest of the insect orders, and our Skagit County insect collection contains only a small fraction of the bees, wasps, and ants that live here. Like other large insect orders, the order Hymenoptera is organized by families. Watch for characteristics that help to distinguish one family from another.

Bumblebees and Honeybees (Apidae)

Of all the insects in Skagit County, one of the most valuable to us is the bumblebee. We have several species that are native to this area, and they are found from high mountain meadows to sea level. The bumblebees are our best pollinators. There were no honeybees in North America until they were brought here from Europe by early colonists. Bumblebees have always been here, and they are very important in my garden and orchard because I do not keep honeybees. For several years there were no beekeepers within several miles of my place and I never saw any honeybees. During those years, my fruit trees and berries were pollinated entirely by bumblebees and other native pollinators, and I had excellent crops. Our bumblebees work from dawn until dusk, even on rainy days. They do their work without any help from us, but there are a few things we can do to protect and encourage them. It is easier to do that if we know their life cycle and where they live.

The first bumblebees of the season are the large overwintering queens that come out on sunny days as early as February. They have been sleeping under piles of leaves or dry grass through the coldest part of the winter. They are hungry when they awaken, and they search for early spring flowers to sip a little nectar.

When the weather warms up and lots of flowers are in bloom, they search for suitable nesting sites, often an abandoned mouse nest or a thick clump of grass. They apparently never reuse an old nest. That helps eliminate predatory mites and diseases. As soon as the nest is prepared, the queen searches for a good nectar source and gorges herself on the sweets from the flowers. She then returns to her nest and takes a long nap.

A long nap after a large meal could be a recipe for gaining weight, but the bee cannot increase her size due to the exoskeleton that covers her body. Instead, she uses digested carbohydrate to produce wax from special glands in her abdomen. She uses her spiny legs and her mandibles to pull the scales of wax from between her abdominal segments, and from those she forms the first honey pots for storing the honey she makes. She also makes a wax pad on which she lays eggs that hatch into tiny larvae. She feeds them from the honey and pollen that she has stored. When the larvae are fully grown, they pupate, and she encloses the cocoons in a wax ball with a groove on the top on which she sits like a brooding hen.

The first brood of workers—all females from fertilized eggs—are smaller than the queen because she did not have enough honey stored up to feed them all they needed and the weather was still cool. The new workers gather nectar and increase the honey supply while the queen stays home to lay eggs and produce wax. As the colony increases in number, sometimes to as many as 100 workers, the nest is enlarged and the honey supply is sufficient so by the end of summer full-sized bumblebees are being produced. The queen then lays some non-fertilized eggs, which produce males. The males go to the flowers to sip nectar and there they mate with newly emerged females, which will be the only winter survivors to start new colonies next spring.

What can we do to help bumblebees increase their numbers and work for us as pollinators? A few weedy corners with dry grass and debris will provide nesting sites for them. A continual source of nectar will provide food as they need it throughout the season. Winter-blooming heathers are a favorite of bumblebees when there are few other plants blooming. Late-summer bloom is also important. Be careful with pesticides where bees are working.

Wild swarms of honeybees are being destroyed by mites and diseases because no beekeeper is there to care for them. Our native bees are therefore becoming very important, especially to backyard gardeners who do not keep honeybees or live near someone who does. We have several other native pollinators besides bumblebees, but I think in our area, bumblebees are helping us the most. Besides that, they are fascinating friends to have helping you in your garden and orchard.

Apis nellifera. **Honeybee**. Length ⅜ inch. Photo p. 25.

Bombus vosnesenskii. **Bumblebee**. Length ⅝ inch. Photo p. 25.

Sweat Bees (Halictidae)

Sweat bees are so-called because they seem to be attracted to the sweaty skin of people working in the garden. The females do have stingers, as do other ground bees, but they are not known to sting people unless you grasp them in your fingers

and hurt or restrain them. These are the most abundant bees I see in my garden and orchard.

This bee digs a tunnel in soft soil and forms a nest chamber in which it stores pollen and nectar for the larva that hatches from the egg laid there. The larva changes into a pupa that overwinters in the ground and emerges as an adult bee the next spring.

I have two different species in the genus *Lasioglossum* nesting in my garden. One is about ¼ inch in body length and the other is about ⅜ inch. This genus includes many species in our area, but they are difficult to determine to species, so until I get some help on these, I will just call them big *Lasioglossum* and little *Lasioglossum*. The name means hairy tongue (*lasio* means hairy and *glossa* means tongue), so maybe we can call them the big hairy-tongued and little hairy-tongued bee. They dig their burrows in the same area, and gather pollen and nectar from the same blossoms. I see them working from early spring until late fall, gathering pollen and nectar from all kinds of blossoms. A large oregano plant in our herb garden blooms profusely all through the late summer and fall, and on a warm sunny day, I have seen hundreds of hairy-tongued bees feeding on the oregano blossoms. If for some reason you wanted to produce oregano seed, this would be the best bee to help you.

There are two other halictid bees in our collection. One, in the genus *Agapostemon,* is a bright metallic green bee about ⅜ inch long. It also nests in the ground, but it is not as abundant as *Lasioglossum*. The other one is in the genus *Sphecodes* and is common but never seen in large numbers. It is black with a red abdomen and about ⅜ inch long. It is a cheater called a cleptoparasite. You have heard of a kleptomaniac, a person who cannot resist stealing. This little bee steals its food from other ground-nesting bees instead of gathering for itself. There is no shortage of pollen and nectar for food, but the other bees have to work harder to support *Sphecodes* as well as their own brood.

***Agapostemon* sp**. **Halictid Bee**. Length ⅜ inch. No photo.

***Lasioglossum* sp**. **Hairy-Tongued Bee**. Length ½ inch. Photo p. 25.

***Sphecodes* sp**. **Halictid Bee**. Length ⅜ inch. Photo p. 25.

Acute-Tongued Burrowing Bees (Andrenidae)

We see bees in the genus *Andrena* here in early spring. They often nest in a clear undisturbed spot with little or no vegetation. In Skagit County weeds soon overtake empty spots and these bees are not abundant here. When they do find a good spot of ground, they will sometimes be seen digging burrows in large numbers; however, they are not considered colonial as they work by themselves even when they are crowded together.

***Andrena* sp**. **Acute-Tongued Burrowing Bee**. Length ½ inch. Photo p. 26.

Yellow-Faced Bees (Colletidae)

This family name comes from the Greek word *collett*, which means glued together, referring to their use of sticky nectar from blossoms to glue soil particles together to form the walls of the egg chambers they dig in loose soil. We have one species of these bees in our collection. It is in the genus *Hylaeus*. It is about ¼ inch long and has a yellow face. Instead of carrying pollen on its body hair like most bees, this bee carries pollen mixed with nectar in its crop and regurgitates it for the larvae in the nest.

***Hylaeus* sp**. **Yellow-Faced Bee**. Length ¼ inch. Photo p. 26.

Digger Bees (Anthophoridae)

These bees are robust and hairy, something like a small bumblebee. Ours, in the genus *Peponapis*, nests in the ground or in banks, and it lines the cells of its nest with a thin waxy material. We also have a member of this family that is parasitic. It is in the large genus *Nomada*. It is more wasplike in appearance, with very little body hair and reddish in color. It does not need body hair to transport pollen since it lays its eggs in other bees' nests, so its larvae can feed on the pollen stored there.

***Nomada* sp**. **Digger Bee**. Length ⅜ inch. Photo p. 26.

***Peponapis* sp**. **Digger Bee**. Length ⅜ inch. No photo.

Leafcutter Bees (Megachilidae)

You may have wondered what insect cuts such neat circles from the edges of the leaves on your rose bush. These cuts make the leaves look a bit ragged, but I hope you will forgive the little leafcutter bees because they are some of our best pollinators. We need all the insect pollinators we can get, since honeybees are not as abundant as they used to be. Leafcutter bees, which use the leaves they cut to make their nests, are in the same family as orchard mason bees, which use mud for their nest-building material.

Leafcutter bees are active from early spring to late summer, so their pollinating activities are valuable to many different flowering plants, whereas orchard mason bees live only a few weeks in the spring, sometimes completing their work even before all the apple trees have bloomed.

Our native leafcutter bees are never very abundant, and they do not live together in colonies. Each female must search out a small hole or cavity in which to build her nest. I have seen them using the unfilled holes in the nest blocks I put out for orchard mason bees. Some people have come into Master Gardener plant clinics complaining about bees building their nests under and between the shingles on their houses or in the grooves of wood siding. A few of these nests have been brought in, and they are obviously the work of leafcutter bees.

The female leafcutter bee uses her scissorlike jaws to cut nearly perfect circles ¼ to ½ inch in diameter from the edges of leaves. She pushes these circles

into her nest hole to form the end of a brood chamber. Then she cuts oblong pieces of leaf that she rolls up into short tubes to form the walls of the chamber.

When the outer walls of the chamber are ready, she gathers pollen and nectar from blossoms and stores enough at the bottom to feed the one larva that will hatch from the egg she lays there. Then she cuts another leaf circle to close off the bottom cell. She repeats the process, constructing leaf cells until the tube is filled. A 3-inch hole may have six cells, each with one egg. After the larvae are fully grown, they spin soft silk cocoons in which to spend the winter as pupae. They then emerge as adult bees the following spring.

Alfalfa seed growers in eastern Washington learned many years ago that our resident leafcutter bees are much better pollinators of alfalfa blossoms than honeybees are. The growers tried many ways to increase the population of leafcutter bees, such as drilling holes in fence posts and barns, until a bright (or lazy!) graduate student thought of filling nest boxes with drinking straws. The increase in production of alfalfa seed per acre was phenomenal, and you can still see nest boxes full of straws in the alfalfa fields at blossom time.

Some Master Gardeners have collected leafcutter bees and brought them to me for the Skagit County insect collection, and we have several kinds there for you to look at. I am sure there are many more kinds in Skagit County that we do not have as yet. We need to protect and encourage these valuable pollinators in every way we can. If you see some of these little bees at work and can collect a specimen (do not take very many!), bring them to me so we can discover what we have. Do not put bee specimens in alcohol. Just put them in the freezer to kill and preserve them. Once we discern what kinds of leafcutter bees we have in Skagit County, we can determine what flowers they are pollinating and, I hope, find ways to help them increase their population.

***Megachiles* sp**. **Leafcutter Bee**. Length ⅜ inch. No photo.

***Osmia* sp**. **Orchard Mason Bee**. Length ⅜ inch. Photo p. 26.

Thread-Waisted Wasps (Sphecidae)

One of the largest families of the order Hymenoptera is the family that includes the thread-waisted wasps. This is the family Sphecidae (pronounced Sfeesidee). They are often called hunting wasps because they capture other creatures for their food. They vary in size from the smallest, which are ⅛ inch long and capture aphids for their food, to the cicada killer that is 1½ inches long. They all have stingers and venom to subdue their prey, but they are not as likely to sting people as bees and yellowjackets are. The life cycles of hunting wasps are complex and have been studied by many people. A French naturalist, J. Henri Fabre (1823–1915), spent many years studying and observing wasps, and his book *The Hunting Wasps* is a classic work that is still used as a source of information about these fascinating insects.

There are 16 species of hunting wasps presently in the Skagit County insect collection and no doubt many more yet to be collected and identified. One, in the genus *Prionyx*, makes its nest in the ground and provisions it with grasshoppers. Like other predatory wasps, it paralyzes its prey with its sting so the grublike

larvae can have fresh food as it is needed. This black wasp is ¾ inch long, and she has long legs that enable her to carry or pull a grasshopper larger than herself. She straddles the grasshopper, grasps the grasshopper's antennae with her mandibles, and drags it forward to a spot suitable for digging a hole. She stashes the paralyzed grasshopper in a nearby clump of grass while she proceeds to dig like a dog, sending the dirt out behind her. Her feet have stiff bristles, which help in digging.

The site for digging is a bare spot, preferably in dry, sandy soil. The wasp digs a burrow 1 to 3 inches deep, depending on the nature of the soil. I have found *Prionyx* nesting in sandy soil near a beach in Anacortes. When the burrow is finished, the paralyzed grasshopper is retrieved, dragged to the burrow, and pulled or pushed into a slightly enlarged chamber near the end. Then the wasp lays an egg on a soft spot near the base of the grasshopper's hind leg, where the newly hatched wasp grub can penetrate to begin feeding.

When feeding and growth is completed, the grub spins a cocoon in which to change into an adult wasp, which will emerge a year later when there are again grasshoppers available so it can repeat the behavioral pattern of its parent. There are no *Prionyx* wasps from the previous generation present when the new *Prionyx* emerges from its burrow. How does it know what a *Prionyx* wasp is supposed to do? Who tells it where to sting a grasshopper in order to paralyze but not kill it so its offspring can have fresh food to eat? Instinctive patterns of behavior have fascinated scientists for hundreds of years.

A common thread-waisted wasp that most of us are acquainted with is the mud-dauber wasp (*Sceliphron caementarium*) that decorates our houses with mud nests. *Sceliphron* in Greek means dry, parched, or lean, a reference to the wasp's slender waist. It is ¾ inch long, black with yellow markings, and is often seen flying around our buildings in warm summer weather. Why are these big thread-waisted wasps frequently seen flying in the house? Are they doing any damage? Can they sting?

Their common name, mud dauber, and their species name, *caementarium,* tell us something about what they are doing (*caementarius* in Latin means mason or builder of walls). These wasps gather mud with which to build a cement nest or brood chamber. They need a dry location for the mud nest because if it got wet it would fall apart. They may spend many hours searching for a suitable spot and that is when you see them flying in and around buildings. The attic is an ideal spot, not only dry, but warm in summer when they and their offspring are most active. It is also a protected spot, not likely to be disturbed.

After the nest site is located, the female wasp goes in search of mud. Clay works best, but if she does not find clay she will use whatever is available. The success of her nesting project often depends upon finding the right building material. She gathers soft mud with her jaws and front legs, forming it into a ball that can be carried in flight. If you are close enough, you may hear her making a low humming sound as she gathers mud. When she arrives at the nesting site and begins to shape the mud with her mouthparts and feet, she makes a high-pitched singing sound. You may have heard that sound on a warm summer day coming from the attic or wall and wondered what it was.

It takes many trips for the wasp to gather enough mud to form a tube about 1 inch long and ¼ inch in diameter, which she plasters to a flat surface such as a rafter or wall. When the mud tube is nearly finished, the wasp goes in search of a food supply for the mud-dauber larva that will live and grow in the tube. The mud daubers in our area provision their nests with small spiders. It may take several weeks for the young wasp grub to grow to full size ready to pupate for the winter. It needs a good supply of fresh food all during that growing time, so the female provisions the nest with enough spiders to ensure a sufficient supply and lays one egg attached to one of the spiders. Then she seals up that tube with mud and starts another one alongside. Once a tube is sealed, she never opens it, so there is no way to provide any more food. Dead spiders would dry up and spoil during the time required for growth of the larva, so the wasp does not kill them, she only paralyzes them with her sting. That way the larva has fresh spider meat every day for as long as it needs it.

The mud-dauber wasp continues to make more mud tubes packed closely together until there are as many as six or eight or until she runs out of mud and spiders or time and energy. After the wasp larvae in the mud nests finish eating and growing, they transform into pupae for the winter and emerge the next summer as adult mud daubers. The new adult wasps have never seen a mud nest being built and their mother is not there to give them building instructions or to tell them where to find spiders and how to paralyze them with their stings. That does not matter, they do it anyway and they have not been known to make use of the old nest in any way.

Are these mud-dauber wasps harmful, beneficial, or just interesting? That depends on how you relate to them. If you do not like mud nests on your nicely painted house, you could keep them washed off with a water hose. If you do not like spiders in and around your house, you might appreciate the help of the wasps to get rid of them. I will let you decide what you want to do about these little six-legged cement masons.

A large hunting wasp that digs its nest in sand is the sand wasp (*Bembix americana*). It is ¾ inch long and resembles a yellowjacket or large bee. It does not build a nest of paper or mud. The female digs a burrow in the sand, often several feet deep. She hunts for a fly, which she paralyzes by stinging and then carries with her legs as she flies back to her nest. She lays one egg on the fly and that egg hatches into a grub that eats the fly. She continues to hunt for flies to provide food for the grub as it feeds and grows. If the weather is cold or stormy, she may not leave the burrow for several days, and then the grub remains inactive as it waits for its next meal.

The female wasp sleeps in the entrance to her burrow at night, and she will not allow the male to sleep there. He has to dig a burrow for himself. I have found sand wasps nesting in sandy areas in Anacortes near the bay. They frighten people who think they are yellowjackets. They can sting, but they are not aggressive and they do not pay any attention to people unless someone interferes with their activities at the nest site. Each female digs a separate burrow, but there are often several nesting near each other at a good sandy site. It is best to leave them alone, if possible, so they can reduce the fly population.

Many of the thread-waisted wasps do not have an obvious thread waist like the mud-dauber wasp, but their abdomens are narrowly joined to the thorax and other structural features, along with their hunting habits, place them in the same family. One of these is *Diodontus,* which is widely distributed but not often noticed because it is only ⅛ to ¼ inch long. This genus is found worldwide with 23 species in North America.

These little hunting wasps dig burrows in soft dirt and provision their nest with aphids, often placing as many as 20 aphids in the nest as food for one *Diodontus* larva. Each female wasp digs her own nest, and often many will be nesting in a spot where the soil is right for digging and a good supply of aphids is nearby.

Insect collectors often overlook these tiny wasps or prefer not to bother with them. American entomologists who first described and named species of *Diodontus* from 1809 to 1910 often had only one or two specimens to look at. The males and females of these little wasps are quite different in appearance, so they were sometimes named as different species. Many years later, in 1980, I began a study of the American species of *Diodontus*, and by then there were much larger numbers of specimens in major American collections, so I was able to revise the genus *Diodontus*, placing male and females of the same species under one name, eliminating duplicate names, and describing new species that had not been previously recognized.

This fascinating work of insect taxonomy took me to large insect collections like the ones at the Smithsonian in Washington, D.C., the Philadelphia Academy of Sciences, the California Academy of Sciences, and even to a collection in Copenhagen, Denmark. I studied over 4000 specimens of these little wasps over a period of 10 years and published a generic revision of the genus *Diodontus* in North America in 1989.

One of the most exciting experiences was looking at the actual specimen in the Copenhagen collection that was studied by Fabricius in 1793 and given the name *Diodontus minutus*. The preservation of that little European wasp for almost 200 years enabled me to compare an American species, *Diodontus franclemonti,* with it and determine that our American species is identical to the European species *D. minutus,* and we now use the European name. I can only assume that the wasp made its way from Europe to America in commercial shipments and established itself from coast to coast.

Recently some Washington State University researchers looking for a biological control for aphids in potato fields in eastern Washington asked me to identify *Diodontus* wasps they had collected there, and I was able to recognize them as *D. minutus*. I have seen one specimen of *Diodontus* collected from spinach near Mount Vernon, Washington, in 1943, but as yet, I have not collected a single specimen of *Diodontus* in Skagit County. You may be able to help me by bringing any tiny wasps you find to the WSU Extension office. Who knows, you might discover a new species!

Another little wasp, ⅛ inch long, that digs tunnels in the dirt is *Pulverro*. It has been collected in British Columbia to the north of us and in northern California, but I have not seen any specimens from Skagit County. It is found throughout

the western United States, and it should be found here. It provisions its nest with thrips, so it is considered beneficial by farmers and gardeners.

I discovered a new species of *Pulverro* in the mountains of northwestern California and named it *Pulverro monticola,* which means "from the mountains." Besides collecting many specimens of *Pulverro*, I examined specimens in major American collections and found the female of *P. columbianus*, the one from British Columbia. The female had been named *P. colorado* because it looked so different and was found so far away. How did I know it was the female of *P. columbianus*? That is a long story. I also recognized a new species of *Pulverro* from southeastern California and gave it to a graduate student to describe in his dissertation. He named it *Pulverro eighmei*. Now, that poor little wasp has to carry that difficult name forever.

Two other hunting wasps found in Skagit County that dig nests in the soil and provision them with flies are in the genera *Crossocerus* and *Crabro*.

There are also several hunting wasps that nest in holes in wood. Those found in Skagit County include *Pemphredon*, *Passaloecus*, *Stigmus*, *Trypoxylon*, *Rhopalum,* and *Ectemnius*. I have collected specimens of these in various locations from Anacortes to Marblemount. They are rarely noticed because of their small size, limited numbers, and solitary and inconspicuous behavior. However, they play an important role not only in the natural ecosystem, but also in the agroecosystem, which includes our gardens. We should be doing more to get acquainted with them and protect them.

On a warm sunny day in August when I was wandering through the WSU Skagit County Extension Master Gardener Discovery Garden in Mount Vernon observing insect activity, a small plot of clean, dry sand appeared to be an attractive spot for insect activity. What were they finding there? They were too small for me to identify without a microscope, so I collected a few specimens to study at my desk. There were several different kinds of flies, but I was delighted to discover that a small wasp was also using the sandy area for its nesting site. This was my first contact with the ¼-inch-long wasp *Oxybelus ventralis* in Skagit County. I doubt that it is rare here, but I had never been at the right place at the right time to see it. My insect research for many years was focused on relatives of this little wasp, and I had collected this same species in other places. It is a beneficial insect for the garden and one more agent of integrated pest control.

No common name has been given to this little wasp. Maybe you can come up with one after I tell you what it is doing in the Discovery Garden. It is often seen flying around the blossoms of wild carrots, parsnips, and other umbelliferous plants. It could be sipping a bit of nectar there to provide energy for its activities, but it is also there to capture its prey: small flies. It frequently captures root maggot flies, the adults of the wormlike larvae that chew holes in radishes and turnips. It has also been observed capturing mosquitoes and black flies, both of which bite people. The method by which it carries the captured fly to its nesting burrow in the sand has fascinated many entomologists. It grabs the unsuspecting fly either out of the air or from the surface of a leaf and immediately thrusts its stinger into the neck of the fly to paralyze it. Instead of carrying the fly in its legs, which

would interfere with its rapid flight, the little wasp impales the fly on its stinger and tows it behind as it flies back to the sand plot.

Take a break from your work in the garden some day and sit by a sandy area to observe what is going on there. If you are fortunate enough to see this little wasp there before it goes after a fly, you will see it energetically digging a tunnel in the sand. It will stand on its head and make the sand fly with its feet. It will construct a burrow vertically into the sand about 3 inches deep. A small chamber at the bottom will be excavated to hold five or six flies. The first fly captured is dragged down to the chamber and one egg is fastened to it. The other flies are tucked in around it until the chamber is full. Sometimes another chamber will be dug adjacent to the first one and a new tunnel will be dug from the surface. Frequently several wasps will be nesting in the same spot of sand, but they neither assist nor hinder each other. It is peaceful co-existence.

The egg hatches into a tiny grub, which feeds on the flies in the room in the sand and then pupates in a cocoon, where it remains through the winter. It emerges as an adult *Oxybelus* wasp in August and repeats the life cycle. You may see a pair of wasps, male and female, working together to construct the nest. Only the female is equipped with the sting that enables her to paralyze and transport the flies that are needed to provision the nest. These little wasps never occur in large numbers, but they are widespread and play an important role in the gardens and fields. I am pleased that they have chosen the Discovery Garden as a place to nest. Now, don't you dare hurt these little friends of mine.

Bembix americana. **Sand Wasp**. Length ½ inch. No photo.

Crabro latipes. Length ½ inch. Photo p. 27.

***Crossocerus* sp**. **Square-Headed Wasp**. Length ¼ inch. Photo p. 27.

Diodontus boharti. Length $^{3}/_{16}$ inch. Photo p. 27.

Diodontus minutus. Length ⅛ inch. No photo.

***Ectemnius* sp**. Length ¼ inch. No photo.

***Oxybelus* sp**. Length $^{3}/_{16}$ inch. Photo p. 27.

Passaloecus cuspidatus. Length $^{5}/_{16}$ inch. Photo p. 27.

***Pemphredon* sp**. Length ⅜ inch. Photo p. 27.

***Prionyx* sp**. Length ¾ inch. No photo.

Pulverro eighmei. Length ¼ inch. No photo.

Pulverro monticola. Length ¼ inch. Photo p. 27.

Rhopalum clavipes. Length ⅜ inch. Photo p. 27.

Sceliphron caementarium. **Mud-Dauber Wasp**. Length ¾ inch. Photo p. 27.

***Stigmus* sp**. Length $^{3}/_{16}$ inch. No photo.

***Trypoxylon* sp**. Length ⅜ inch. Photo p. 27.

Spider Wasps (Pompilidae)

So far, this large family of hunting wasps is represented in Skagit County by only one species, but there may be more yet to be found. Like the mud-dauber wasps, these also provision their nests with paralyzed spiders. However, instead of building mud nests, they dig burrows in the ground or search out natural cavities, such as those found in rotten wood. They are mostly shiny black, about ½ inch long, with dusky-colored wings. They flutter their wings nervously while running about on their long legs in search of spiders. They have a painful sting, but are not likely to sting you unless you handle them or interfere with their search.

Pompilidae. **Dusky-Winged Spider Wasp**. Length ½ inch. No photo.

Cuckoo Wasps (Chrysididae)

These little wasps are mostly about ¼ inch long, so they are often overlooked. When you do see one, you will be amazed at its beauty. They are shiny metallic green or blue, often iridescent, with elegantly sculptured bodies. Their beauty is best seen under the microscope.

They are called cuckoo wasps because, like the cuckoo bird, they lay their eggs in other wasps' and bees' nests instead of constructing their own. That way they do not have to gather food for their offspring. They are most often seen flying in the vicinity of nesting bees or searching for the holes of twig-nesting wasps. Entering the nests of bees and other wasps can be a dangerous business, and the cuckoo wasp is not immune to the stings of its host. It is well equipped for its task, however. Its body is covered with armor. The shiny metallic exoskeleton that is so colorful and sculptured protects it from sharp stingers. The underside of its abdomen is concave and if attacked, it tucks its head down and rolls up into a ball leaving no exposed area susceptible to the stinger of the bee or wasp whose nest it is invading.

Cuckoo wasps are widespread, but never abundant in one place. It does not appear that the bees and wasps they prey upon are seriously threatened by these little parasites. Only a small number of eggs or larvae are destroyed by the cuckoo wasp's larvae. I have collected three different species of cuckoo wasps in my yard, each with a different color and pattern of sculpture. There are no doubt many other cuckoo wasps in Skagit County. Now that you know they are out there, watch for them and bring more in for the collection, so we can enjoy looking at their gemlike beauty.

***Omaulus aeneus*. Cuckoo Wasp**. Length $^{3}/_{16}$ inch. Photo p. 28.

Sawflies (Tenthredinidae)

The name sawfly, like so many other common names, is a misnomer. Sawflies, like other members of the order Hymenoptera, have four wings (two pairs) whereas true flies in the order Diptera have two wings (one pair). The adult female sawfly has an ovipositors with sawlike teeth, which she uses to insert her eggs into plant tissue. The larvae of sawflies resemble caterpillars, but sawfly larvae do not have crochet hooks on their prolegs and they have more than five pairs

of prolegs. Caterpillars have crochet hooks and five or fewer pairs of prolegs. Most sawfly larvae feed on the leaves of plants, and some are serious pests.

Since sawfly larvae and caterpillars look so much alike, is there any reason to learn to tell which is a caterpillar and which is a sawfly larva? Yes, there is if you want to advise someone about how to control them in the garden. Specific pesticides like the biological pesticide *Bacillus thuringiensis* are designed to kill caterpillars, and they will not kill sawfly larvae. The adults of caterpillars are moths and butterflies, which are common and easily recognized. Sawfly adults are wasps, but they look very much like flies and are more difficult to recognize. Only a few of the many kinds of sawflies are pests, so it helps to know which ones we need to be concerned about in our gardens.

A sawfly that is a common pest on currants is the imported currant worm (*Nematus ribesii*). The female sawfly lays a large number of eggs in the veins of the newly emerging currant leaves. The larvae grow rapidly and can completely defoliate the plant. If you are not watching, it seems like it happens overnight. The currant may grow some new leaves, but the plant is weakened and may not bear a crop. The mature sawfly larvae drop to the soil, overwinter in cocoons, and emerge as adults the following spring just as the currant plants are growing new leaves.

Not all sawfly larvae look like caterpillars. The pear slug (*Caliroa cerasi*) is actually a sawfly larva, but it has almost invisible prolegs, is slug-shaped, and has a black slimy covering that makes it look like a slug. The pear slug skeletonizes the leaves of pear, cherry, and plum trees and can cause enough damage to weaken a tree. The first generation from overwintering cocoons in the soil appears in early summer. It is usually not abundant, but the next generation is much larger, and by late summer and early fall a tree can be almost stripped by the chewing of pear slugs. The adult form of the pear slug looks like a small black bee.

The birch leafminer sawfly (*Fenusa pusilla*) is commonly seen skeletonizing the leaves of birch trees in our yards. The larva resembles a caterpillar that also feeds on birch leaves, but it can be recognized as a sawfly larva by its prolegs and the S-shaped curve in its body when at rest. The leaves turn brown where they have been skeletonized, and the damage can be extensive enough to give the appearance that the tree is dying. Early detection and control can keep these sawflies in check.

In Skagit County there are many more kinds of sawflies feeding on trees in the forest than there are feeding on trees in our yards. A common sawfly that feeds on the leaves of alder is the alder woolly sawfly (*Eriocampa ovata*), so-called because the larva is covered with a white woolly secretion. That makes it easy to detect on the lower leaves of young alder trees. It is not likely to feed on other plants in the garden. It should not be confused with white woolly aphids, which feed on several different garden plants. Sawfly larvae have chewing mouthparts and aphids have sucking mouthparts.

The large alder sawfly (*Cimbex americana*) is common in our alder woods. The large larvae look like caterpillars without hairs and are usually coiled when at rest. They feed on the leaves of alder, but are never abundant enough to do any damage to the trees. The mature larvae drop to the ground and spin co-

coons, where they spend the winter under leaf litter. The adults emerge in the spring and eggs are laid in the new alder leaves.

A bright red gall on willow leaves is caused by the willow-leaf gall sawfly (*Pontania pacifica*). The adult female sawfly inserts eggs into slits made in the leaf with her sawlike ovipositor. The leaf responds by producing a bright red swelling or gall ⅜ inch in diameter. The larva feeds on the inside of the gall. Soon after the leaf drops to the ground in the fall, the larva emerges to pupate on the ground, where it overwinters, emerging as an adult sawfly the following spring when the willow leaves are growing. These galls are never abundant enough to do any damage to the willow tree and they are quite decorative on the green willow leaves.

There are many other kinds of sawflies, but most of them feed on weeds or never multiply fast enough to do any serious damage to the plants. If you learn to distinguish between sawfly larvae and caterpillars, you can simplify the control of insect pests.

Closely related to sawflies is the horntail wasp (*Urocerus californicus*), which has a needlelike ovipositor instead of a sawlike ovipositor. Its body is 1 inch long and the sharp, stiff ovipositor is ½ inch long. It uses its ovipositor to lay eggs in the bark of dead or dying fir trees. The grublike larvae chew tunnels in the wood as they feed on dead or decaying wood. These wasps are large and spectacular with their long stingerlike ovipositors, and people frequently ask about them. When my brother and I were working in the woods with my father, we frequently saw these large horntail wasps buzzing around noisily. They were attracted by the odor of freshly cut fir trees, and we watched them drilling into the bark with their large pointed ovipositors. We did not know what they were doing and when one landed on my brother's hat we were afraid it was trying to drill into his head! They do not sting people and are of no economic importance. It is good to be able to tell people that.

Caliroa cerasi. **Pear Slug**. Length ⅜ inch. Photo p. 28.

Cimbex americana. **Alder Sawfly**. Length ¾ inch. No photo.

Eriocampa ovata. **Alder Woolly Sawfly**. Length ½ inch. No photo.

Fenusa pusilla. **Birch Leafminer Sawfly**. Length ⅜ inch. No photo.

Nematus ribesii. **Imported Currant Worm**. Length ⅜ inch. No photo.

Pontania pacifica. **Willow-Leaf Gall Sawfly**. Length ¼ inch. No photo.

Urocerus californicus. **Horntail Wasp**. Length 1 inch. No photo.

Gall Wasps (Cynipidae and Other Families)

Insects that produce galls on plants are most common in the family of wasps known as cynipid wasps. There are over 600 species of gall wasps in North America. Most of them cause some concern among gardeners, who want to know what they are and if they will damage plants.

Many plants have galls, but not all galls are caused by gall wasps. Mites and aphids cause galls, as do fungi and bacteria. However, gall wasps are the cause of galls on more plants than any other organism. The female wasp initiates the growth of a gall by inserting an egg into the tissues of the plant. The plant responds to the chemical and mechanical stimulation with the abnormal cell growth that produces the gall. The plant's response to each different species of wasp produces a different kind of gall with different shapes and colors. The gall provides food and shelter for the developing larva of the gall wasp with no apparent damage to the plant. Many galls are colorful and decorative, adding interest to the plant.

Sometimes other insects lay their eggs in the gall and their offspring live as parasites on the developing wasp. Other insects live in the gall without harming the wasp. Sometimes a gall may be home for several different insects and mites. If you open a gall, what you find there may not be the originator of the structure.

A common gall of interest in Skagit County is the rose-leaf gall caused by the cynipid wasp *Diplolepis*. These round spiny galls are often brightly colored in various shades of red and are quite attractive. The larvae spend the winter in the galls, which drop with the leaves in the autumn. They emerge as adult wasps in the spring just in time to lay their eggs on the newly developing leaves. There is no apparent damage to the rose plants. This wasp lays its eggs only on wild roses and does not pose any threat to ornamental roses in the garden.

Another common gall caused by a gall wasp is found on the stems of the thimbleberry plant, which grows at the edge of clearings and the borders of roads. The cynipid gall wasp that causes thimbleberry-stem galls is *Diastrophus kincaidii*. The female wasp lays several eggs in soft new spring growth. The knobby stem gall that results may be 1 inch thick and 2 inches long. It is green like the rest of the stem and may not be noticed until the leaves drop off in the fall, exposing the brown knobby stem. This little wasp is not abundant or widespread, but if you look at enough thimbleberry plants you will find it. It is a weak flier and does not travel very far, so the populations are quite localized. There are specimens of this little wasp in the Skagit County insect collection.

We have some interesting galls brought to Master Gardener plant clinics each season. A few have been kept as specimens, but it would be interesting to make a collection of as many different plant galls as we can find in Skagit County and determine which insect causes them.

***Diastrophus kincaidii*. Thimbleberry-Stem Gall Wasp**. Length ⅛ inch. Photo p. 28.

***Diplolepis* sp**. **Rose-Leaf Gall Wasp**. Length $^{3}/_{16}$ inch. No photo.

Parasitic Wasps (Chalcidae, Braconidae, and Other Families)

A large number of wasps in the order Hymenoptera are known as parasitic wasps. True parasites live at the expense of their hosts, but do not kill them because then they would have no place to live. Examples of true parasites are tapeworms, nematodes, protozoans, and many others that live and reproduce within the host's body without killing the host. Parasitic wasps, however, lay their eggs in the host

and the larva consumes the host's body causing its death. For that reason, entomologists prefer to call them parasitoids rather than parasites. These parasitic wasps are the ones that have "tails" in the form of needlelike ovipositors. They use these to penetrate the host's body to lay eggs rather than to inject venom like yellowjackets do.

Most parasitic wasps are very small and not seen by gardeners. They are often host-specific with a different species for different caterpillars, aphids, scales, etc. With more than 10,000 species in North America, these parasitic wasps are a large portion of the order Hymenoptera; however, they are not well known except by specialists who deal with the biological control of insect pests. We need to be aware of their presence and do everything possible to protect them because without them it would be practically impossible to control pest damage in our gardens.

The members of one large group of parasitic wasps are commonly known as chalcid wasps. Over 2000 species of the family Chalcidae have been recognized and named in North America. They are mostly less than ⅛ inch long, but some, such as egg parasites like the trichogramma wasp, are as small as $^{1}/_{32}$ inch long. Many of the chalcid wasps have shiny metallic colors. Some have an unusual ability to multiply rapidly by a process known as polyembryony. One egg inserted into a caterpillar can divide, divide, and re-divide into as many as 1000 offspring. That is nature's method of cloning!

A little wasp named *Aphidius* is commonly found in aphid colonies. Using its needlelike ovipositor, it lays its egg in the aphid. The wasp larva then feeds on the internal organs of the aphid and spins its cocoon within the distended shell of the dead aphid's body. If you see round, puffed-up, empty aphid shells, you know these aphid wasps are helping to control the aphid population. Sometimes they will completely eliminate the aphids from a plant.

Another large family of parasitic wasps is the Braconidae, which includes many genera and more than 1000 species in North America. Caterpillars are often hosts for braconid wasps. The wasp larvae frequently emerge from the caterpillar to spin their cocoons, and you may see a caterpillar with many white braconid cocoons attached to its body. At that point the caterpillar is either already dead or soon will be.

These small parasitic wasps are not often seen by gardeners, but it is good to know they are there doing their part to balance the unstable ecosystem. If you observe the specimens in the collection under the microscope, you can learn to identify them by family. Then you will know that they are your friends, not some pesky fly or gnat that you want to get rid of. Most people do not realize how many different kinds of insects there are because so many of them are very small like these parasitic wasps.

Ichneumon Wasps (Ichneumonidae)

Some important insects have never been given user-friendly common names. This is one of them. Pronounce it any way you want to, but it looks as bad as chrysanthemum or rhododendron until you get accustomed to it. A recent book on Ameri-

can insects states that there are over 5000 species of ichneumon wasps in the United States and Canada, none of them with common names, and they are difficult to identify. Why do we even bother with them? They are all parasites of other insects and play important roles in the biological control of insect pests, especially caterpillars. They frighten many gardeners who see them flying around their plants, seemingly looking for someone to attack with their long "stingers." How many good gardeners have stomped them or even sprayed potent pesticides to kill them?

Ichneumon wasps are well represented in Skagit County. They vary greatly in size, shape, and color. The larger ones with bodies ½ to 1 inch long are the ones we most often notice. The smaller ones, less than ⅜ inch long, are much more abundant but rarely noticed. There is likely no species of moth in Skagit County whose caterpillar is not parasitized by an ichneumon wasp, and the wasps are mostly host specific, which means each species of caterpillar is attacked by at least one species of ichneumon wasp. Why aren't the caterpillars completely eliminated by the wasps? The chances of the wasps finding every caterpillar of their particular host species are slim. Besides, if they came anywhere near that, their food supply would be so difficult to find they would face extinction themselves. This is a good example of the so-called balance of nature or perhaps more accurately "dynamic equilibrium" of nature, since it never achieves a perfect balance. As the caterpillars increase, the wasps increase because of the more abundant food supply. As the wasps increase, they destroy more of their food supply and as food becomes more difficult to find, the wasps decrease, letting the caterpillars multiply again. That explains the fluctuating populations we see of insects like tent caterpillars.

A spectacular ichneumon wasp was brought to one of our Master Gardener plant clinics, and I have found one of the same kind in my own yard. It is 3½ inches long including the stingerlike ovipositor. It might frighten you, but if you could watch it long enough, you would be amazed at what it does. It lands on the bark of a tree and crawls up and down, tapping with its long antennae, obviously searching for something. Eventually it finds the spot it is looking for and begins to drill into the bark with its needlelike ovipositor. It has detected the larva of a horntail wasp chewing its tunnel in the wood an inch or more below the surface of the bark. The ovipositor is made up of three threads, hardened by minerals, which fit together with a groove in the center. Vibrating those sharp-pointed threads forces them into the bark and sapwood of the tree to contact the horntail grub in its tunnel. An egg is forced down the ovipositor to parasitize the grub. If the ichneumon parasite larva killed its host, they would both die, trapped in the wood, which the parasite is unable to chew. So the wasp larva feeds only on nonvital organs like the fat body until its host has nearly completed its life cycle and has chewed its way out near the surface of the bark. Then it kills and consumes its host grub and completes its own life cycle to emerge as another giant ichneumon wasp in the genus *Megarhyssa* (*mega* meaning large and *rhyssa* meaning tail) to start over again. You can see both *Megarhyssa* and its horntail wasp host in the Skagit County insect collection.

People often ask if the ichneumon wasps will sting them with their needle-like ovipositors. The wasps are interested only in laying eggs in caterpillars or other insects, but if you handle a live one it might try to sting you in self-defense. Small ones could not likely penetrate your skin, but larger ones might be able to. If any ichneumon wasp comes flying around you, just shoo it away and tell it to go find a caterpillar.

Ichneumonidae. Ichneumon Wasp. Length ⅝ inch. Photo p. 28.

***Megarhyssa* sp**. **Horntail Parasite**. Length 3½ inches. No photo.

Yellowjackets and Wasps with Folded Wings (Vespidae)

There are 10 different species of yellowjackets in the Pacific Northwest, but we can recognize them just as yellowjackets without knowing their individual species names. They have been studied in great detail because of their importance to people. Some people are highly allergic to their venom, and an attempt has been made to develop antivenin medications effective for the species that are most likely to sting people. They differ in their habits and temperament.

The common yellowjacket (*Vespula vulgaris*) and the western yellowjacket (*Vespula pennsylvanica*) are the most aggressive species and the ones most likely to sting. They hide their nests, usually in holes in the ground but sometimes in the walls of buildings or in rotten logs. They eat a wide variety of things including other insects, dead animals, garbage, and ripe fruit. The aerial yellowjacket (*Dolichovespula arenaria*) builds its paper nest above ground, often under the overhang of a building or on the branch of a tree. It is also equipped with a stinger to defend its nest, but it is not as aggressive as the common and western yellowjackets. It feeds mostly on live insects it captures and kills. It does not scavenge for protein like the common yellowjacket and is not as much of a pest at the picnic table.

The bald-faced hornet (*Dolichovespula maculata*) has no yellow color, so it is called hornet instead of yellowjacket, even though it is in the same genus as yellowjackets. Bald-faced refers to its smooth white face. It is the least aggressive and is not likely to sting unless its nest is disturbed. Bald-faced hornets often attain large numbers in one nest, and the paper nests get very large, up to 24 inches in diameter. Some people welcome them around their houses to help control flies, which they do very well. However, they can sting as well as any other yellowjacket, so be careful.

The yellowjacket queen starts a new nest all by herself in early spring. The overwintering queens are the largest members of the previous season's colony. You may see them gathering wood fibers from weathered fences and porch railings. They chew the fibers into a pulp mixed with saliva and spread it out to dry to form the walls of the paper nest. These little creatures were making paper long before modern paper mills. If you examine a piece of yellowjacket paper closely, you can see patterns made by adding each mouthful of fiber, sometimes of different colors. It takes a lot of mouthfuls of wood fiber to build a paper house. The comb is also made of paper with cells to hold each larva as it grows. The workers are females, but smaller than the queen, and as the colony increases in size and

number, the queen stays home to lay eggs while the workers gather food and fiber.

Yellowjackets feed on nectar from flowers, but they do not store it as honey. They like ripe fruit, which gives them energy to do their work. The larvae need protein for growth, so the workers gather meat to feed the larvae. They are not choosy, and they will butcher caterpillars, spiders, flies, grasshoppers, and even stink bugs. Bald-faced hornets are larger than their yellowjacket relatives, and they will frequently capture and kill yellowjacket workers to feed to their larvae.

The larvae grow rapidly, and when they are mature they spin cocoons in their paper cells and soon emerge as adult workers. Later in the season, the queen lays some unfertilized eggs to produce males that mate with the largest of the females. These large mated females are the overwintering queens that start new colonies in the spring. The nests are destroyed during the winter by weather and predators, and the new queen starts a new nest each spring.

One summer day as I was working in my garden and admiring my beautiful cabbage plants, I saw a yellowjacket climbing out from between the cabbage leaves. My immediate reaction was to stomp on the unwelcome creature that was invading my garden. Then I noticed it was carrying something in its jaws: a fat green cabbageworm that had been chewing holes in my plants. Well, I had to recognize that even a yellowjacket can do something good.

Yellowjackets also eat house flies and several kinds of barnyard flies, and they feed their young with spittle bugs, fall webworms, and codling moths. We should not try to kill all the yellowjackets in our area. However, they can be a hazard, especially to small children and to people who are allergic to their sting, so it is often necessary to destroy yellowjackets nesting in our gardens or around our houses. People are frightened by the presence of a yellowjacket, even if it is not doing anything to threaten them. Food-processing plants and garbage attract large numbers of yellowjackets that may be a threat to workers. Food harvesters, loggers, and firefighters are also inhibited in their work when yellowjackets are present. You can read about some methods of yellowjacket control in WSU Extension Bulletin 0643, “Yellowjackets and Paper Wasps.”

If you can learn to identify yellowjackets—common, western, aerial, or bald-faced—you will be better able to decide whether or not to destroy them. The common yellowjackets and the western yellowjackets that hide their nests in the ground or other secluded spots are the most dangerous to have around your yard and garden. Some years the yellowjacket colonies never get very large and may not even be noticed. Other years the weather, food, and enemies may be such that by late summer each colony contains hundreds of yellowjackets that really cause trouble. Large populations of yellowjackets discourage people from using campgrounds and outdoor recreational facilities and control measures become necessary.

Knowing that not all yellowjackets are the same and that some are not likely to sting you and that in the right place they can even be beneficial should help you to learn to share Skagit County with them. But it surely would help if some way we could convince them to stay in the right place!

The term wasp is a common name for some other insects in the family Vespidae. They fold their wings lengthwise when at rest, like the yellowjackets. One that looks like a yellowjacket and is often mistaken for one is the paper wasp (*Polistes*). It is black and yellow, but the body shape is different. The abdomen is more slender and tapered. Its nest is also different. It makes paper from wood fiber like yellowjackets do, but it does not cover the nest comb with a paper envelope. The comb is often built under the roof overhang of a house, where it is fastened by a short stem.

The adult wasps can be easily observed tending the nest and feeding the larvae in the cells. The comb is enlarged as the family grows, and there may be 10 to 20 workers bringing food to the nest. They use flies, caterpillars, and any other insects they can find to feed the larvae. The adults also eat insects, but they are strongly attracted to ripe fruit, which they bite into with their mandibles. Paper wasps are not as aggressive as yellowjackets and usually do not bother people. However, if you disturb their nest, they are not slow to defend themselves with their stingers. The nests are usually exposed and easy to destroy, but where possible, it is good to leave them alone and let these little predators fulfill their role in the ecosystem.

Another common vespid wasp in Skagit County is the potter wasp (*Ancistrocerus* sp.). As its name implies, it is a skilled potter, and it constructs intricate little vases out of clay. The wasp is ½ inch long and the vase it makes is about ⅜ inch in diameter, often perfectly round as if turned on a potter's wheel. How does it do that? The small opening at the top is neatly rimmed and often there are ridges or decorations on the sides. Several small paralyzed caterpillars are placed inside and one egg is laid before the mouth of the vase is sealed with a thin plug of clay. The vase is usually built on a small twig or branch 3 to 5 feet from the ground. These little wasps rarely sting people.

***Ancistrocerus* sp. Potter Wasp**. Length ½ inch. Photo p. 29.

***Dolichovespula arenaria*. Aerial Yellowjacket**. Length ½ inch. Photo p. 29.

***Dolichovespula maculata*. Bald-Faced Hornet**. Length ½ inch. Photo p. 29.

***Polistes* sp. Paper Wasp**. Length ½ inch. No photo.

***Vespula pennsylvanica*. Western Yellowjacket**. Length ½ inch. No photo.

***Vespula vulgaris*. Common Yellowjacket**. Length ½ inch. Photo p. 29.

Ants (Formicidae)

There is practically no place on Earth that is not inhabited by ants, except aquatic habitats. Even though they are not commonly observed by most people, they are one of the most dominant forms of life on the planet, and they have adapted to many different habitats. They often occur in large numbers and dense populations. For example, in the Amazon rain forest one acre may contain as many as 8 million ants. Worldwide more than 8000 species have been recognized and named. Six different species of ants have been collected and identified in the Skagit County insect collection. WSU Extension Bulletin 0671, "Identification and Hab-

its of Key Ant Pests of Washington," lists nine genera of ants found in the state of Washington, several of which are represented by a number of species. It is important to be able to identify ants at least to genus in order to make recommendations for control.

Three different species of small ants are commonly seen in houses, where they may be obnoxious pests. The odorous house ant (*Tapinoma sessile*) is probably the most common and widespread, and it is by no means restricted to houses. This ant ($^{3}/_{16}$ inch long) is found nesting under the bark of logs and stumps, and along the edges of lakes and streams. In the house, it prefers sweets, but it feeds on many different foods in the kitchen. When disturbed or crushed, it produces an odor similar to rotten fruit. Its nest is usually concealed under the house, which makes it difficult to control. The pharaoh ant (*Monomorium pharaoensis*) was introduced from Africa and has become well established in our area. It is ⅛ inch long. It will eat practically anything in the house that it can chew with its sharp mandibles, but it prefers sweets and meat. The pavement ant (*Tetramorium caespitum*), which is the same size as the odorous house ant, can be a household pest, but it is more commonly seen outside. It eats seeds, chews the stems of small plants, and may even chew holes in garments. Its sting is painful to people who are sensitive to its venom. It is an intermediate host of two species of poultry tapeworms.

The common red ant (*Formica* sp.) is ⅜ inch long. It is not common in homes, but it does search for sweets and will go anywhere to gather them. Most often it is seen gathering honeydew secreted by plant aphids. It cares for the aphids, tending and protecting them, in order to obtain their sweet secretions, even moving them from one plant to another. Red ants can bite hard enough to penetrate the skin, and then they spray the area with formic acid, which burns like fire. I can still remember, as a small child, picking a beautiful stem of fireweed blossoms to take to my mother. By the time I reached the house, I was dancing and screaming from the bites of red ants I had disturbed on that fireweed stem, where they were tending their aphid cows. My mother had to strip my clothes off and remove the ants with the broom. That did not discourage me from later wanting to learn more about insects.

Moisture ants (*Lasius* sp.) are ¼ inch long and are commonly found in moist, decaying wood or in damp soil that contains decaying organic matter. They search for sweets and may be seen in the house, but they are not common there. They are not considered a structural pest because they work in wood that is already partially decayed.

Many people are concerned about carpenter ants (*Camponotus* sp.). When these large black ants fly in and around buildings, people wonder where they are coming from and whether they are chewing up the wooden structure of the buildings. Large, winged carpenter ants, about ¾ inch long, are reproductive queens and kings and they are not the ones that chew wood. It is the ½-inch-long wingless workers left behind in the colony that are doing the chewing. The winged queens are out flying in search of a suitable place to start a new colony somewhere in the vicinity. Finding the existing colony can be very difficult. The nest is

completely concealed within the wood, and the ants come and go through one or two small openings.

Carpenter ants do not have the necessary bacteria and protozoans in their guts to digest cellulose so they do not eat wood like termites do. Instead, they chew tunnels and chambers in the wood in which to live and raise their larvae, which are soft and legless and would be quickly gobbled up by predators if they were left exposed. The workers feed on a wide variety of foods, including small caterpillars and other insects that they are able to capture. They also gather energy foods such as nectar from flowers and honeydew from aphids. The workers are mostly active at night. If you can find them gathering food at night and watch long enough to see where they are taking it, you might be able to locate their nest. They require moisture in the nest, so they usually chew their tunnels and galleries in soft, damp wood. As the colony expands, they may extend some of their tunnels into adjacent dry wood, but the nucleus of the colony will always be in wood with a high moisture content.

Sometimes a large carpenter ant with no wings is found crawling around inside the house. Workers have no wings, but they are less than ½ inch long. These larger ants are queens that have shed their wings. After flying to a likely spot in which to start a new colony, the queen ant breaks her wings off since they are no longer needed. Under a magnifying glass you can still see the wing stubs that verify her identity. Only a tiny fraction of swarming queens escape predators, find a suitable site for a nest, and survive through many other hazards to be successful in starting a new colony. That is good because otherwise we would be knee-deep in carpenter ants.

Our forested areas provide an abundance of suitable nesting sites for carpenter ants. In summer when the winged reproductives swarm and fly, they can be seen searching everywhere for a place to live. When land is cleared for building sites, there are always roots and portions of stumps left in the ground or covered up with dirt. Those are good home sites for carpenter ants and that may bring them closer to the houses. The wood structure of houses must be kept dry to discourage carpenter ants from moving in.

There are several bulletins and publications to help you learn more about carpenter ants and how to control them. Look up WSU Extension Bulletins 0671, "Identification and Habits of Key Ant Pests of Washington," and 0818, "Carpenter Ants: Their Biology and Control." Locating the nest of the ants makes control more feasible, but that is often difficult to accomplish. If you know their life cycle and feeding habits, you will be more successful in your efforts to control them. The presence of a few carpenter ants in the house does not necessarily mean they have established residence there, but it does alert you to the possibilities and should lead you to further investigation.

***Camponotus* sp**. **Carpenter Ant**. Length ⅜–½ inch. Photo p. 29.

***Formica* sp**. **Red Ant**. Length ⅜ inch. Photo p. 29.

***Lasius* sp**. **Moisture Ant**. Length ¼ inch. No photo.

Monomorium pharaoensis. **Pharaoh Ant**. Length ⅛ inch. No photo.

Tapinoma sessile. **Odorous House Ant**. Length $^{3}/_{16}$ inch. No photo.

Tetramorium caespitum. **Pavement Ant**. Length $^{3}/_{16}$ inch. No photo.

True Bugs (Hemiptera)

The word bug has many meanings in our language. Even entomologists use the word bug in a general sense for many different insects. Common names of insects that are not in the order Hemiptera—such as lightningbugs, bessiebugs, mealybugs, ladybugs, and potatobugs—should be written as one word. Insects in the order Hemiptera are the "true bugs," and their common names should use the word bug separately, such as bed bug, stink bug, leaf bug, and plant bug.

True bugs in the order Hemiptera (*hemi* means half and *ptera* means wing) share some common characteristics. Their front wings are distinctive as one half is membranous and transparent and the other half is thickened and opaque. They also have beaklike mouthparts, so instead of biting or chewing, they insert their needlelike beaks into their dinners to suck liquid food.

The common stink bug (*Banasa dimidiata*) is a good example of a true bug. If you want to know why stink bugs are so named, just handle one and then smell your fingers or disturb one that is feeding on a ripe raspberry and then eat the raspberry. They have repugnatorial glands, which secrete a strong-smelling substance to discourage predators.

Several species of true bugs are widespread in our area, and they can be seen sucking the juices from the tender new growth on many plants. When many of them attack the same plant, they can do considerable damage. When stink bugs stick their beaks into developing apples or pears to suck the juice, they do not destroy the fruit, but they do leave a scar or dimple. These depressed areas on the fully grown apples or pears are called cat-faces, and their presence makes the fruit unsuitable for sale at market. Cat-faces on strawberries result in deformed berries with hard white spots.

All true bugs hatch from eggs as nymphs rather than as caterpillars or grubs. Nymphs are like miniature adults without wings. They have legs and the same beaklike mouthparts as adults. Wings begin to develop as small pads as they grow larger, but they are not functional until the final adult stage.

Several true bugs in the order Hemiptera are predators on other insects and are beneficial in that they help control populations of harmful insects. Damsel bugs (*Nabis americoferus*) (I wonder why they are called damsel bugs?) feed on aphids, leafhoppers, plant bugs, and small caterpillars by stabbing them with their sharp beaks and sucking the juice out. One of the smallest of the true bugs, the minute pirate bug (*Triphleps tristicolor*), is also beneficial. It is only about ⅛ inch long, but it feeds on mites and thrips.

Banasa dimidiata. **Stink Bug**. Length ½ inch. Photo p. 30.

Elasmostethus cruciatus. **Stink Bug**. Length ½ inch. Photo p. 30.

Lygaeus reclivatus. **Milkweed Bug**. Length ⅜ inch. Photo p. 30.

Nabis americoferus. **Damsel Bug**. Length ½ inch. No photo.

Triphleps tristicolor. **Minute Pirate Bug**. Length ⅛ inch. No photo.

Bed Bugs (Cimicidae)

Bed Bugs? Not in my house! The very words elicit a negative response in most people. Once a common problem, bed bugs are now relatively unknown. During the 1800s and early 1900s bed bugs were widespread and likely to be found in houses and hotels everywhere. What happened to them and why are they coming to our attention now?

Prior to 1945 there were very few pesticides that were effective in controlling bed bugs. Then came DDT and other chemical pesticides that, if used properly, could eradicate bed bugs without harm to people. During World War II, DDT was used to get rid of bed bugs, lice, and fleas in the military environment, and after the war the same methods were used in the general population with great success. After 1960 there was a trend against chemical pesticides and most of them were restricted, but by then bed bugs were found only in isolated segments of society.

Bed bugs do not fly and crawl only short distances, so they depend upon hitchhiking to move from one place to another where they can find a comfortable hiding place and regular meals of warm blood. They may be transported in luggage and clothing. Since 1998 there has been a resurgence of bed bugs in the United States, Canada, Europe, Australia, and Africa. Worldwide commerce has undoubtedly increased the spread of bed bugs. In the late 20th century, most WSU Extension entomologists had never seen a bed bug. Now they are getting an increasing number of calls and specimens to identify.

What does a bed bug look like? The adult is ¼ inch long, flat, brown or reddish brown, wingless, and has a needlelike beak. Its bite is painless, but its saliva contains allergens that usually cause a red, itchy spot. Bed bugs are mainly nocturnal, hiding in mattresses, behind headboards that are fastened to the wall, and in furniture during the day. The bites are similar to mosquito bites and may be difficult to diagnose, and small early infestations of bed bugs are difficult to detect.

A mature female may lay 200 to 500 eggs during a two-year lifetime. The eggs hatch into small nymphs that require a blood meal each time they molt and grow to the next larger size. Their favorite habitat is a warm, cluttered bedroom with convenient places to hide. They can survive for several months without feeding. They must be found and identified as quickly as possible to facilitate control. There are no traps to collect them with bait (only warm bodies). The best detection device is a flashlight and keen eyes. There may be only one cast skin or a few fecal specks on a mattress cover to indicate their presence.

The media has sensationalized bed bugs, depicting them as the goblins under the bed waiting to attack us at night. Some people are developing an entomophobia and doing strange and dangerous things because of their fear of bed bugs. People need to be informed, but they also need to be reassured that the bed bug problem can be solved. We do not have to put up with them like so many people did before entomologists developed methods of control, both chemical and nonchemical. Education and prevention are the most cost-effective procedures for

controlling the spread of this pest. Soooo, night, night, sleep tight, and don't let the bedbugs bite!

Cimex lectularius. **Bed Bug**. Length $^{3}/_{16}$ inch. No photo.

Aphids, Adelgids, Leafhoppers, Spittle Bugs, and Scales (Homoptera)

This is a large group of plant feeders with sucking beaks like Hemiptera, but with much more diverse wing patterns. They develop large populations rapidly and can do considerable damage in the garden if not controlled in some way. Whiteflies and mealybugs are included in this order.

Aphids (Aphididae)

It seems like aphids are everywhere, and many kinds are specific to a certain plant, such as cabbage aphid, lettuce aphid, rose aphid, and apple aphid. Then there are those that feed on many different plants like the green peach aphid and the potato aphid. Several hundred different species of aphids are known in the western United States, but most of them are similar in appearance and cause similar damage to the plants they live on.

Aphids damage plants in several ways. They use their sharp beaks to suck the juice from leaves and stems. Their digestive systems subtract some of the nutrients from the sap, but most of the sap is excreted and it drips onto the leaves causing a sticky mess called honeydew. Molds and mildews grow in the honeydew and some, such as black sooty mold, shut off the light the plant needs to produce food. Many aphids carry virus diseases on their beaks and spread them from leaf to leaf and from plant to plant. Aphids feed on the undersides of new leaves causing them to distort and curl, sometimes forming galls.

Aphid life cycles are complex and often involve different stages during different times of the year. They multiply rapidly during spring and early summer by an asexual process with only females, no males, and no eggs. The females produce small females instead of eggs, and those females mature rapidly and produce more females. The females can produce hundreds of aphids in a few days.

Later in the summer, males are produced and the mature males and females often migrate to a different plant, where they start the overwintering stages. This phase is essential for aphids that feed on annual plants that will die and not provide a place for the aphids to spend the winter. Specialized egg-laying daughter aphids are produced. They lay overwintering eggs that hatch in the spring and develop into winged females, which fly to new plants to start the population over again. That is how aphids seem to suddenly appear from nowhere in early spring.

The rapidly developing populations of wingless female aphids early in the season do not move far from the plant or leaf where they were born. If you knock them onto the ground, they are not likely to ever get back to the leaves again, and the many predatory insects on the ground will devour them before they ever get a chance to try. That is a good way to quickly reduce the aphid population, but it will probably not eliminate them completely. There will always be a few remaining in folded leaves or other protected spots to start the population explosion over again.

You really do not want to eliminate aphids completely. If you did, then what would the lady beetles and other predator insects find to eat? They would

have to move away to some other garden. Have you learned to recognize the larvae of lady beetles, lacewings, and hover flies? They can reduce the aphid population to where you may not be aware of aphids in your garden. But sometimes the aphid population explosion is so great even the predators cannot keep up with it, and then you will have to do something, such as washing the aphids off your plants with water or using a non-persistent pesticide to rapidly reduce the population. I enjoy eating tender broccoli tips from my garden, but I do not enjoy them garnished with dead aphid carcasses.

Acyrthosiphon barri. **Lettuce Aphid**. Length ⅛ inch. No photo.

Aphis pomi. **Green Apple Aphid**. Length ⅛ inch. No photo.

Brevicoryne brassicae. **Cabbage Aphid**. Length ⅛ inch. No photo.

Macrosiphon euphorbiae. **Potato Aphid**. Length ⅛ inch. No photo.

Merhinchites bicolor. **Rose Aphid**. Length ⅛ inch. No photo.

Myzus persica. **Green Peach Aphid**. Length ⅛ inch. No photo.

Adelgids (Adelgidae)

Adelgids are similar to aphids. The Cooley spruce gall adelgid (*Adelges cooleyi*) has a complex two-year life cycle that involves five biological forms, three on spruce and two on Douglas fir. Here we will look at the symptoms of its hosts and how to detect the damage this adelgid can do to landscape trees. If you want to learn more about its life cycle, read WSU Extension Bulletin 0966, "Managing the Cooley Spruce Gall Adelgid."

At first glance you might think your spruce tree is just making cones for seed. The female adelgid lays hundreds of eggs near the tip of a twig in the spring. The eggs hatch into hungry nymphs that find the soft new growth at the base of needles a good place to insert their beaks. Their feeding stimulates the soft-growing stems to swell into conelike structures that enclose the nymphs in a nutritious mass, where they can feed on plant juices while protected from their enemies. By midsummer the 1- to 2-inch-long conelike galls harden and openings form at the base of each needle from which the mature adelgids escape to fly away to another tree.

If the adelgid lands on a Douglas fir, it lays eggs on the needles, where they hatch into a wingless form that sucks juices from the needles and forms a white woolly cover for protection. The adelgid can multiply in that form and by the end of summer the fir tree is decorated with tiny white tufts. It is too early for Christmas tree decorations and the infected needles drop off, spoiling the neat appearance of a good Christmas tree if the infection is heavy. Meanwhile the spruce tree has developed brown conelike galls at the branch tips, which do not drop off like real spruce cones, but remain for several years. That stops the terminal growth of the branch and produces a deformed spruce tree.

Spruce and Douglas fir trees in the forest can survive attacks of spruce gall adelgids and grow to maturity. Landscape trees might also survive, but a heavy infestation of this pest will disfigure the trees and spoil their intended role as

symmetrical forms in a beautiful landscape. Where Douglas fir and spruce trees are planted together, the problems caused by this pest will continue to increase.

Adelges cooleyi. **Cooley Spruce Gall Adelgid**. Length ⅛ inch. Photo p. 30.

Leafhoppers (Cicadellidae)

This is one of the largest families in the order Homoptera with about 2500 species in North America. There are several different leafhoppers in the collection, and many more in Skagit County that we have not collected and identified. Leafhoppers are small, usually less than ¼ inch long, with narrow bodies that are somewhat wedge shaped. They have strong hind legs and often jump when disturbed, hence the name leafhopper.

Leafhoppers use their beaks to suck plant juices from the leaves of plants, often leaving white spots where they have emptied the cells. Some are host specific, feeding on only one kind of plant. Their names often indicate their food plant, such as potato leafhopper and rose leafhopper. Others feed on many different plants, such as the aster leafhopper, which feed on grasses, vegetables, and flowers and spreads aster yellow disease.

Spittlebugs (Cercopidae)

The white frothy spittle on grasses, weeds, and trees is produced by spittlebugs, which closely resemble leafhoppers. The nymphs' soft bodies need protection from drying, so they surround themselves with foam produced from a sticky fluid secreted from the anal opening at the tip of the abdomen. The adults have a harder exoskeleton and do not produce spittle.

The meadow spittlebug (*Philaenus spumarius*) is common in our area and the alder spittlebug (*Clastoptera obtusa*) can be found on our alder trees. There are many other spittlebugs in Skagit County yet to be collected and identified.

Clastoptera obtusa. **Alder Spittlebug**. Length ¼ inch. No photo.

Philaenus spumarius. **Meadow Spittlebug**. Length $^{3}/_{16}$ inch. No photo.

Scales (Coccidae)

These insects are highly specialized and very different from the other families in the order Homoptera. The females are soft bodied and wingless and secrete a waxy covering for protection. They have beaks to suck juices from the plant leaves or stems to which they are attached. The males have no beaks and have wings, but they are fragile and do not live long, so they are seldom seen.

Scale insects can be very damaging to plants, and they are difficult to control because of their protective waxy covering. Some are host specific, feeding on only one kind of plant, but others may feed on a wide variety of plants.

One scale that is common in our area is the cottony camellia scale (*Pulvinaria floccifera*). It is found on many plants besides camellia, such as holly, rhododendron, and maple. There are many kinds of scale on fruit trees. A common one is the European fruit lecanium (*Parthenolecanium corni*). It is also found on

shade trees, including maple, poplar, and willow. Scales are frequently on the undersides of leaves and can be easily overlooked. Not only are there many different kinds of scale insects, there are also many parasitic insects that feed on them and provide a natural control.

Coccus hesperidum. **Brown Soft Scale**. Size ⅛ inch. Photo p. 30.

Parthenolecanium corni. **European Fruit Lecanium**. Size $^{3}/_{16}$ inch. No photo.

Pulvinaria floccifera. **Cottony Camellia Scale**. Size ⅛ inch. No photo.

Springtails (Collembola)

Many insects are small enough to be overlooked by most people until the insect becomes abundant in one spot. That is true of springtails, which are from $^{1}/_{16}$ to ¼ inch long. They need abundant moisture, so they are often hidden in dense foliage, leaf litter, or damp soil. The damp climate of the Pacific Northwest is favorable to springtails, and we have many different kinds in many different habitats. People find them on damp wooden porches, in barns and outbuildings, in puddles, and on the beach in sea wrack. Most springtails are of no economic importance, but they can be a nuisance when they become very abundant.

Most springtails jump when disturbed, which attracts our attention, especially when they are massed together in one spot. They jump by means of a springlike appendage or tail that is held under the abdomen by a clasp and released under tension, tossing them up into the air. A springtail less than ¼ inch in body length can leap 3 to 4 inches, which is quite a feat for a creature so small. Mild and wet winter days often bring springtails out in swarms, where they may cover damp soil or the surface of a puddle of water. A good example is the common springtail (*Tomocerus vulgaris*), which is purplish black and ⅛ inch long. Springtails come in many colors from black to white, including brown, green, blue, or purple.

Springtails are one of the most abundant insects in the soil, and they play an important role in recycling soil nutrients by feeding on decayed organic matter in the upper soil layers. A few may cause some damage by feeding on sprouting seeds in the garden, greenhouse, or mushroom cellar. The large glaciers and snowfields in our mountains are the home of a springtail that feeds on algae that grows there and on pollen that is blown there by the wind. They are called snow fleas because they jump. The dark blue pigment in their bodies collects enough energy from the sun to raise their body temperature above that of the snow or ice they live on. They may also be found on the late-winter snow in forested areas. They are sometimes a nuisance when they find their way into the sugar-maple sap buckets. They like sweets too!

There is little information about springtails in gardening books because they are of no great importance to gardeners. However, when people who do not know insects very well see them in their yard and garden, they are concerned and want to know if they will do any damage. Specimens of springtails are brought to Master Gardener plant clinics for identification and information about how to control them. It is important to learn to recognize as many different kinds of insects as you can so you know which ones are harmless, and you can avoid using pesticides when it is not necessary to do so.

Hypogastrura nivicola. **Snow Flea**. Length $^{1}/_{20}$ inch. No photo.

Tomocerus vulgaris. **Common Springtail**. Length ⅛ inch. No photo.

Thrips (Thysanoptera)

These tiny insects (less than $^{1}/_{20}$ inch long) in the order Thysanoptera (*thysan* means fringe and *ptera* means wing) are not commonly seen by gardeners, but sometimes the damage they do to our plants becomes very obvious. Thrips have rasping mouthparts that they use to scrape the surface of leaves and flowers. They do not consume much, but their feeding often leaves white scars. That would not be too serious on a large healthy plant, but on the developing petals of flowers, like gladiolus, it can be very damaging.

Female thrips insert their eggs into small slits they make in plant leaves. In a week or so, the eggs hatch into nymphs that look like adults, except for their smaller size and the lack of wings. After feeding and growing, they turn into non-feeding pupae that soon change into adults. Several generations may occur during one season, so you might see all stages of the life cycle at one time on a plant. Small black fecal pellets remain attached to the leaf where thrips are feeding, and that is often a good indication of their presence.

There are many kinds of thrips, some very host specific and others that feed on a wide variety of plants. Onion thrips (*Thrips tabaci*) feed on beans and cabbage as well as onions. Western flower thrips feed on a wide variety of flowers and vegetables and sometimes transmit virus diseases such as tomato spotted wilt and impatiens necrotic spot.

Feeding injuries on plants are noticed first as white or silvery spots on the leaves resulting from the destruction of upper cell layers by the rasping mouthparts of thrips. They feed on the nutritious sap from the broken plant cells. A heavy infestation of thrips can reduce the vigor and yield of plants. Seedlings are often distorted from damage to rapidly growing stems and leaves. Some thrips overwinter in the adult stage on dead plants, and they start new populations as soon as plants start their spring growth.

Sometimes transplants are infested with either adult thrips or eggs. Onion sets often have thrips hiding in their papery layers just waiting for the tender new growth. When the adults have fully developed wings, they can fly from one plant to another. They are so small and light the wind can carry them long distances to new food sources. Their small size and weak flight make them susceptible to heavy rains or overhead sprinklers, which can wash them off and onto the soil, where predators destroy most of them. Our rainy weather could be of some advantage, couldn't it?

One reference notes that onion thrips are commonly found on most produce, so they might be the most frequently eaten insect in our part of the world: thrip-enhanced protein for the gourmet cook.

Thrips simplex. **Gladiolus Thrips**. Length $^{1}/_{20}$ inch. No photo.

Thrips tabaci. **Onion Thrips**. Length $^{1}/_{16}$ inch. Photo p. 30.

Silverfish and Bristletails (Thysanura)

Insects in the house are always unwelcome. Some are only a nuisance, but some can be destructive. Silverfish and bristletails feed on fabrics, especially if the cloth has been starched. For that reason, they prefer cotton and linen rather than the wool that clothes moths prefer. They also chew on paper, and eat flour and dry cereals. They grow and multiply best in a warm, moist environment. They do not have the hard body covering that most insects have so they lose moisture rapidly in a dry environment. Our humid climate provides many favorable habitats for these soft-bodied insects. They wander into the drier parts of the house in search of food, usually at night, and retreat to a more favorable environment during the day.

Silverfish are named for the shiny scales that cover their flattened bodies. The ones we see most commonly are *Lepisma saccharina*. The species name refers to its preference for starchy foods. Some are called firebrats because they live in the stonework of fireplaces and chimneys. They have long slender antennae on their heads and three long threadlike bristles at the opposite end of their bodies. They do not have larval forms like caterpillars, and the young look like miniature adults. They develop slowly and often live for several years, eventually reaching full size at about ¾ inch long. These little insects do not have wings, but their legs are designed for running and they can move rapidly. If you try to capture silverfish, you will discover how slippery their smooth, scaly bodies are.

Bristletails are similar to silverfish, but they are darker in color and their bodies are not as flattened. They are not as likely to be seen inside the house. They jump when disturbed, landing as far as a foot away. They feed on algae, lichens, and decaying vegetation. You may have seen them in the compost or bark mulch in your garden. If you go for a walk on the beach, you may find them under rocks or hiding in the cracks above the high-tide line. They are not likely to do any damage in your house and if they do wander in, they will not remain and lay their eggs there like silverfish do. For that reason, it is good to be able to tell the difference between bristletails and silverfish.

***Lepisma saccharina.* Silverfish**. Length ½ inch. Photo p. 31.

***Microcoryphia.* Bristletail**. Length ½ inch. Photo p. 31.

Lacewings (Neuroptera)

Biological control of insect pests helps reduce problems in our gardens so we do not need to use as many chemical pesticides. In order to use biological control, we must learn to recognize beneficial insects and do whatever we can to encourage them. Lacewings are not as common as lady beetles, but adult lacewings are easily recognized once you know what they look like. However, it is the larvae that are the most beneficial and they are not as easily recognized. Like other predaceous larvae they are not easily seen, especially when small, and they are fierce-looking creatures when seen close up. You might think they need to be killed.

The lacewing larva has been called the aphid lion because of its voracious actions in a colony of aphids. It has sharp, curved jaws on the front of its head, which it uses to stab soft aphids and lift them into the air. While the helpless aphid is waving its legs in the air, the lacewing larva uses its hollow needlelike jaws to suck the body juices out of the aphid. The lacewing larvae are so voracious and ready to attack anything edible they will even devour their own siblings as they hatch from the eggs.

The adult female green lacewing (*Chrysopa* sp.) takes special measures to prevent that. She has a silk gland in the tip of her abdomen and before laying an egg, she touches her abdomen to the leaf and by raising it up she spins a stiff silk thread on which to glue the egg ½ inch up in the air. When the larvae hatch from the egg, they drop to the leaf and wander off not recognizing the presence of succulent eggs at the top of the silk stalks. They soon find aphids or other small insects to eat, including caterpillars, leafhoppers, mealybugs, and whiteflies. They also eat insect eggs and mites if they find them. Adult lacewings prefer to eat pollen, nectar, and honeydew, but they will eat some insects if they are hungry.

Green lacewings are common and widespread and may be purchased from catalogs for release in your garden. They will not eliminate all aphids, but they are a good part of biological control of insect pests. If you see them in your garden, try not to disturb them for two reasons. They are helping you reduce pests, and they give off a foul odor for protection that will be difficult to remove from your fingers or clothing. Green lacewing adults are about ¾ inch long.

We also have a smaller lacewing in our area, the brown lacewing (*Hemerobius* sp.), which is about ⅜ inch long. Its food habits are similar, but the female glues her eggs to the leaf surface rather than placing them on stalks. Brown lacewings are more active in cooler temperatures and may be better suited to our area. I see them frequently in my garden and orchard. Watch for the larvae; they are beneficial in the same way as green lacewing larvae.

You will find additional information about lacewings in the Oregon State University Extension publication PNW 343, "Beneficial Organisms Associated with Pacific Northwest Field Crops," and in WSU Puyallup Research and Extension Pest Leaflet Series 84, "Green Lacewing." Information on how to access these publications on the Web is given in "Resources" at the back of this book.

***Chrysopa* sp. Green Lacewing**. Length ¾ inch. Photo p. 31.

***Hemerobius* sp. Brown Lacewing**. Length ⅜ inch. Photo p. 31.

Grasshoppers, Crickets, and Katydids (Orthoptera)

Grasshoppers (Acrididae and Tetrigidae)

Our cool, moist climate is not the best place for grasshoppers. The few kinds of grasshoppers and crickets we have here are not usually abundant, but they do feed on vegetation so they are not welcome in our gardens. A sure indication of warm weather and low humidity is the snapping and crackling sound made by the larger grasshoppers as they hover in the air and flutter their wings. They do that only when the humidity reaches a low level.

Grasshoppers lay their eggs in the soil to overwinter, and the eggs hatch into tiny nymphs the next spring. Our damp winter weather subjects the eggs to many fungus diseases, and foraging mice, moles, and shrews devour most of them. Nymphs resemble adults except for the wings, which start out as small flaps and gradually enlarge until the full-sized adult stage. They have well-developed jaws for biting off bits of vegetation, and when they are abundant, they can rapidly strip plants of leaves. The pioneers moving westward faced devastating plagues of the Rocky Mountain locust, which devoured their crops and migrated in huge swarms. Changes in climate and ecosystems brought about the extinction of the Rocky Mountain locust and only its remains are now seen frozen in the glaciers on the eastern slopes of the Rocky Mountains.

Several different kinds of grasshoppers may be seen in Skagit Valley each summer, and occasionally they multiply enough to become pests during drier years. The red-legged grasshopper (*Melanoplus femurrubrum*) and the two-striped grasshopper (*Melanoplus bivittatus*) are common in gardens and fields.

The pygmy grasshopper, in the family Tetrigidae, is common near ponds and streams or areas of damp vegetation. It is only about ½ inch long when fully grown and is often mistakenly thought to be the young of larger grasshoppers. Its front wings are very small, but the hind wings are covered by a spinelike extension of the front part of the body, which is unusual for a grasshopper. It is never a problem in the garden.

***Arphia* sp**. **Orange-Winged Grasshopper**. Length 1½ inches. Photo p. 31.

Melanoplus bivittatus. **Two-Striped Grasshopper**. Length 1⅜ inches. Photo p. 31.

***Melanoplus femurrubrum*. Red-Legged Grasshopper**. Length ¾ inch. No photo.

Tetrigidae. Pygmy Grasshopper. Length ½ inch. Photo p. 31.

Crickets (Gryllacrididae and Grylloblattidae)

The crickets we have in Skagit County are found mostly in damp, dark places such as under buildings or leaf litter. They are belong to the family Rhaphidophoridae (formerly Gryllacrididae), and they are commonly called cave crickets even though they live in many places besides caves. They are active mostly at

night, when they come out to feed on vegetation. They can damage small plants in the garden, but they are usually not abundant enough to be of concern. Our crickets are wingless and do not chirp like those in warmer, drier climates.

We have a rare cricket in our area that is often sought by insect collectors. The books call it a grylloblattid, but it is commonly referred to as the snow cricket. Some friends of mine collected some in August at Mount Baker on the surface of a glacier at midnight in the rain—good conditions for finding this cricket. Now I am sure every one of you will be diligently searching for a snow cricket!

Rhaphidophoridae (Gryllacrididae). **Cave Cricket**. Length 1 inch. No photo.

Grylloblattidae. **Snow Cricket**. Length ¾ inch. No photo.

Katydids (Tettigoniidae)

We do have katydids here, but they do not chirp about Katy. Ours is the fork-tailed bush katydid (*Scudderia furcata),* and it only lisps out a soft clicking sound. It is green and has long legs and antennae; the body, including wings, is 1½ inches long. It is difficult to see it in the dense green foliage where it feeds on tender young leaves and stems. It is rarely abundant enough to be of any concern to gardeners; in fact, most people have never seen one. It inserts its eggs into the edges of leaves (quite a feat) in the fall. They overwinter with the leaves on the ground and hatch into nymphs in the spring. Adults are not usually seen until late summer or early fall.

Scudderia furcata. **Fork-Tailed Bush Katydid**. Length 2 inches. Photo p. 32.

Cockroaches (Blatteria)

Some insects have found human habitations to be better places to live than the natural ecosystem. Our houses are controlled environments protected from extreme fluctuations in temperature and moisture and often with a constantly available supply of food. Cockroaches are mainly tropical insects that could not survive out of doors in our colder temperate climate. They live here only in heated buildings, and they are transported in shipments of food and luggage.

There is no way to completely prevent the arrival of cockroaches in your house. As careful as large food storage warehouses are, there are cockroaches stowed away in container shipments that can end up in local grocery stores. The female cockroach lays eggs in tough egg cases containing 10 or more eggs, which can be tucked into small spaces or carried with the female into hiding. Once when we were unpacking our luggage after returning from a tour, a cockroach went scurrying away from the suitcase. I was not quick enough to stomp on it before it hid behind the furniture. It must have been a male because we never saw it or any others again. If it had been an egg-laying female or if we had brought both males and females home with us, we could have had an infestation of cockroaches in our house.

Four of the many different kinds of cockroaches are likely to be pests in our homes here in Skagit County. The brown-banded cockroach (*Supella longipalpa*), originally from Africa, and the German cockroach (*Blatella germanica*), originally from southeast Asia, live only in heated buildings and do not survive outside. The American cockroach (*Periplaneta americana*), originally from Africa, and the oriental cockroach (*Blatta orientalis*), originally from the Middle East, can live outside, but in our climate they only survive the winter by moving inside. There are a few native species of cockroaches that were here in North America before houses were built, and they still prefer the natural ecosystem rather than our homes. The one that is common on the Pacific Coast, the woods roach (*Parcoblatta americana*), has not been recorded this far north.

People do not like cockroaches for several reasons. They are often associated with filth and debris, they are active at night when we cannot see them, and they have a distinctive, offensive odor. Cockroaches in the home are an aesthetic nuisance, and their presence may lower the value of property. Fortunately, numerous methods of control have been developed to help you keep your property free from cockroaches. There are both chemical and non-chemical methods of getting rid of cockroaches, and you can find many of them on the shelves of home and garden stores. Be sure to read labels carefully and follow instructions to prevent damage to people and pets.

Cockroaches thrive on the same foods we eat, mainly because it is readily available to them. Food scraps left exposed either in the kitchen or garbage are easily found and eaten by cockroaches. Removing their source of food not only greatly reduces their numbers, it also forces them to go to the traps or poison baits put out to control them. Pet foods, which are often available to cockroaches, provide a food source that can support a large population.

Those who have traveled or lived in the warmer tropical climates can tell stories about cockroaches that horrify us northerners. Our beautiful Skagit Valley may have some problems, but we can be thankful we do not share our homes with mouse-sized cockroaches.

Blatta orientalis. **Oriental Cockroach**. Length 1 inch. No photo.

Blatella germanica. **German Cockroach**. Length ½ inch. Photo p. 32.

Parcoblatta americana. **Woods Roach**. Length ½ inch. No photo.

Periplaneta americana. **American Cockroach**. Length 1 inch. Photo p. 32.

Supella longipalpa. **Brown-Banded Cockroach**. Length ½ inch. Photo p. 32.

Fleas (Siphonaptera)

Fleas are adapted to sucking blood from many different animals, and people everywhere in the world have problems with them. The order Siphonaptera (*siphon* means sucking mouthparts and *aptera* means wingless) includes hundreds of different kinds of fleas, but they look similar and are not easy to tell apart.

The most common flea in our area is the cat flea (*Ctenocephalides felis*). It not only sucks blood from our pets, but from us as well. There is a human flea that prefers humans, but it also feeds on cats, dogs, and other animals. The life cycles of these common fleas are similar, so it is not essential that we tell them apart. There are many remedies and methods of control for fleas that are available either from the store or the veterinarian. However, an understanding of the flea life cycle can help in administering controls and in reducing the amount of pesticides used.

Adult fleas tend to remain on the host animal as much as possible and feed often, taking several blood meals during each 24-hour period. The flea digestive system is not very efficient in digesting blood, and the flea must consume large quantities in order to get sufficient nourishment. Small fecal pellets of dried blood are ejected almost constantly. Each female flea may lay several hundred eggs during her lifetime, and the eggs are deposited singly and loosely in the fur covering the body of the host. The cat or dog scratches and shakes its fur, scattering flea eggs and dried blood fecal pellets wherever it is resting. The pet's bedding is an ideal place for the eggs to hatch into flea larvae. There is protection, warmth, and food there in abundance.

Flea larvae look like tiny, whitish worms with chewing mouthparts to feed on organic debris and dried fecal blood. They do not bite their hosts, but the warmth in the bed of the cat or dog speeds up their development and within a week they spin silken cocoons in which to pupate. Another week completes their development, and they emerge from their cocoons as fully grown adult fleas ready to jump on to the host, where they spend their lifetimes sucking blood and reproducing.

Now that you know the flea life cycle, you can better understand how to interfere with its development and reduce its numbers drastically. The first and easiest thing to do is keep pets' bedding clean. A washable bed cloth, laundered each week, prevents re-infection of the host. Medication to kill the fleas on the host stops the source of flea eggs in the bedding.

Fleas can transmit typhus to humans and tapeworms to dogs and cats. Bubonic plague, a bacterial disease spread to humans by rat fleas, was a scourge in Europe from the 14th to 17th centuries. Fleas are so common and widespread it is impossible to avoid them completely, but with all the information and medication available to us, we do not have to put up with them like people did who lived hundreds of years ago. For further information on fleas, and how to control them, see WSU Extension Bulletin 0817, "Flea Control."

Ctenocephalides felis. **Cat Flea**. Length ⅛ inch. No photo.

Earwigs (Dermaptera)

Common names have strange origins. Do earwigs crawl into people's ears or hide under their wigs? I have never heard of that happening. Have you? They do have forceps or pinchers at the tail end, which they try to use in self-defense, but they are not very strong and cause more fright than damage.

Earwigs are most active at night and hide during the day. They prefer cool, moist hiding places such as mulch or bark. They also take cover inside houses, where they are more of a nuisance than a hazard. Their food is varied, consisting of the softer parts of green plants, fruits, and other insects. They have actually been used as a biological control for aphids on fruit trees.

The eggs are laid in early summer in damp, protected spots. The female earwig guards the eggs and protects the young ones for several weeks after they hatch or until they are able to forage for food on their own. That is why you may find a whole colony of small earwigs under a board or in some protected spot. The young ones are just smaller versions of the adults, and they grow by molting several times until they are mature. There is only one generation per season in our area.

Earwigs do have wings, but the common European earwig (*Forficula auricularia*), which is the one we see mostly in our area, is not known to fly. The wings are thin and membranous and are kept tightly folded under the short wing-covers. Their legs are well developed for crawling, and they can move considerable distances at night from their daytime hiding places. Earwigs can do some damage in the garden. They chew on the small, tender leaves of seedlings, and they may chew into soft fruits like strawberries. In the fall when apples are ripe, they find cracks around the stem ends of apples on the tree or cracks in the scabby spots and feed on the apples. Eventually they eat enough to make a cavity under the apple skin, where they stay during the daytime and where you may find them when you bite into a ripe apple.

Mechanical control of earwigs is made possible by their habit of hiding in cool, moist places during the day. Boards, cardboard, or other flat objects can be placed near the garden as traps where earwigs will congregate. They can be destroyed there by whatever method you choose: stomping, poisoning, or even dousing them with boiling water.

There are some biological controls for earwigs. After the European earwig was introduced to North America and became a pest in the Pacific Northwest, a tachinid fly parasite was introduced that has become well established in our area and helps control earwig populations. There are also parasitic nematodes and fungal diseases, but all these biological controls together will not eliminate earwigs. If they did do away with the earwigs completely, then what would the parasites eat?

If you need to control earwigs, look for information in WSU Extension Bulletin 1206E, "European Earwig Prevention and Control."

Forficula auricularia. **European Earwig**. Length ⅝ inch. Photo p. 32.

Bark Lice (Psocoptera)

If you are a Master Gardener and you are asked how to help a sick plant, you look for clues as to what is wrong. If there is no evidence of disease, you look for insect damage. Any insects you find on the plant are suspects. It is easy to make false accusations, especially if you do not know the insects very well. If you are really struggling to find something and you see tiny aphidlike insects running rapidly along the stems, you are likely to jump to the conclusion that these must be the culprits.

Sometimes it takes a little detective work to come up with the right answer. The process of elimination of suspects is often helpful. These little specks running around are moving too rapidly to be aphids, which move slowly and clumsily. If you can see their mouthparts, you will notice that they have jaws instead of the sucking beaks of aphids. They are not mites, because they have six legs, not eight. If you can get one under the microscope in the right position, you might be able to see a bulge on the front of the face that distinctly places this little insect in the order Psocoptera (pronounced without the P in front). They are sometimes called psocids, but more often by the common name book or bark louse.

Bark lice (psocids) are common and widespread, but they are usually overlooked because of their small size or because people assume they are aphids and treat them as such. Does it really matter? I cringe when I think of how many people have been advised to spray their plants with insecticide when there was no reason to do so. Bark lice do no harm to the plants, but if they do not eat green leaves, what do they eat?

When I was working in the stored grains lab at Oregon State University, someone brought in a sample of wheat from farm storage that had little "specks" running around in it. My first assumption was granary mites, which are commonly seen in stored grain. Under the microscope they had only six legs, so I knew they were insects not mites. When we determined them to be psocids the next question was, what were they doing there? The kernels of wheat showed no evidence of chewing. We sorted out some kernels that had no breaks in the smooth seed coat, put them in a closed container, and added psocids to see what they would do. We added a bit of moisture because the air in the lab was too dry for these soft-bodied insects. The psocids began to multiply and prosper in the sample of wheat. We carefully examined the kernels of wheat every week and saw the psocids thriving and multiplying, but there was no evidence of any damage to the kernels of wheat. Our final conclusion was that the psocids were eating the microscopic fungal threads that are always present on field-stored wheat.

Bark lice commonly feed on the lichens and fungi that grow on the surface of bark. The book louse is often seen in libraries, where it feeds on the starch sizing of the paper and on the paste used in book bindings or on the mold on old books if the humidity is high enough. Get acquainted with these little insects so you can recognize them and then confidently tell people not to worry because they do us no harm.

Psocoptera. Bark Louse. Length $^{1}/_{16}$–⅛ inch. Photo p. 33.

Termites (Isoptera)

Homeowners are concerned about termites because they can do serious damage to their houses. The termites we commonly see in Skagit County are dampwood termites (*Zootermopsis angusticollis*). They do not live in the dry wood structure of our houses, but in this climate any wood that has contact with the ground is likely to have a moisture content high enough to be attractive to them.

People usually see them as winged reproductives when the males and females leave the colony to search for a suitable nest site. They are about ¾ inch long. They tear off their wings after mating and crawl under a chip of wood or a leaf, where the female begins to lay eggs. The eggs hatch into wingless nymphs, which are about ½ inch long, soft bodied, and not able to live outside the nest. They need damp wood for food and a place to hide from predators. Very few queens are successful in establishing a colony. That is good because otherwise we would be knee-deep in termites.

Termites eat wood and have special protozoans in their gut that enable them to digest cellulose. This makes them good recyclers, and if they would eat only dead trees, stumps, and roots they would be considered beneficial insects. Termites are abundant in our forested areas, where there is no shortage of damp wood to be recycled.

Winged termites flying near your house are evidence of a thriving termite colony nearby because they do not fly very far. However, it does not necessarily mean that your house is infested. Decaying fence posts, stumps, and roots of dead trees, or even a pile of landscape bark, can provide food for termites. If the wood structure of your house is well above ground, properly ventilated, and dry, there will be no suitable habitat there for dampwood termites.

Subterranean termites (*Reticulitermes hesperus*) are smaller (½ inch long) than dampwood termites. They are found in Washington, but they are not as common in our area as dampwood termites. As their name implies, subterranean termites live in the soil and feed on wood above ground. They often build mud tubes up foundation walls through which to travel to the wood structure of houses. They live in moist soil, but they feed on dry wood, and they are much more likely to damage buildings than dampwood termites are.

There are many different kinds of termites throughout the world, but most of them live in tropical climates. Isn't that another good reason for living here in beautiful Skagit County?

Reticulitermes hesperus. **Subterranean Termite**. Length ½ inch. No photo.

Zootermopsis angusticollis. **Dampwood Termite**. Length ⅝ inch. Photo p. 33.

Resources

The insect collection referenced in this book is housed at the Plant Clinic in the WSU Skagit County Extension Master Gardener office in Burlington, WA (**https://extension.wsu.edu/skagit/mg/** or 360–428–4270).

To find out more about WSU Skagit County Extension Master Gardener Plant Clinics, visit **https://extension.wsu.edu/skagit/mg/clinics/.** This site includes information on plant clinic hours and locations, and on collecting and packaging insect samples, as well as a curated list of WSU online gardening resources and publications.

A number of Washington State University Extension bulletins are referenced in the text of this book, which was originally released in 2009. Some of these resources have become outdated or unavailable since that time. For the latest available information, try searching within some of the newer insect-related resources listed below:

- **WSU Pest Sense (Pestsense)**
  Compilation of fact sheets for managing pest problems
  http://pestsense.cahnrs.wsu.edu/Home/PestsenseHome.aspx

- **Pacific Northwest Insect Management Handbook**
  https://pnwhandbooks.org/insect

- **Home and Garden Pest Management**
  Washington State Pest Management Resource Service
  http://wsprs.wsu.edu/Homeowners.html

- **WSU Puyallup Plant & Insect Diagnostic Laboratory**
  Washington State University Puyallup Research and Extension Center
  https://puyallup.wsu.edu/plantclinic/

- **Plant Disease and Insect Identification Pests Leaflet Series**
  Washington State University Puyallup Research and Extension Center
  https://puyallup.wsu.edu/plantclinic/pls/

Many of the Washington State University Extension bulletins mentioned in the text and on the photo pages are available for download in PDF format for free by visiting:

- **WSU Publications**
  https://pubs.extension.wsu.edu/gardening

This page intentionally left blank

Bibliography

These are some of the books and papers I consulted while preparing this text.

Bohart, R.M., and A.S. Menke. 1976. *Sphecid Wasps of the World.* University of California Press.

Borror, Donald J., C.A. Triplehorn, N.F, Johnson. 1989. *An Introduction to the Study of Insects.* 6th Edition. Saunders College Publishing.

Cole, Frank R. 1969. *The Flies of Western North America.* University of California Press.

Cranshaw, Whitney. 2004. *Garden Insects of North America.* Princeton University Press.

Eighme, Lloyd E. 1989. "Revision of *Diodontus* in America North of Mexico." *Annals of the Entomological Society of America.* Vol. 82, No. 1, pp 14–28.

Essig, E.O. 1958. *Insects and Mites of Western North America.* Macmillan Co.

Furniss, R.L., and V.M. Carolin. 1977. *Western Forest Insects.* USDA Forest Service.

Haggard, Peter, and Judy Haggard. 2006. *Insects of the Pacific Northwest.* Timber Press.

Hatch, Melville H., 1953–1971. *The Beetles of the Pacific Northwest.* 5 vols. University of Washington Press.

Miller, Jeffrey C., and Paul C. Hammond. 2000. *Macro Moths of Northwest Forests and Woodlands.* USDA Forest Service.

Miller, Jeffrey C., and Paul C. Hammond. 2003. *Lepidoptera of the Pacific Northwest: Caterpillars and Adults.* USDA Forest Service.

Index

Numbers in bold at the end of each entry indicate photo page numbers.

Acrididae 93, **31**

Acrotrichis castanea 28, **10**

acute-tongue burrowing bees (Andrenidae) 62
  Andrena sp. 62, **26**

Acyrthosiphon barri 86

Adalia annectans 32

Adalia bipunctata 32

Adelges cooleyi 86–87, **30**

Adelgidae 86–87

adelgids (Aldelgidae) 86–87
  Cooley spruce gall (*Adelges cooleyi*) 86–87, **30**

aerial yellowjacket (*Dolichovespula arenaria*) 76, 78

Aeshna multicolor 59, **25**

Agapostemon sp. 62

Agathidium jasperinum 27

Aholibah underwing moth (*Catocala aholibah*) 20, **5**

alder ambrosia beetle (*Gnathotrichus alni*) 47

alder bark beetle (*Alniphagus aspericollis*) 47, **20**

alder flea beetle (*Altica ambiens*) 42, **18**

alder sawfly (*Cimbex americana*) 71–72

alder spittlebug (*Clastoptera obtusa*) 87

alder woolly sawfly (*Eriocampa ovata*) 71, 72

alfalfa semi-looper (*Autographa californica*) 20

Alniphagus aspericollis 47, **20**

Altica ambiens 42, **18**

Altica tombacina 42

ambrosia beetles (Scolytidae) .. 46–47, **20**

American cockroach (*Periplaneta americana*) 95, 96, **20**

Ampedus behrensi 38, **15**

Ampedus phoenicopterus 38

Ancistrocerus sp. 78, **29**

Andrena sp. 62, **26**

Andrenidae 62, **26**

anobiid beetle (*Hemicoelus gibbicollis*) 36, **14**

Anobiidae 36–37, **14**

Anoplodera (Ortholeptura) valida 40

Anoplodera aspera 40

Anoplodera crassipes 40, **16**

Anoplodera dolorosa 40, **16**

Anoplophora glabripennis 40, 41

Antheraea polyphemus 21, **6**

Anthocomus sp. 29

Anthophoridae 63, **26**

Anthrenus verbasci 34, 35, **13**

ants (Formicidae) 78–81
  carpenter (*Camponotus* sp.) . 79–80, **29**
  moisture (*Lasius* sp.) 79, 80
  odorous house (*Tapinoma sessile*) 79, 81
  pavement (*Tetramorium caespitum*) 79, 81
  pharaoh (*Monomorium pharaoensis*) 79, 80
  red (*Formica* sp.) 79, 80, **29**

Apatolestes sp. 53

aphid lion ..... *See* lacewings

Aphididae 85–86

aphids (Aphididae) 85–86
  cabbage (*Brevicoryne brassicae*) . 86
  green apple (*Aphis pomi*) 86
  green peach (*Myzus persica*) 86
  lettuce (*Acyrthosiphon barri*) 86
  potato (*Macrosiphon euphoribiae*) 86
  rose (*Merhinchites bicolor*) 86

Aphis pomi 86

Aphodius pardalis 48, **21**

Aphodius sp. 48, **21**

Apidae 60–61, **25**

Apis nellifera 61, **25**

Aploderus linearis 27
apple ermine moth (*Yponomeuta mallinellus*) 22, 23, **7**
apple maggot (*Rhagoletis pomonella*) 54, 55, **23**
Araeopidius monachus 30
Arctiidae 14–17, **1–2**
Arphia sp. 93, **31**
Asemum sp. 41
Asian long-horned beetle (*Anoplophora glabripennis*) 40, 41
asparagus beetle (*Criocerus asparagi*) 42, **18**
Athous scissus 38
Athous vittiger 38, **18**
Attagenus piceus 34, 35
Autographa californica.....20
bacon beetle.....*See* larder beetle
bald-faced hornet (*Dolichovespula maculata*) 76, 78, **29**
Banasa dimidiata.....82, **30**
banded alder borer (*Rosalia funebris*) 41, **17**
bark beetles (Scolytidae) 46–47
alder (*Alniphagus aspericollis*)47, **20**
alder ambrosia (*Gnathotrichus alni*) 47
Douglas fir (*Dendroctonus pseudotsugae*).....47, **20**
Dryocoetes autographus 47
European shot-hole borer (*Xyleborus dispar*) 46, 47, **20**
Hylastes sp. 47
Hylurgops rufipennis 47
Rocky Mountain juniper (*Phloeosinus scopulorum*) 47, **20**
shot-hole borer (*Scolytus rugulosus*) 46, 47
western cedar (*Phloeosinus punctatus*) 47, **20**
western hemlock wood stainer (*Gnathotrichus sulcatus*) ...47, **20**
bark lice (Psocoptera) 99, **33**
bed bugs (Cimicidae) 83–84
Cimex lectularius 84
bees 60–64
acute-tongued burrowing (Andrenidae) 62, **26**
bumblebees (Aphidae) 60–61, **25**
digger (Anthophoridae) 63, **26**
honeybees (Aphidae) 60–61, **25**
leafcutter (Megachilidae) . 63–64, **26**
sweat (Halictidae) 61–62, **25**
yellow-faced (Colletidae) 63, **26**
beetles (Coleoptera) 24–48, **8–21**
Behrensia conchiformis 20, **5**
Bembix americana 66, 69
Bibio nervosus..... 56–57, **24**
Bibionidae..... 56–57
birch leafminer sawfly (*Fenusa pusilla*) 71, 72
Bittacomorpha occidentalis 56, **24**
black carpet beetle (*Attagenus piceus*) 34, 35
black flies (Simuliidae)..... 54, **23**
black vine weevil (*Brachyrhinus (Otiorhynchus) sulcatus*) .43, 45, **19**
Blatella germanica.....95, 96
Blatta orientalis 96
Blatteria 95–96
blow fly (*Phaenicia* sp.)..... 50, **21**
blue bottle fly (*Calliphora vomitoria*) 50
blue-eyed darner (*Aeshna multicolor*) 59, **25**
Bombus vosnesenskii..... 60–61, **25**
bot flies (Oestridae) 55, **23**
bottle flies (Calliphoridae) 50
blow fly (*Phaenicia* sp.) 50, **21**
blue (*Calliphora vomitoria*) 50
*Brachyrhinus (Otiorhynchus) ovatus*45, **19**
Brachyrhinus (Otiorhynchus) rugostriatus..... 45, **19**
Brachyrhinus (Otiorhynchus) singularis 45
Brachyrhinus (Otiorhynchus) sulcatus 43, 45, **19**
Braconidae..... 73
bread beetle.....*See* drugstore beetle
Brevicoryne brassicae 86
bristletails (Thysanura) 91
Microcoryphia 91, **31**

Bromius obscurus 42

Brotkaefer ..... *See* drugstore beetle

brown lacewing (*Hemerobius* sp.) ... 92, **31**

brown powderpost beetle (*Lyctus brunneus*) 37, **14**

brown soft scale (*Coccus hesperidum*) 88, **30**

brown spider beetle (*Ptinus clavipes*) 35, **13**

brown-banded cockroach (*Supella longipalpa*) 95, 96, **32**

bulb fly (*Eumerus* sp.)..... 52

bumblebee (*Bombus vosnesenskii*) 60–61, **25**

Buprestidae 39

Buprestis aurulenta 39, **16**

Buprestis laeviventris 39, **16**

butterflies (Lepidoptera) 12–13
  imported cabbageworm (*Pieris rapae*) 12–13, **1**
  mustard white (*Pieris napi*) 13

cabbage aphid (*Brevicoryne brassicae*) 86

cabbage looper (*Trichoplusia ni*) 20

cabbageworm, imported (*Pieris rapae*) 12–13, **1**

caddisflies (Trichoptera) 59, **25**

Caliroa cerasi 71, 72, **28**

Calligrapha californica 42, **18**

Calliphora vomitoria 50

Calliphoridae 50, **21**

Calvia guttata 32

Camponotus sp. 79–80, **29**

Cantharidae 29, **11**

Carabidae 24–26, **8**

Carabus granulatus 25, **8**

carpenter ant (*Camponotus* sp.) 79–80, **29**

carpet beetles (Dermestidae) 34–35
  black (*Attagenus piceus*) 34, 35
  hide beetle (*Dermestes maculatus*) 34
  larder beetle (*Dermestes lardarius*) 34, **13**
  varied (*Anthrenus verbasci*) .. 34, 35, **13**
  warehouse beetle (*Trogoderma inclusum*) 35

carrion beetles (Silphidae) 27
  Necrophilus hydrophilooides 27, **9**
  Necrophorus vespilloides 27, **9**

cascara looper (*Triphosa haesitata*) 19, **4**

cat flea (*Ctenocephalides felis*) 97

Cateretes pennatus 30

Catocala aholibah 20, **5**

cave cricket (Rhaphidophoridae (Gryllacrididae)) 93–94

Cerambycidae 40–41, **16–17**

Cercopidae 87

Cerisy's sphinx moth (*Smerinthus cerisyi*) 21, **6**

Ceutorhyncus sp. 45, **19**

Chalcidae 73–74

checkered beetles (Cleridae) 30
  red-bellied clerid (*Enoclerus sphegius*) 30, **11**

cherry fruit fly (*Rhagoletis cingulata*) 54, 55

Choristoneura rosaceana 22, **7**

Chrysididae 70, **28**

Chrysobothris mali 39

Chrysolina quadrigemina 42, **18**

Chrysomela interna 42

Chrysomelidae 41–43, **18**

Chrysopa sp. 91, **31**

Chrysops sp. 53, **22**

Cicadellidae 87

Cicindelidae 26, **9**

cigarette beetle (*Lasioderma serricorne*) 36

Cimbex americana 71–72

Cimex lectularius 84

Cimicidae 83–84

Clastoptera obtusa 87

clay-colored weevil (*Brachyrhinus (Otiorhynchus) singularis*).....45

Cleridae 30, **11**

click beetles (Elateridae) 38
Ampedus behrensi 38, **15**
Ampedus phoenicopterus 38
Athous scissus.....38
Athous vittiger 38, **15**
Ctenicera opacula 38
Dalopius sp.....38, **15**
Elater sp.....38
Elathous nebulosus 38
Hemicrepidius morio 38
Hemicrepidius pallidipennis ...38, **15**
Limonius crotchi 38, **15**
Megapenthes caprella.....38, **15**

Clostera apicaulus 20, **5**

clothes moths (Tineidae) 22
webbing (*Tineola bisselliella*) 22

cluster fly (*Pollenia rudis*) ... 49, 50, **21**

Coccidae 87

Coccinella nivicula monticola 32

Coccinella septempunctata.....32, **12**

Coccinella subversa 32

Coccinella trifasciata 32

Coccinellidae.....30–33, **12**

Coccus hesperidum.....88, **30**

cockroaches (Blatteria)..... 95–96
American (*Periplaneta americana*) 96
brown-banded (*Supella longipalpa*) 96
German (*Blatella germanica*) . 95, 96
Oriental (*Blatta orientalis*).....96
woods roach (*Parcoblatta americana*) 96

codling moth (*Cydia pomonella*) 22, 23, **7**

Coleoptera.....24–48, **8–21**

Collembola 89

Colletidae.....63, **26**

Colydiidae 33

Colymbetes exaratus 26, **8**

common crane fly.....56, **24**

common house fly 49, 50, **21**

common springtail (*Tomocerus vulgaris*).....89

common yellowjacket (*Vespula vulgaris*) 76–78, **29**

compost beetle (*Sphaeridium bipustulatum*) 37, **14**

convergent lady beetle (*Hippodamia convergens*) 30–31, 32

Cooley spruce gall adelgid (*Adelges cooleyi*) 86–87, **30**

Corticaria valida..... 30

cottony camellia scale (*Pulvinaria floccifera*).....87, 88

Crabro latipes..... 69, **27**

crane flies (Tipulidae) 55–56
common 56, **24**
European (*Tipula paludosa*) ...55, 56
phantom (*Bittacomorpha occidentalis*) 56, **24**

crickets (Orthoptera) 93–94
cave (Rhaphidophoridae (Gryllacrididae)) 93–94
snow (Grylloblattidae)..... 94

Criocerus asparagi 42, **18**

Criorhina luna..... 52

Crossocerus sp. 69, **27**

Ctenicera opacula 38

Ctenocephalides felis 97

cuckoo wasps (Chrysididae)..... 70
Omaulus aeneus 70, **28**

Cucujidae 33, **13**

Cucujus clavipes 33, **13**

Culicidae.....52–53

Curculionidae 43–45, **19**

currant worm, imported (*Nematus ribesii*).....71, 72

Cuterebra sp. 55, **23**

cutworms (Noctuidae) 19–20
Aholibah underwing moth (*Catocala aholibah*)..... 20, **5**
alfalfa semi-looper (*Autographa californica*) 20
Behrensia conchiformis 20, **5**
cabbage looper (*Trichoplusia ni*) .. 20
Egira rubrica..... 20, **5**
Feralia comstocki 20, **5**
western bean (*Loxigrotis albicosta*) 19

Cychrus tuberculatus..... 25, **8**

Cycloneda polita..... 31, 32, **12**

Cydia nigricana 22

Cydia pomonella..... 22, 23, **7**

cylindrical bark beetles (Colydiidae) .33
Namurina pacificus 33

Cynipidae.....72–73, **28**

Dalopius sp. 38, **15**

dampwood termite (*Zootermopsis angusticollis*)..... 100, **33**

damsel bug (*Nabis americoferus*).....82

damselflies (Odonata) 59

darkling beetles (Tenebrionidae) 37–38
Palorus sp. 38
Phellopsis porcata.....38, **15**
Trilobium destructor.....38, **15**

Dascillidae.....30

deer flies (Tabanidae) 53
Apatolestes sp.....53
Chrysops sp. 53, **22**

Deleaster concolor.....27

Dendroctonus pseudotsugae 47, **20**

Dendroides ephemeroides.....37, **14**

Dendrophagus glaber.....33, **13**

Dermaptera.....98, **32**

Dermestes lardarius.....34, **13**

Dermestes maculatus.....34

Desmocerus auripennis 41, **16**

Diastrophus kincaidii.....73, **28**

Dictyopterus hamatus 28

Dictyopterus simplicipes 28, **10**

digger bees (Anthophoridae).....63
Nomada sp. 63, **26**
Peponapis sp.....63

Diodontus boharti.....69, **27**

Diodontus minutus 69

Diplolepis sp. 73

Diptera 49–58, **21–24**

Dolichopodidae 57, **24**

Dolichopus sp. 57, **24**

Dolichovespula arenaria 76, 78, **29**

Dolichovespula maculata 76, 78, **29**

Douglas fir bark beetle (*Dendroctonus pseudotsugae*) 47, **20**

dragonflies (Odonata)..... 59, **25**
blue-eyed darner (*Aeshna multicolor*)..... 59, **25**

Drepana arcuata 20, **6**

Drepanidae 20, **6**

drugstore beetle (*Stegobium paniceum*).....36, 37, **14**

Dryocoetes autographus 47, **20**

dung flies (Scathophagidae) 57–58, **24**

dusky-winged spider wasp (Pompilidae)..... 70

Dytiscidae..... 26, **8**

Dytiscus hatchi 26, **8**

earwigs (Dermaptera) 98
European (*Forficula auricularia*).. 98, **32**

Ectemnius sp.....68, 69

Egira rubrica 20, **5**

Elasmostethus cruciatus..... 82, **30**

Elater sp. 38, **15**

Elateridae 38, **15**

Elathous nebulosus 38

Ellychnia greeni 29

Ellychnia hatchi 29, **11**

Ellychnia sp.....28, 29

Endomychidae..... 33

Enoclerus sphegius..... 30, **11**

Ephemeroptera..... 59, **25**

Ephestia kuehniella 23, **7**

Epitrix subcrinita..... 42, **18**

Epitrix tuberis..... 42, **18**

Ergates spiculatus..... 41, **16**

Eriocampa ovata.....71, 72

Eristalis tenas..... 52

ermine moths (Yponomeutidae) .22, 23
apple (*Yponomeuta mallinellus*).. 22, 23, **7**

Euchlaena tigrinaria..... 19, **3**

Eumerus sp..... 52

Eupoedes volucris.....52

European crane fly (*Tipula paludosa*) 55, 56

European earwig (*Forficula auricularia*) 98, **32**

European fruit lecanium (*Parthenolecanium corni*) 87–88

European shot-hole borer (*Xyleborus dispar*) 46, 47, **20**

fall webworm (*Hyphantria cunea*) ...15, 17, **1**

Fannia sp. 49

feather-wing beetles (Ptiliidae) 28
Acrotichis castanea 28, **10**

Fenusa pusilla 71, 72

Feralia comstocki.....20, **5**

fire-colored beetles (Pyrochroidae)...37
Dendroides ephemeroides 37, **14**

fireflies (Lampyridae) 28–29
Ellychnia greeni 29
Ellychnia hatchi 29, **11**
Phausis rhombica.....29

flat bark beetles (Cucujidae) 33
Dendrophagus glaber 33, **13**
Pediacus depressus 33
red (*Cucujus clavipes*) 33, **13**
saw-toothed grain beetle (*Oryzaephilus surinamensis*) ...33, **13**
Silvanus bidentatus.....33

flat-headed borers ... *See* metallic wood borers

flea beetles (Chrysomelidae) 41–43
alder (*Altica ambiens*) 42, **18**
Altica tombacina 42
asparagus beetle (*Criocerus asparagi*) 42, **18**
Chrysomela interna 42
golden tortoise beetle (*Metriona bicolor*).....43, **18**
Klamath weed beetle (*Chrysolina quadrigemina*) 42, **18**
tickseed-leaf beetle (*Calligrapha californica*).....42, **18**
tuber (*Epitrix tuberis*).....42, **18**
western fruit beetle (*Syneta albida*) 43, **18**
western grape rootworm (*Bromius obscurus*) 42
western potato (*Epitrix subcrinita*) 42, **18**

flea weevil (*Rhynchaenus salicis*).... 45, **19**

fleas (Siphonaptera)..... 97
cat flea (*Ctenocephalides felis*) 97

flesh flies (Sarcophagidae) 50–51
Sarcophaga aldrichi 50, 51

flies (Diptera)..... 49–58, **21–24**

flower beetles (Melyridae and Malachiidae) 29
Anthocomus sp. 29
Malachius aeneus 29

Forficula auricularia 98, **32**

fork-tailed bush katydid (*Scudderia furcata*) 94, **32**

Formica sp. 79, 80, **29**

Formicidae 78–81, **29**

fruit flies (Tephritidae) 54–55
apple maggot (*Rhagoletis pomonella*) 55, **23**
cherry (*Rhagoletis cingulata*) 55
walnut husk fly (*Rhagoletis completa*)..... 55

fungus gnats (Mycetophilidae and Sciaridae) 58, **24**

furniture beetles (Anobiidae) 36–37
anobiid beetle (*Hemicoelus gibbicollis*) 36, **14**
drugstore beetle (*Stegobium paniceum*) 36, 37, **14**
Lasioderma serricorne..... 36
Microbregma emraginatum 36
Ptilinus basalis 36
Vrilleta decorata..... 37

gall wasps (Cynipidae) 72–73
rose-leaf (*Diplolepis* sp.) 73
thimbleberry-stem (*Diastrophus kincaidii*) 73, **28**

Geometridae 19, **4**

German cockroach (*Blatella germanic*a) 95, 96

giant silk moths (Saturniidae) 21
polyphemus moth (*Antheraea polyphemus*)..... 21, **6**

gladiolus thrips (*Thrips simplex*)..... 90

Gnathotrichus alni..... 47

Gnathotrichus sulcatus..... 47, **20**

golden buprestid (*Buprestic aurulenta*) 39, **16**

golden tortoise beetle (*Metriona bicolor*) 43, **18**

golden-winged elder borer (*Desmocerus auripennis*) 41, **16**

Grammoptera filicornis.....41

granary weevil (*Sitophilus granarius*) 44–45, **19**

grasshoppers (Acrididae).....93
orange-winged grasshopper (*Arphia* sp.) 93, **31**
red-legged (*Melanoplus femurrubrum*) 93
two-striped (*Melanoplus bivittatus*) *93*

grasshoppers (Tetrigidae).....93
pygmy 93

green apple aphid (*Aphis pomi*) 86

green lacewing (*Chrysopa* sp.) ..92, **31**

green peach aphid (*Myzus persica*) .85, 86

ground beetles (Carabidae)..... 24–25
Carabus granulatus.....25, **8**
Cychrus tuberculatus.....25, **8**
Harpalus aeneus.....25, **8**
Lebia moesta 25
Notiophilus aeneus.....25
Parargutor lustrans 25
Pterostichus castaneous.....25
Pterostichus vulgaris 25, **8**
Scaphinotus marginatus 25–26, **8**

Gryllacrididae 93

Grylloblattidae 93, 94

Gymnaetron tetrum 45, **19**

Gyrinidae 26–27, **8**

Gyrinus sp.....27, **8**

Habrosyne scripta.....20, **5**

Haematobia irritans 49, 50, **21**

hairy-tongued bee (*Lasioglossum* sp.) 62, **25**

halictid bee (*Agapostemon* sp.) 62

halictid bee (*Sphecodes* sp.) 62

Halictidae..... 61–62

handsome fungus beetles (Endomychidae) 33
Mycetina idahoensis 33

Harmonia axyridis 31, 32, **12**

Harpalus aeneus 25, **8**

Hemerobius sp. 92, **31**

Hemicoelus gibbicollis..... 36, **14**

Hemicrepidius morio..... 38

Hemicrepidius pallidipennis..... 38, **15**

Hemiptera..... 82–84, **30**

hemlock looper (*Lambdina fiscellaria*) 19

hide beetle (*Dermestes maculatus*) . 34

Hippoboscidae 57, **24**

Hippodamia convergens..... 30–31, 32

Homoptera..... 85–88, **30**

honeybee (*Apis nellifera*) 60–61, **25**

hooktip moths (Drepanidae) 20
Drepana arcuata 20, **6**

horn fly (*Haematobia irritans*)...49, 50, **21**

horntail parasite (*Megarhyssa* sp.)... 76

horntail wasp (*Urocerus californicus*) 72

horse flies (Tabanidae) 53
Tabanus sp. 53, **22**

house flies (Muscidae) 49
cluster fly (*Pollenia rudis*) 49, 50, **21**
common (*Musca domestica*) .49, 50, **21**
horn fly (*Haematobia irritans*) 49, 50, **21**
little (*Fannia* sp.).....49, 50, **21**
stable fly (*Stomoxys calcitrans*).. 49, 50

hover flies (Syrphidae) 51–52
bulb fly (*Eumerus* sp.) 52
Criorhina luna..... 52
Eristalis tenas..... 52
Eupeodes volucris 52
Melanostoma sp. 52
Sericomyia chalcopyga..... 52
Sphegina sp. 52
Syrphus arcuatus 52, **22**

hunting wasps.....*See* thread-waisted wasps

Hydria undulata..... 19, **4**

Hydrophilidae..... 37, **14**

Hylaeus sp. 63

Hylastes sp. 47

Hylurgops rufipennis..... 47

Hymenoptera.....60–81, **25–29**

Hyphantria cunea 15, 17, **1**

Hypogastrura nivicola.....89

ichneumon wasps (Ichneumonidae)74–76
horntail parasite (*Megarhyssa* sp.) 76, **28**

Ichneumonidae 74–76, **28**

inchworms (Geometridae).....19, **4**

Indian meal moth (*Plodia interpunctella*)..... 22, 23, **7**

Isabella tiger moth ..... *See* woollybear, banded

Isoptera..... 100, **33**

Japanese beetle (*Popillia japonica*) . 47–48

katydids (Tettigoniidae).....94
fork-tailed katydid (*Scudderia furcata*) 94, **32**

Klamath weed beetle (*Chrysolina quadrigemina*).....42, **18**

lacewings (Neuroptera) 92
brown (*Hemerobius* sp.) 92, **31**
green (*Chrysopa* sp.) 92, **31**

lady beetles (Coccinellidae)..... 30–33
Adalia annectans 32
Calvia guttata 32
Coccinella nivicula monticola 32
Coccinella subversa.....32
Coccinella trifasciata 32
convergent (*Hippodamia convergens*) 32
multicolored Asian (*Harmonia axyridis*) 32, **12**
pine (*Mulsantina picta*) 32
seven-spotted (*Coccinella septempunctata*).....32, **12**
spider mite destroyer (*Stethorus punctum*).....32, **12**
20-spotted (*Psyllobora vigintimaculata*)..... 31, 33, **12**
two-spotted (*Adalia bipunctata*) ...32
western blood-red (*Cycloneda polita*) 32, **12**

Lambdina fiscellaria 19

Lampyridae 28–29, **11**

lappet moth (*Phyllodesma americana*) 18

larder beetle (*Dermestes lardarius*) 34, **13**

Lasiocampidae.....17–18, **3**

Lasioderma serricorne 36

Lasioglossum sp. 62, **25**

Lasius sp. 79, 80

Lathridiidae..... 30

leaf beetles (Chrysomelidae) .. *See* flea beetles

leafcutter bees (Megachilidae) ... 63–64
Megachiles sp. 64
orchard mason bee (*Osmia* sp.).. 64, **26**

leafhoppers (Cicadellidae) 87

leafroller moths (Tortricidae) 22–23
codling moth (*Cydia pomonella*) . 23, **7**
oblique banded (*Choristoneura rosaceana*) 22, **7**
pea worm moth (*Cydia nigricana*) 22

Lebia moesta..... 25

Leiodidae..... 27

Lepidoptera..... 12–20, **1–6**

Lepisma saccharina 91, **31**

Leptura obliterata 41, **17**

lettuce aphid (*Acyrthosiphon barri*) .. 86

Limonius crotchi..... 38, **15**

lion beetle (*Ulochaetes leoninus*)41, **17**

Lipoptena depressa 57, **24**

little house fly (*Fannia* sp. ...49, 50, **21**

long-horned beetles (Cerambycidae) 40–41
Anoplodera (Ortholeptura) valida. 40
Anoplodera aspera..... 40
Anoplodera crassipes 40, **16**
Anoplodera dolorosa 40, **16**
Asemum sp. 41
Asian (*Anoplophora glabripennis*) 40, 41
banded alder borer (*Rosalia funebris*) 41, **17**
Ergates spiculatus 41, **16**
golden-winged elder borer (*Desmocerus auripennis*) .. 41, **16**
Grammoptera filicornis..... 41
Leptura obliterata..... 41, **17**
lion beetle (*Ulochaetes leoninus*) 41, **17**

Necydalis diversicollis 41
Pachyta armata 41, **17**
Phymatodes nitidus 41
Pidonia gnathoides 41
Pidonia scripta 41, **17**
Plectrura spinicauda 41, **17**
ribbed pine borer (*Rhagium inquisitor*) 41, **17**
western ash borer (*Neoclytus conjunctus*) 41, **17**
white spotted sawyer (*Monochamus scutellatus*) 41, **17**

long-legged flies (Dolichopodidae) .. 57, **24**

loopers (Geometridae) 19
Euchlaena tigrinaria 19, **3**
hemlock (*Lambdina fiscellaria*) 19
Hydria undulata 19, **4**
Nemoria darwiniata 19, **4**
Pero mizon 19, **4**
Triphosa haesitata 19, **4**

Lophocampa argentata 16, 17, **1**

Lophocampa maculata 16, 17, **2**

louse flies (Hippoboscidae) 57, **24**

Loxagrotis albicosta 19

Lucanidae 47, **20**

Lycidae 28, **10**

Lyctidae 37, **14**

Lyctus brunneus 37, **14**

Lyctus cavicollis 37, **14**

Lyctus planicollis 37

Lygaeus reclivatus 82, **30**

Lymantriidae 17, **3**

Macrosiphon euphorbiae 86

Malachiidae 29

Malachius aeneus 29

March flies (Bibionidae) 56
Bibio nervosus 56, 57, **24**

mayflies (Ephemeroptera) 59

meadow spittlebug (*Philaenus spumarius*) 87

Mediterranean flour moth (*Ephestia kuehniella*) 23, **7**

Megachiles sp. 64

Megachilidae 63–64

Megapenthes caprella 38, **15**

Megarhyssa sp. 76

Melanophthalma pumila 30

Melanophthalmus distinguenda 30

Melanoplus bivittatus 93, **31**

Melanoplus femurrubrum 93

Melanostoma sp. 52

Melyridae 29

merchant grain beetle (*Oryzaephilus mercator*) 33

Merhinchites bicolor 86

metallic wood borers (Buprestidae) .. 39
Buprestis laeviventris 39
golden buprestid (*Buprestis aurulenta*) 39, **16**
Pacific flat-headed borer (*Chrysobothris mali*) 39

Metriona bicolor 43, **18**

Microbregma emarginatum 36

Microcoryphia 91, **31**

Microlepidoptera 22–23, **7**

micromoths (Microlepidoptera) .. 22–23, **7**

Micropeplus brunneus 28, **10**

milkweed bug (*Lygaeus reclivatus*) . 82, **30**

minute brown scavenger beetles (Lathridiidae) 30
Corticaria valida 30
Melanophthalmus distinguenda ... 30
Melanophthalmus pumila 30

minute pirate bug (*Triphleps tristicolor*) 82

moisture ant *(Lasius* sp.) 79, 80

Monochamus scutellatus 40, 41, **17**

Monomorium pharaoensis 79, 80

mosquitoes (Culicidae) 52–53

moths (Lepidoptera) 13–21, **1–6**

mud-dauber wasp (*Sceliphron caementarium*) 65–66, 69, **27**

Mulsantina picta 32

multicolored Asian lady beetle (*Harmonia axyridis*) 31–32, **12**

Musca domestica 49, 50, **21**

Muscidae 49–50, **21**
mustard white (*Pieris napi*) 12, 13
Mycetina idahoensis 33
Mycetophilidae 58, **24**
Myzus persica 85, 86
Nabis americoferus 82
Namunaria pacificus 33
Necrophilus hydrophiloides 27, **9**
Necrophorus vespilloides 27, **9**
Necydalis diversicollis 41
Nematus ribesii 71, 72
Nemoria darminiata 19, **4**
Neoclytus conjunctus 41, **17**
net-winged beetles (Lycidae) 28
  Dictyopterus hamatus 28
  Dictyopterus simplicipes 28, **10**
Neuroptera 92, **31**
Nitidulidae 30
Noctuidae 19–20, **5**
Nomada sp. 63, **26**
Notiophilus aeneus 25
Notodontidae 20, **5**
oblique banded leafroller (*Choristoneura rosaceana*) 22, **7**
Odonata 59
odorous house ant (*Tapinoma sessile*) 79, 81
Oestridae 55, **23**
Omaulus aeneus 70, **28**
Omus dejeani 26, **9**
onion thrips (*Thrips tabaci*) 90, **30**
orange-winged grasshopper (*Arphia* sp.) 93, **31**
orchard mason bee (*Osmia* sp.) . 64, **26**
Orgyia antiqua 17, **3**
Oriental cockroach (*Blatta orientalis*) 96
Orthoptera 93–94, **31–32**
Oryzaephilus mercator 33
Oryzaephilus surinamensis 33, **13**
Osmia sp. 64, **26**
Oxybelus sp. 68, 69, **27**
Oxytelus nitidulus 28
Pachyta armata 41, **17**
Pacific flat-headed borer (*Chrysobothris mali*) 39
Pactopus hornii 38
Palorus sp. 38
paper wasp (*Polistes* sp.) 78
Parargutor lustrans 25
parasitic wasps (Braconidae) 73–74
parasitic wasps (Chalcidae) 73–74
Parcoblatta americana 95, 96
Parothus californicus 28
Parthenolecanium corni 87–88
Passaleocus cuspidatus 69, **27**
pavement ant (*Tetramorium caespitum*) 79, 81
pea worm moth (*Cydia nigricana*) 22
pea-leaf weevil (*Sitona lineatus*) 45
pear slug (*Caliroa cerasi*) 71, 72, **28**
Pediacus depressus 33
Pelecomalium testaceum 28, **10**
Pemphredon sp. 69, **27**
Peponapis sp. 63
Periplaneta americana 95, 96, **32**
Pero mizon 19, **4**
Phaenicia sp. 50, **21**
phantom crane fly (*Bittacomorphia occidentalis*) 56, **24**
pharaoh ant (*Monomorium pharaoensis*) 79, 80
Phausis rhombica 29
Phellopsis porcata 38, **15**
Philaenus spumarius 87
Phloeosinus punctatus 47, **20**
Phloeosinus punctatus scopulorum . 47, **20**
Phyllodesma americana 18
Phymatodes nitidus 41
Pidonia gnathoides 41

Pidonia scripta 41, **17**
Pieridae 12–13, **1**
Pieris napi 12, 13
Pieris rapae 12–13, **1**
pine lady beetle (*Mulsantina picta*) ... 32
Pissodes sp. 45, **19**
Plecoptera 59
Plectrura spinicauda 41, **17**
Plodia interpunctella 22, 23, **7**
plume moths (Pterophoridae) 23
Podabrus cavicollis 29, **11**
Podabrus pruinosus 29, **11**
Podabrus sp. 29, **11**
Polistes sp. 78
Pollenia rudis 49, 50, **21**
polyphemus moth (*Antheraea polyphemus*) 21, **6**
Polyphylla decemlineata 48, **21**
Pompilidae 70
Pontania pacifica 72
Popillia japonica 47–48
potato aphid (*Macrosiphon euphorbiae*) 86
potter wasp (*Ancistrocerus* sp.) . 78, **29**
powderpost beetles (Lyctidae) 37
  brown (*Lyctus brunneus*) 37, **14**
  southern lyctus beetle (*Lyctus planicollis*) 37
  western lyctus beetle (*Lyctus cavicollis*) 37, **14**
predaceous diving beetles (Dytiscidae) 26
  Colymbetes exaratus 26, **8**
  Dytischus hatchi 26, **8**
  Rhantus hoppingi 26
Prionyx sp. 64–65, 69
prominents (Notodontidae) 20
  Clostera apicaulus 20, **5**
Prosimulum sp. 54, **23**
pseudo-click beetles (Throscidae) 38
  Pactopus hornii 38
  Trixagus sereceus 38
Pseudohaida rothi 28, **10**
Psocoptera 99, **33**
Psyllobora vigintimaculata ... 31, 33, **12**
Pterophoridae 22, 23
Pterostichus castaneous 25
Pterostichus vulgaris 25, **8**
Ptiliidae 28, **10**
Ptilinus basalis 36
Ptinidae 35, **13**
Ptinus clavipes 35, **13**
Ptinus fur 35, **13**
Pulverro eighmei 68, 69
Pulverro monticola 68, 69, **27**
Pulvinaria floccifera 87, 88
pygmy grasshopper (Tetrigidae) 93, **31**
Pyralidae 23, **7**
Pyrochroidae 37, **14**
Pyrrharctia isabella 14, 15, 17, **2**
Quedius (Distichalius) sp. 28
rat-tailed maggot .... *See Eristalis tenas*
red ant (*Formica* sp.) 79, 80, **29**
red flat bark beetle (*Cucujus clavipes*) 33, **13**
red-bellied clerid (*Enoclerus sphegius*) 30, **11**
red-legged grasshopper (*Melanoplus bivittatus*) 93
Reticulitermes hesperus 100
Rhagio costatus 54, **23**
Rhagionidae 53–54, **23**
Rhagium inquisitor 41, **17**
Rhagoletis cingulata 54, 55
Rhagoletis completa 55
Rhagoletis pomonella 54, 55, **23**
Rhantus hoppingi 26
Rhaphidophoridae (Gryllacrididae) . 93–94
Rhopalum clavipes 69, **27**
Rhynchaenus salicis 45, **19**
ribbed pine borer (*Rhagium inquisitor*) 41, **17**

rice weevil (*Sitophilus oryzae*) ... 44, 45

Rocky Mountain juniper bark beetle (*Phloeosinus scopulorum*) 47, **20**

Rosalia funebris.....41, **17**

rose aphid (*Merhinchites bicolor*) 86

rose-leaf gall wasp (*Diplolepis* sp.) ...73

rough strawberry root weevil (*Brachyrhinus (Otiorhynchus) rugiostratus*) 45, **19**

round fungus beetles (Leiodidae) 27
Agathidium jasperinum 27
Sciodrepoides watsoni 27

round-headed borers . *See* long-horned beetles

rove beetles (Staphylinidae)..... 27–28
Aploderus linearis 27
Deleaster concolor 27, **10**
Micropeplus brunneus.....28, **10**
Oxytelus nitidulus 28
Parothius californicus 28
Pelecomalium testaceum.....28, **10**
Pseudohaida rothi 28, **10**
Quedius (Distichalius) sp. 28
Tachyporus chrysomelinus 28

rusty tussock moth (*Orgyia antiqua*)17, **3**

sand wasp (*Bembix americana*) . 66, 69

sap beetles (Nitidulidae) 30
Cateretes pennatus 30

Sarcophaga aldrichi 50–51

Sarcophagidae 50–51

Saturniidae.....21, **6**

sawflies (Tenthredinidae)..... 70–72
alder (*Cimbex americana*)..... 71–72
alder woolly (*Eriocampa ovata*) ...71, 72
birch leafminer (*Fenusa pusilla*) ..71, 72
horntail wasp (*Urocerus californicus*) 72
imported currant worm (*Nematus ribesii*)..... 70, 72
pear slug (*Caliroa cerasi*) 71, 72, **28**
willow-leaf gall (*Pontania pacifica*) 72

saw-toothed grain beetle (*Oryzaephilus surinamensis*) 33, **13**

scales (Coccidae)..... 87–88
brown soft (*Coccus hesperidum*) .88, **30**
cottony camellai (*Pulvinaria floccifera*) 87, 88
European fruit lecanium (*Parthenolecanium corni*) ...87–88

Scaphinotus marginatus..... 25–26, **8**

scarab beetles (Scarabaeidae) ...47–48
Aphodius pardalis..... 48, **21**
Aphodius sp...... 48, **21**
10-lined June beetle (*Polyphylla decemlineata*) 48, **21**

Scarabaeidae 47–48, **21**

Scathophagidae 57–58, **24**

Sceliphron caementarium ... 65–66, 69, **27**

Sciaridae 58, **24**

Sciodrepoides watsoni 27

Scolytidae..... 46–47, **20**

Scolytus rugulosus 46, 47

Scudderia furcata..... 94, **32**

Sericomyia chalcopyga..... 52

seven-spotted lady beetle (*Caccinella septempunctata*) 32, **12**

shot-hole borer (*Scolytus rugulosus*) 46, 47

Silphidae 27, **9**

Silvanus bidentatus 33

silverfish (Thysanura) 91
Lepisma saccharina 91

silver-spotted tiger moth (*Lophocampa argentata*)..... 16–17, **1**

Simuliidae..... 54, **23**

Sinodendron rugosum..... 47, **20**

Siphonaptera..... 97

Sitona lineatus..... 45

Sitophilus granarius..... 44–45, **19**

Sitophilus oryzae 44, 45

skin beetles..... *See* carpet beetles

Smerinthus cerisyi 21, **6**

snipe flies (Rhadionidae) 53–54
Rhagio costatus 54, **23**
Symphoromyia sp. 54, **23**

snout beetles ..... *See* weevils

snout moths (Pyralidae)..... 23

Indian meal moth (*Plodia interpunctella*) 23, **7**
Mediterranean flour moth (*Ephestia kuehniella*) 23

snow cricket (Grylloblattidae) 94

snow flea (*Hypogastrura nivicola*) 89

soft-bodied plant beetles (Dascillidae) 30
Araeopidius monachus 30

soldier beetles (Cantharidae) 29
Podabrus cavicollis 29, **11**
Podabrus pruinosus 29, **11**
Podabrus sp. 29, **11**

southern lyctus beetle (*Lyctus planicollis*) 37

Sphaeridium bipustulatum 37, **14**

Sphecidae 64–69, **27**

Specodes sp. 62, **25**

Sphegina sp. 52

Sphingidae 21, **6**

sphinx moths (Sphingidae) 21, **6**

spider beetles (Ptinidae) 35
brown (*Ptinus clavipes*) 35, **13**
white-marked (*Ptinus fur*) 35, **13**

spider mite destroyer (*Stethorus punctum*) 33, **12**

spider wasps (Pompilidae) 70
dusky-winged 70

Spilosoma virginica 14, 15, 17, **2**

spittlebugs (Cercopidae) 87
alder (*Clastoptera obtusa*) 87
meadow (*Philaenus spumarius*) ... 87

spotted tussock moth (*Lophocampa maculata*) 16, 17, **2**

springtails (Collembola) 89
common (*Tomocerus vulgaris*) 89
snow flea (*Hypogastrura nivicola*) 89

square-headed wasp (*Crossocerus* sp.) 69, **27**

stable fly (*Stomoxys calcitrans*) . 49, 50

stag beetles (Lucanidae) 47, **20**

Staphylinidae 27, **10**

Stegobium paniceum 36, 37, **14**

Steremnius tuberosus 45

Stethorus punctum 33, **12**

Stigmus sp. 69

stink bug (*Banasa dimidiata*) 82, **30**

stink bug (*Elasmostethus cruciatus*) 82, **30**

Stomoxys calcitrans 49, 50

stoneflies (Plecoptera) 59

strawberry root weevil (*Brachyrhinus (Otiorhynchus) ovatus*) ... 43, 45, **19**

subterranean termite (*Reticulitermes hesperus*) 100

Supella longipalpa 95, 96, **32**

sweat bees (Halictidae) 61–62
hairy-tongued bee (*Lasioglossum* sp.) 62, **25**
halictid bee (*Agapostemon* sp.) ... 62
halictid bee (*Sphecodes* sp.) . 62, **25**

Symphoromyia sp. 54, **23**

Syneta albida 43, **18**

Syrphidae 51

Syrphus arcuatus 55, **22**

Tabinidae 53, **22**

Tabanus sp. 53, **22**

tachinid flies (Tachinidae) 51, **22**

Tachinidae 51, **22**

Tachyporus chrysomelinus 28

Tapinoma sessile 79, 81

10-lined June beetles (*Polyphylla decemlineata*) 48, **21**

Tenebrionidae 37–38, **15**

tent caterpillars (Lasiocampidae) 17–18
lappet moth (*Phyllodesma americana*) 18
Tolype distincta 18
western (*Malacosoma californicum*) 17, **3**

Tenthredinidae 70–72, **28**

Tephritidae 54–55, **23**

termites (Isoptera) 100
dampwood (*Zootermopsis angusticollis*) 100, **33**
subterranean (*Reticulitermes hesperus*) 100

Tetramorium caespitum 79, 81

Tetrigidae 93, **31**

Tettigoniidae.....94, **32**

thimbleberry-stem gall wasp (*Diastrophus kincaidii*).....73, **28**

thread-waisted wasps (Sphecidae).64–69
Crabro latipes 69, **27**
Diodontus boharti 69, **27**
Diodontus minutus..... 67, 69
Ectemnius sp. 68, 69
mud-dauber wasp (*Sceliphron caementarium*) 65–66, 69, **27**
Oxybelus sp. 68, 69, **27**
Passaloecus cuspidatus.....69, **27**
Pemphredon sp. 69, **27**
Prionyx sp. 64–65, 69
Pulverro eighmei..... 68, 69
Pulverro monticola 68, 69, **27**
Rhopalum clavipes 69, **27**
sand wasp (*Bembix americana*) ..66, 69
square-headed wasp (*Crossocerus* sp.).....69, **27**
Stigmus sp. 69
Trypoxylon sp. 69, **27**

thrips (Thysanoptera) 90
gladiolus (*Thrips simplex*) 90
onion (*Thrips tabaci*) 90, **30**

Thrips simplex 90

Thrips tabaci.....90, **30**

Thyatiridae 20

thyatirids (Thyatiridae).....20
Hybrosyne scripta 20, **5**

Thysanoptera.....90, **30**

Thysanura 91, **31**

tickseed-leaf beetle (*Calligrapha californica*).....42, **18**

tiger beetles (Cicindelidae) 26
Omus dejeani.....26, **9**

tiger moths..... 14–16
silver-spotted (*Lophocampa argentata*) 16–17, **2**
spotted tussock moth (*Lophocampa maculata*) 16, 17, **2**

Tineidae.....22

Tineola bisselliella.....22

Tipula paludosa 55, 56

Tipulidae 55–56, **24**

Tolype distincta.....18

Tomocerus vulgaris.....89

Tortricidae 22–23, **7**

Trilobium destructor 38, **15**

Trichoplusia ni 20

Trichoptera 59, **25**

Triphleps tristicolor..... 82

Triphosa haesitata..... 19, **4**

Trixagus sereceus 38

Trogoderma inclusum 35

true bugs (Hemiptera) 82
damsel bug (*Nabis americoferus*). 82
milkweed bug (*Lygaeus reclivatus*) 82, **30**
minute pirate bug (*Triphleps tristicolor*) 82
stink bug (*Banasa dimidiata*). 82, **30**
stink bug (*Elasmostethus cruciatus*) 82, **30**

Trypoxylon sp..... 69, **27**

tuber flea beetle (*Epitrix tuberis*)42, **18**

tussock moths (Lymantriidae)..... 17
rusty (*Orgyia antiqua*)..... 17, **3**

20-spotted lady beetle (*Psyllobora vigintimaculata*) 33, **12**

twig weevil (*Pissodes* sp.) 45, **19**

two-spotted lady beetle (*Adalia bipunctata*) 32

two-striped grasshopper (*Melanoplus bivittatus*) 93, **31**

Ulochaetes leoninus..... 41, **17**

Urocerus californicus 72

varied carpet beetle (*Anthrenus verbasci*).....34, 35, **13**

Vespidae..... 76–78, **29**

Vespula pennsylvanica..... 76, 77, 78

Vespula vulgaris 76–78, **29**

Virginia tiger moth .....*See* woollybear, yellow

Vrilleta decorata 37

walnut husk fly (*Rhagoletis completa*) 55

warehouse beetle (*Trogoderma inclusum*).....34–35

wasps 64–78
cuckoo (Chrysididae) 70, **28**

gall (Cynipiadae) 72–73, **28**
ichneumon (Ichneumonidae) 74–76, **28**
parasitic (Chalcidae, Braconidae, and Others) 73–74
sawflies (Tenthredinidae) .70–72, **28**
spider (Pompilidae) 70
thread-waisted (Sphecidae) . 64–69, **27**
yellowjackets (Vespidae) .76–78, **29**

water scavenger beetles (Hydrophilidae) 37
compost beetle (*Sphaeridium bipustulatum*).....37, **14**

webbing clothes moth (*Tineola bisselliella*) 22

weevils (Curculionidae) 43–45
black vine (*Brachyrhinus (Otiorhynchus) sulcatus*) .. 43, 45, **19**
Ceutorhynchus sp. 45, **19**
clay-clored (*Brachyrhinus (Otiorhynchus) singularis*) 45
flea (*Rhynchaenus salicis*) 45, **19**
granary (*Sitophilus granarius*) ...44–45, **19**
Gymnaetron tetron 45, **19**
pea-leaf (*Sitona lineatus*).....45
rice (*Sitophilus oryza*) 44–45
rough strawberry root (*Brachyrhinus (Otiorhynchus) rugiostriatus*)..43, 45, **19**
Steremnius tuberosus 45, **19**
strawberry root *Brachyrhinus (Otiorhynchus) ovatus*).... 43, 44, 45, **19**
twig (*Pissodes* sp.).....45, **19**

western ash borer (*Neoclytus conjunctus*) 41, **17**

western bean cutwork (*Loxagrotis albicosta*) 19, 20

western blood-red lady beetle (*Cycloneda polita*) 31, 32, **12**

western cedar bark beetle (*Phloeosinus punctatus*).....47, **20**

western firefly (*Ellychnia* sp.) ... 28, 29, **11**

western fruit beetle (*Syneta albida*) 43, **18**

western grape rootworm (*Bromius obscurus*) 42

western hemlock wood stainer (*Gnathotrichus sulcatus*).....47, **20**

western lyctus beetle (*Lyctus cavicollis*) 37, **14**

western potatoe flea beetle (*Epitrix subcrinita*) 42, **18**

western tent caterpillar (*Malacosoma californicum*) 17, 18, **3**

western yellowjacket (*Vespula pennsylvanica*)..... 76, 77, 78

whirligig beetles (Gyrinidae) 26–27
Gyrinus sp. 27, **8**

white butterflies (Pieridae) 12–13, **1**

white-marked spider beetle (*Ptinus fur*) 35, **13**

white-spotted sawyer (*Monochamus scutellatus*) 40, 41, **17**

willow-leaf gall sawfly (*Pontania pacifica*)..... 72

woods roach (*Parcoblatta americana*) 95, 96

woollybears.....14–17
banded (*Pyrrharctia isabella*) 14, 15, 17, **2**
yellow (*Spilosoma virginica*) .14, 15, 17, **2**

Xyleborus dispar.....46, 47, **20**

yellow woollybear (*Spilosoma virginica*) 14, 15, 17, **2**

yellow-faced bees (Colletidae) 63
Hylaeus sp. 63, **26**

yellowjackets (Vespidae).....76–78
aerial (*Dolichovespula arenaria*) . 78, **29**
bald-faced hornet (*Dolichovespula maculata*).....76, 78, **29**
common (*Vespula vulgaris*) ..76, 78, **29**
paper wasp (*Polistes*sp.) 78
potter wasp (*Ancistrocerus* sp.) .. 78, **29**
western (*Vespula pennsylvanica*) . 78

Yponomeuta mallinellus 22, 23, **7**

Yponomeutidae.....22, 23, **7**

Zootermopsis angusticollis 100, **33**

Insects of Skagit County

PhotoPages

This page intentionally left blank

Whites (Pieridae)

Pieris rapae
Imported Cabbageworm
Wingspan 1¾ inches

Woollybears, Tiger Moths, and Fall Webworm (Arctiidae)

Hyphantria cunea
Fall Webworm
Wingspan ¾ inch

Hyphantria cunea
Fall Webworm, larva
(photo from WSU EB 0827)

Lophocampa argentata
Silver-Spotted Tiger Moth
Wingspan 2 inches

Lophocampa argentata
Silver-Spotted Tiger Moth, larva

Woollybears, Tiger Moths, and Fall Webworm (Arctiidae)

Lophocampa maculata
Spotted Tussock Moth
Wingspan 2 inches

Lophocampa maculata
Spotted Tussock Moth, larva

Pyrrharctia isabella
Banded Woollybear or Isabella Tiger Moth
Wingspan 2 inches

Pyrrharctia isabella
Banded Woollybear, larva

Spilosoma virginica
Yellow Woollybear or Virginia Tiger Moth
Wingspan 2 inches

Spilosoma virginica
Yellow Woollybear, larva

Tussock Moths (Lymantriidae)

Orgyia antiqua
Rusty Tussock Moth
Wingspan 1 inch

Orgyia antiqua
Rusty Tussock Moth, larva

Tent Caterpillars (Lasiocampidae)

Malacosoma californicum
Western Tent Caterpillar, male
Wingspan 1½ inches

Malacosoma californicum
Western Tent Caterpillar, larva
(photo from www.for.gov.bc.ca)

Inchworms and Loopers (Geometridae)

Euchlaena tigrinaria
Wingspan 1½ inches

Euchlaena tigrinaria, larva

Inchworms and Loopers (Geometridae)

Hydria undulata
Wingspan 1½ inches

Nemoria darwiniata
Wingspan 1¼ inches

Pero mizon
Wingspan 1¼ inches

Pero mizon, larva

Triphosa haesitata
Wingspan 1¼ inches

Triphosa haesitata, larva

Cutworms (Noctuidae)

Behrensia conchiformis
Wingspan 1¼ inches

Catocala aholibah
Aholibah Underwing Moth
Wingspan 2½ inches

Egira rubrica
Wingspan 1¼ inches

Feralia comstocki
Wingspan 1¼ inches

Prominents (Notodontidae)

Clostera apicaulus
Wingspan 1¼ inches

Thyatirids (Thyatiridae)

Habrosyne scripta
Wingspan 1½ inches

Hooktip Moths (Drepanidae)

Drepana arcuata, Wingspan 1½ inches

Giant Silk Moths (Saturniidae)

Antheraea polyphemus, Polyphemus Moth
Wingspan 4 inches

Sphinx Moths (Sphingidae)

Smerinthus cerisyi, Cerisy's Sphinx Moth
Wingspan 2¾ inches

Smerinthus cerisyi
Cerisy's Sphinx Moth, larva

Leafroller Moths (Tortricidae)

Choristoneura rosaceana
Oblique Banded Leafroller
Wingspan ⅝ inch

Choristoneura rosaceana
Oblique Banded Leafroller, larva
(photo from OREC EB 1263)

Cydia pomonella, Codling Moth
Wingspan ½ inch
(photo from WSU EB 1073)

Cydia pomonella
Codling Moth, larva
(photo from WSU EB 1073)

Snout Moths (Pyralidae)

Plodia interpunctella
Indian Meal Moth
Wingspan ½ inch
(photo from WSU EB 1396)

Plodia interpunctella
Indian Meal Moth, larva
(photo from WSU EB 1396)

Ermine Moths (Yponomeutidae)

Yponomeuta mallinellus
Apple Ermine Moth
Wingspan ½ inch
(photo from WSU EB 1526)

Yponomeuta mallinellus
Apple Ermine Moth, larva
(photo from WSU EB 1526)

Ground Beetles (Carabidae)

Carabus granulatus
Length ¾ inch

Cychrus tuberculatus
Length ¾ inch

Harpalus aeneus
Length ⅜ inch

Ground Beetle, larva
(photo from WSU EB 1447)

Pararguter lustrans
Length $^{5}/_{16}$ inch

Pterostichus vulgaris
Length ½ inch

Scaphinotus marginatus
Length ¾ inch

Tiger Beetles (Cicindelidae)

Omus dejeani
Length ¾ inch

Whirligig Beetles (Gyrinidae)

Gyrinus sp.
Length $^{3}/_{16}$ inch

Predaceous Diving Beetles (Dytiscidae)

Colymbetes exaratus
Length ⅝ inch

Dytiscus hatchi, female
Length ⅞ inch

Dytiscus hatchi, male
Length ⅞ inch

Carrion Beetles (Silphidae)

Necrophilus hydrophiloides
Length ⅜ inch

Necrophorus vespilloides
Length ½ inch

Rove Beetles (Staphylinidae)

Deleaster concolor
Length ½ inch

Micropeplus brunneus
Length ⅛ inch

Pseudohaida rothi
Length $^{3}/_{16}$ inch

Pelecomalium testaceum, female
Length $^{3}/_{16}$ inch

Feather-Wing Beetles (Ptiliidae)

Acrotrichis castanea
Length $^{1}/_{32}$ inch

Net-Winged Beetles (Lycidae)

Dictyopterus simplicipes
Length ⅜ inch

Fireflies (Lampyridae)

Ellychnia hatchi
Length ⅜ inch

Soldier Beetles (Cantharidae)

Podabrus cavicollis
The "White-Footed" Soldier Beetle! (see text)
Length ¼ inch

Podabrus pruinosus
Length ½ inch

Podabrus sp.
Length ¼ inch

Checkered Beetles (Cleridae)

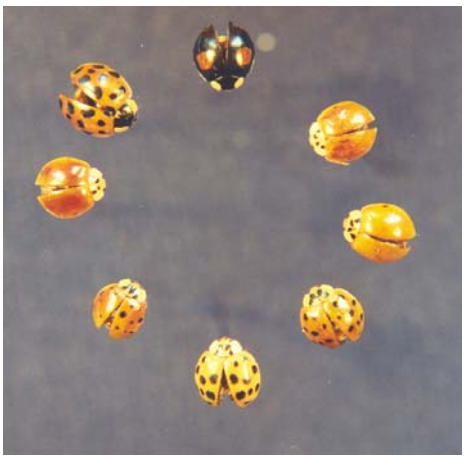
Enoclerus sphegius
Red-Bellied Clerid
Length ⅜ inch

Lady Beetles (Coccinellidae)

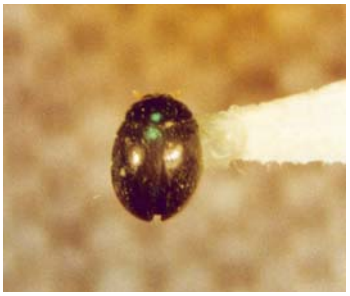
Coccinella septempunctata
Seven-Spotted Lady Beetle
Length ¼ inch

Cycloneda polita
Western Blood-Red Lady Beetle
Length $^{3}/_{16}$ inch

Psyllobora vigintimaculata
20-Spotted Lady Beetle
Length ⅛ inch



Harmonia axyridis
Multicolored Asian Lady Beetle
Length ¼ inch



Stethorus punctum
Spider Mite Destroyer
Length $^{1}/_{16}$ inch

Lady Beetle, larva

Lady Beetle, pupa

Flat Bark Beetles (Cucujidae)

Cucujus clavipes
Red Flat Bark Beetle
Length ½ inch

Dendrophagus glaber
Length ¼ inch

Oryzaephilus surinamensis
Saw-Toothed Grain Beetle
Length ⅛ inch

Carpet or Skin Beetles (Dermestidae)

Anthrenus verbasci
Varied Carpet Beetle
Length ⅛ inch

Dermestes lardarius
Larder or Bacon Beetle
Length $^{5}/_{16}$ inch

Dermestid, larva
Length $^{3}/_{16}$ inch

Spider Beetles (Ptinidae)

Ptinus clavipes
Brown Spider Beetle
Length $^{3}/_{16}$ inch

Ptinus fur
White-Marked Spider Beetle
Length $^{3}/_{16}$ inch

Furniture Beetles (Anobiidae)

Hemicoelus gibbicollis
Anobiid Beetle
Length ⅛ inch

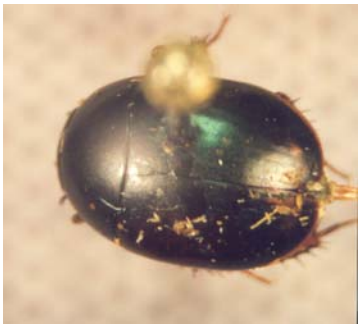
Stegobium paniceum
Drugstore or Bread Beetle
Length ⅛ inch

Powderpost Beetles (Lyctidae)

Lyctus brunneus
Brown Powderpost Beetle
Length $^{3}/_{16}$ inch

Lyctus cavicollis
Western Lyctus Beetle
Length $^{3}/_{16}$ inch

Water Scavenger Beetles (Hydrophilidae)



Sphaeridium bipustulatum
Compost Beetle
Length ⅜ inch

Fire-Colored Beetles (Pyrochroidae)

Dendroides ephemeroides
Length ½ inch

Darkling Beetles (Tenebrionidae)

Phellopsis porcata
Length ⅛ inch

Tribolium destructor
Length ⅛ inch

Click Beetles (Elateridae)

Ampedus behrensi
Length $^{7}/_{16}$ inch

Athous vittiger
Length ⅜ inch

Dalopius sp.
Length ¼ inch

Hemicrepidius pallidipennis
Length $^{5}/_{16}$ inch

Limonius crotchi
Length ½ inch

Megapenthes caprella
Length ¼ inch

Metallic Wood or Flat-Headed Borers (Buprestidae)

Buprestis aurulenta
Golden Buprestid
Length ⅝ inch

Buprestis laeviventris
Length ¾ inch

Long-Horned Beetles and Round-Headed Borers (Cerambycidae)

Anoplodera crassipes
Length ⅜ inch

Anoplodera dolorosa
Length ⅜ inch

Desmocerus auripennis
Golden-Winged Elder Borer
Length ⅝ inch

Ergates spiculatus
Length 2 inches

Long-Horned Beetles and Round-Headed Borers (Cerambycidae)

Leptura obliterata
Length ⅝ inch

Monochamus scutellatus
White-Spotted Sawyer
Length ⅞ inch

Neoclytus conjunctus
Western Ash Borer
Length ½ inch

Pachyta armata
Length ⅝ inch

Pidonia scripta
Length $^{5}/_{16}$ inch

Plectrura spinicauda
Length ⅝ inch

Rhagium inquisitor
Ribbed Pine Borer
Length ⅝ inch

Rosalia funebris
Banded Alder Borer
Length 1⅛ inch

Ulochaetes leoninus
Lion Beetle
Length ⅝ inch

Leaf Beetles (Chrysomelidae)

Altica ambiens
Alder Flea Beetle
Length $^{3}/_{16}$ inch

Calligrapha californica
Tickseed-Leaf Beetle
Length ¼ inch

Chrysolina quadrigemina
Klamath Weed Beetle
Length $^{3}/_{16}$ inch

Crioceris asparagi
Asparagus Beetle
Length $^{3}/_{16}$ inch

Epitrix subcrinita
Western Potato
Flea Beetle
Length $^{1}/_{16}$ inch

Epitrix tuberis
Tuber Flea Beetle
Length $^{1}/_{16}$ inch

Metriona bicolor
Golden Tortoise
Beetle
Length $^{3}/_{16}$ inch

Syneta albida
Western Fruit Beetle
Length $^{3}/_{16}$ inch

Weevils or Snout Beetles (Curculionidae)

Root Weevil
Length ⅜ inch
(photo from WSU EB 0970E)

Root Weevil, larva
(photo from WSU EB 0970E)

Brachyrhinus ovatus
Strawberry Root Weevil
Length $^{3}/_{16}$ inch

Brachyrhinus rugostriatus
Rough Strawberry Root Weevil
Length $^{5}/_{16}$ inch

Brachyrhinus sulcatus
Black Vine Weevil
Length ⅜ inch

Ceutorhynchus sp.
Length ⅛ inch

Gymnaetron tetrum
Length ⅛ inch

Pissodes sp.
Length ⅛ inch

Rhynchaenus salicis
Flea Weevil
Length $^{3}/_{16}$ inch

Sitophilus granarius
Granary Weevil
Length ⅛ inch

Bark and Ambrosia Beetles (Scolytidae)

Alniphagus aspericollis
Alder Bark Beetle
Length ⅛ inch

Dendroctonus pseudotsugae
Douglas Fir Bark Beetle
Length ¾ inch

Dryocoetes autographus
Length ⅛ inch

Gnathotrichus sulcatus
Western Hemlock Wood Stainer
Length ⅛ inch

Phloeosinus punctatus
Western Cedar Bark Beetle
Length $^{3}/_{16}$ inch

Phloeosinus scopulorum
Rocky Mountain Juniper Bark Beetle
Length ⅛ inch

Xyleborus dispar
European Shot-Hole Borer
Length ⅛ inch

Stag Beetles (Lucanidae)

Sinodendron rugosum
Length ½ inch

Scarab Beetles (Scarabaeidae)

Aphodius pardalis
Length $^{3}/_{16}$ inch

Aphodius sp.
Length ¼ inch

Polyphylla decem-lineata
10-Lined June Beetle
Length 1⅛ inch

House Flies (Muscidae)

Fannia canalicularis
Little House Fly
Length ¼ inch

Haematobia irritans
Horn Fly
Length $^{3}/_{16}$ inch

Musca domestica
Common House Fly
Length ¼ inch

Pollenia rudis
Cluster Fly
Length ⅜ inch

Bottle or Blow Flies (Calliphoridae)

Phaenicia sp.
Blow Fly
Length ½ inch

Tachinid Flies (Tachinidae)

Here is the fly with the brown pupa shell from which it emerged and the cocoon of the caterpillar it parasitized.

Tachinid Fly
Length ⅜ inch

Hover Flies (Syrphidae)

Syrphus arcuatus
Length ½ inch

Hover Fly, larva
(photo from WSU PNW 150)

Horse and Deer Flies (Tabanidae)

Chrysops sp.
Deer Fly
Length ⅜ inch

Tabanus sp.
Horse Fly
Length ¾ inch

Snipe Flies (Rhagionidae)

Rhagio costatus
Length ½ inch

Symphoromyia sp.
Length ⅜ inch

Black Flies (Simuliidae)

Prosimulum sp.
Black Fly
Length ⅛ inch

Bot Flies (Oestridae)

Cuterebra sp.
Bot Fly
Length ⅝ inch

Fruit Flies (Tephritidae)

Rhagoletis pomonella
Apple Maggot
Length ⅛ inch

Rhagoletis pomonella
Apple Maggot, larva
(photo WSU EB 1928)

Crane Flies (Tipulidae)

A Common Crane Fly
Wingspan 1¾ inches

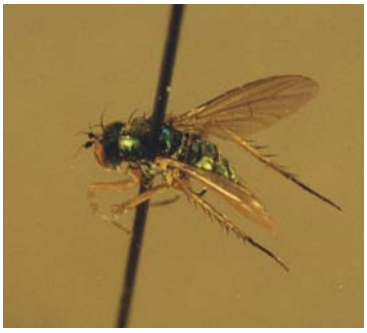
Bittacomorpha occidentalis
Phantom Crane Fly
Wingspan 1 inch

March Flies (Bibionidae)

Bibio nervosus, male
Length ⅜–½ inch

Bibio nervosus, female
Length ⅜–½ inch

Long-Legged Flies (Dolichopodidae)



Dolichopus sp., male
Length ¼ inch

Louse Flies (Hippoboscidae)

Lipoptena depressa
Length ⅛ inch

Dung Flies (Scatophagidae)

Dung Fly
Length ⅜ inch

Fungus Gnats (Sciaridae)

Dark-Winged Fungus Gnat
Length ¼ inch

Dragonflies (Odonata)

Aeshna multicolor
Blue-Eyed Darner
Wingspan 4 inches

Caddisflies (Trichoptera)

Caddisfly
Wingspan 1 inch

Bumblebees and Honeybees (Apidae)

Apis nellifera
Honeybee
Length ⅜ inch

Bombus vosnesenskii
Bumblebee
Length ⅝ inch

Sweat Bees (Halictidae)

Lasioglossum sp.
Hairy-Tongued Bee
Length ½ inch

Sphecodes sp
Halictid Bee, female
Length ⅜ inch

Acute-Tongued Burrowing Bees (Andrenidae)

Andrena sp.
Acute-Tongued Burrowing Bee
Length ½ inch

Yellow-Faced Bees (Colletidae)

Hylaeus sp.
Yellow-Faced Bee, female
Length ¼ inch

Hylaeus sp.
Yellow-Faced Bee, male
Length ¼ inch

Digger Bees (Anthophoridae)

Nomada sp., male
Length ⅜ inch

Nomada sp., female
Length ⅜ inch

Leafcutter Bees (Megachilidae)

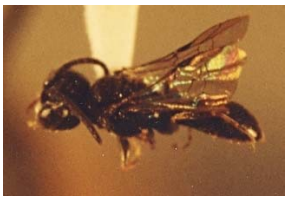
Osmia sp.
Orchard Mason Bee
Length ⅜ inch

Thread-Waisted Wasps (Sphecidae)

Crabro latipes,
male
Length ½ inch

Crabro latipes,
female
Length ½ inch

Crossocerus sp.
Square-Headed
Wasp



Diodontus boharti
Length $^{3}/_{16}$ inch

Oxybelus sp.
Length 1/4 inch

Passaloecus cuspidatus,
female
Length $^{5}/_{16}$ inch

Pemphredon sp.
Length ⅜ inch

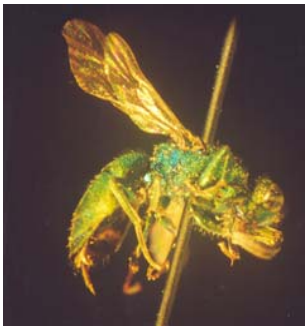
Pulverro monticola, male
Length ¼ inch

Rhopalum clavipes
Length ⅜ inch

Sceliphron caementarium
Mud-Dauber Wasp, on nest
Length ¾ inch

Trypoxylon sp.
Length ⅜ inch

Cuckoo Wasps (Chrysididae)



Omaulus aeneus
Length $^{3}/_{16}$ inch

Sawflies (Tenthredinidae)

Sawfly
Length ½ inch

Caliroa cerasi
Pear Slug, adult
Length ⅜ inch
(photo WSU EB 1369)

Caliroa cerasi
Pear Slug, larva
length 3/8 inch
(photo WSU EB 1369)

Gall Wasps (Cynipidae)

Diastrophus kincaidii
Thimbleberry-Stem
Gall Wasp, female
Length ⅛ inch

Diastrophus kincaidii
Thimbleberry-Stem
Gall Wasp, male
Length ⅛ inch

Ichneumon Wasps (Ichneumonidae)

Ichneumon Wasp
Length ⅝ inch

Yellowjackets and Wasps with Folded Wings (Vespidae)

Ancistrocerus sp.
Potter Wasp
Length ½ inch

Dolichovespula arenaria
Aerial Yellowjacket
Length ½ inch

Dolichovespula maculata
Bald-Faced Hornet
Length ½ inch

Vespula vulgaris
Common Yellowjacket
Length ½ inch

Ants (Formicidae)

Camponotus sp.
Carpenter Ants
Winged female,
½ inch long
Winged male,
⅜ inch long
Workers,
⅜–½ inch long
(photo WSU EB 0818)

Formica sp.
Red Ant
Length ⅜ inch

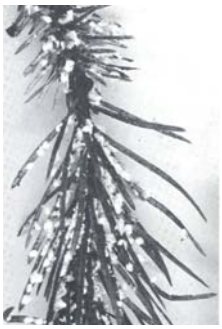
True Bugs (Hemiptera)

Banasa dimidiata
Stink Bug
Length ½ inch

Elasmostethus cruciatus
Stink Bug
Length ½ inch

Lygaeus reclivatus
Milkweed Bug
Length ⅜ inch

Adelgids (Aldelgidae)



Adelges cooleyi
Cooley Spruce Gall Adelgid on Douglas Fir
Length ⅛ inch

Scales (Coccidae)

Coccus hesperidum
Brown Soft Scale, Size ⅛ inch
(photo WSU EB 1552E)

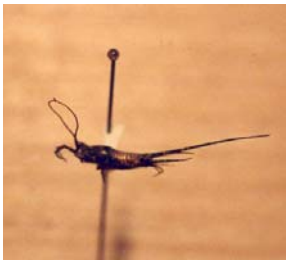
Thrips (Thysanoptera)

Thrips tabaci
Onion Thrips, adult
Length $^{1}/_{16}$ inch
(photo WSU EB 1576)

Thrips
Length $^{1}/_{16}$ inch

Silverfish and Bristletails (Thysanura)

Lepisma saccharina
Silverfish
Length ½ inch



Microcoryphia
Bristletail
Length ½ inch

Lacewings (Neuroptera)

Chrysopa sp.
Green Lacewing, adult
Length ¾ inch
(photo WSU PNW 0343)

Chrysopa sp.
Green Lacewing, larva
(photo WSU PNW 0343)

Hemerobius sp.
Brown Lacewing
Length ⅜ inch

Grasshoppers (Acrididae and Tetrigidae)

Arphia sp.
Orange-Winged
Grasshopper
Length 1½ inches

Melanoplus bivittatus
Two-Striped Grasshopper
Length 1⅜ inches

Tetrigidae
Pygmy Grasshopper
Length ½ inch

Katydids (Tettigoniidae)

Scudderia furcata
Fork-Tailed Bush Katydid
Length 2 inches

Cockroaches (Blatteria)

Blattella germanica
German Cockroach
Length ½ inch
(photo WSU PNW 0186E)

Periplaneta americana
American Cockroach
Length 1 inch
(photo WSU PNW 0186E)

Supella longipalpa
Brown-Banded Cockroach
Length ½ inch
(photo WSU PNW 0186E)

Earwigs (Dermaptera)

Forficula auricularia
European Earwig,
male with curved
pincers
Length ⅝ inch

Forficula auricularia
European Earwig,
female with straight
pincers
Length ⅝ inch

Bark Lice (Psocoptera)

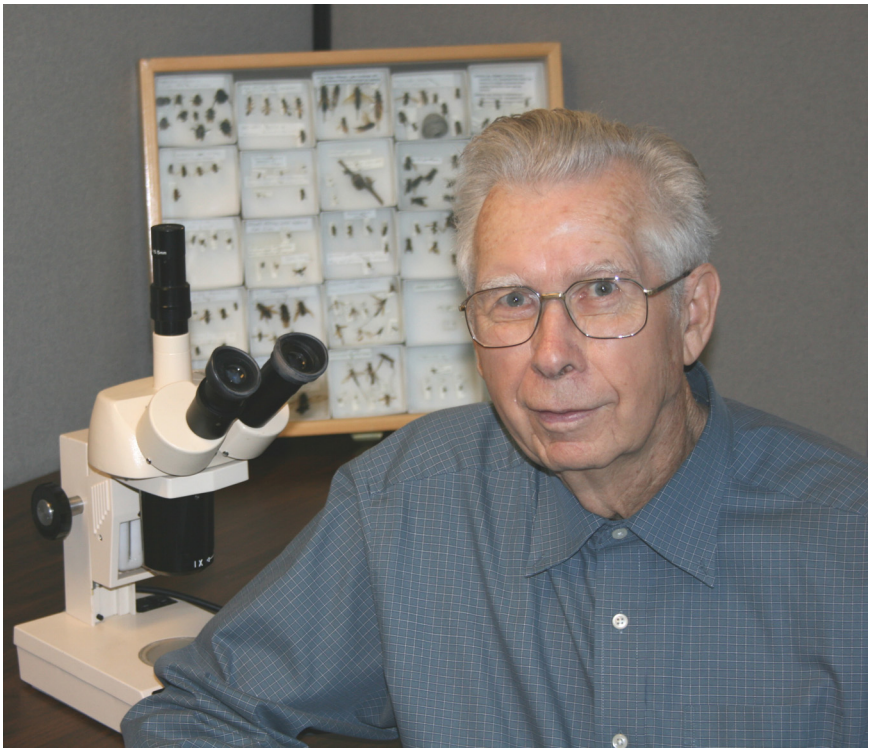
Psocoptera, winged species
Bark Louse, adult
Length ⅛ inch
(photo WSU EB 1397)

Pscocoptera, wingless species
Bark Lice, adults
Length $^{1}/_{16}$ inch
(photo WSU EB 1397)

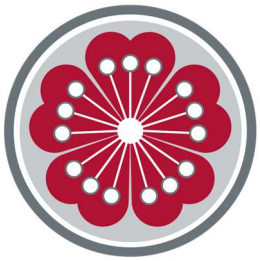
Termites (Isoptera)

Zootermopsis angusticollis, winged reproductive
Dampwood Termite
Length ⅝ inch

About the Author



Lloyd Eighme graduated from Oregon State University with a Ph.D. in entomology in 1965. For 30 years, he taught biology at Pacific Union College in Northern California, offering various courses in entomology, including field methods, a course in which he and his students developed an extensive research collection of insects from the mountains of Northern California. He discovered and named three new species of wasps from those collections. He also taught courses in medical entomology and insect pest control. He is a retired registered professional entomologist with the Entomological Society of America, a society he has belonged to for 40 years. Lloyd has published articles about his research, including a revision of the genus *Diodontus* in North America. He began studying the insects of Skagit County in 1975, and in 1994 he started assisting Washington State University Skagit County Extension Master Gardeners with insect identification.



To obtain copies of this publication, contact the WSU Skagit County Extension Master Gardener office (**https://extension.wsu.edu/skagit/mg/** or 360–428–4270), or visit the Skagit County Master Gardener Foundation website at **https://www.skagitmg.org**.