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A LIST OF PLANT-FEEDING LEIDOPTERA INTRODUCED INTO BRITISH COLUMBIA

DAVID R. GILLESPIE AND BETH I. GILLESPIE

Research and Plant Quarantine Station,
 Agriculture Canada, 8801 East Saanich Road,
 Sidney, British Columbia, and 2523 Meadowland Drive,
 Victoria, British Columbia. Respectively

ABSTRACT

Each of 48 species of plant-feeding Lepidoptera known to be foreign to North America and to occur in British Columbia is briefly summarized with its history and importance. Those feeding on stored products are not indicated.

INTRODUCTION

The following are species-based summaries of the history and importance of exotic Lepidoptera in British Columbia. We hope that this paper will stimulate further investigation of some of these species; particularly useful would be information on the adaptation of native parasites and predators to the exotic species as hosts.

The species are treated alphabetically in order of their generic names. Approved North American English common names (Benoit 1975, Sutherland 1978) are included where available. Where no such common names are available, we have used British common names, as in the reference material.

Species of Lepidoptera feeding on stored products are excluded from the list because they are virtually cosmopolitan, often independent of climate and can be regarded as being native to man's stored products, wherever such products occur.

Limitations of time and resources imposed some restrictions on the scope of these summaries. They are not complete bibliographies of each species, but rather brief notes on the history, distribution, host plants and pest status or potential in North America and elsewhere. Standard abbreviations of Canadian provinces and postal abbreviations of the United States (Table 1) are used throughout.

It is noteworthy that in the two successful eradications of introduced Lepidoptera in B.C., entomologists were aware of the presence of the insects before the pests had had a chance to spread from their original entry points. In both cases prompt and perhaps radical action prevented the establishment of breeding populations. It is also noteworthy that 19 of the 48 introduced Lepidoptera are of the family Tortricidae. This disproportionate representation might indicate an, as yet unknown, biological feature predisposing the Tortricidae to being imported, or to establishing once imported.

The criteria used here to include species in the list were rather strict. Only those species are included for which definite records were located, giving exotic origin and date of entry or first capture. There are probably many introduced species of Lepidoptera not included here for which no such records exist.

TABLE 1. Abbreviations of Provinces and States used in text.

CANADA	
Place	Abbreviation
Alberta	Alta.
British Columbia	B.C.
Manitoba	Man.
New Brunswick	N.B.
Newfoundland	Nfld.
North West Territories	N.W.T.
Nova Scotia	N.S.
Ontario	Ont.
Prince Edward Island	P.E.I.
Quebec	Que.
Saskatchewan	Sask.
Yukon	Yuk.
UNITED STATES	
Arizona	AZ
California	CA
Connecticut	CT
District of Columbia	DC
Idaho	ID
Maine	ME
Maryland	MD
Massachusetts	MA
Michigan	MI
Montana	MT
New Jersey	NJ
New York	NY
Ohio	OH
Oregon	OR
Pennsylvania	PA

Virginia
Washington

VA
WA

Acleris comariana (Zeller), Tortricidae, a strawberry leafroller.

First reported in North America in 1972 as a pest of strawberry in Richmond, B.C. (Cram 1973). It has now been recorded on strawberry, raspberry, blackberry and *Spiraea* in the Lower Fraser Valley of B.C. (Gillespie 1981). It has not been recorded from elsewhere in North America.

It is found in Europe, China, and Japan, and is apparently native to Europe (Bradley *et al.* 1973). It is a minor pest of strawberry in England (Alford 1975, 1976; Vernon 1971; Petherbridge 1920) and Hungary (Balazs & Bodor 1969). *Potentilla palustris* (L.), the marsh cinquefoil, is the main wild host plant in England (Vernon 1971).

Acleris variegana (Denis & Schiffermuller), Tortricidae

First recorded in North America from a single specimen collected at Victoria, B.C. in 1920 (Blackmore 1923). Forbes (1923) recorded specimens from NY. In 1980 and 1981 it was noted on blueberry in the Lower Fraser Valley, B.C. (Gillespie 1981). In western North America it now occurs in B.C., WA, OR and CA (Powell 1964). Food plants in North America are species of *Rosa*, *Prunus*, *Malus*, *Crataegus* and *Vaccinium* (Powell 1964).

Distribution abroad is Europe, North-west Africa, Asia Minor, Central Asia and China (Razowski 1966). Apparently a relatively common and polyphagous species in Europe (Bradley *et al.* 1973).

Aethes rutilana (Hubner), Phaloniiidae, pale juniper webworm.

First recorded in eastern U.S. in 1878 (Baker 1972). Recorded at Field, B.C. sometime before 1965 (Prentice *et al.* 1965). It has been observed feeding on junipers and other ornamental shrubs in the Lower Fraser Valley and on Vancouver Island, B.C. Elsewhere in North America it has been recorded from N.S. to Alta. and in the northeastern U.S., and OH (Freeman 1967; Baker 1972) feeding on juniper especially *Juniperus communis*. It is a Palaearctic species (Bradley *et al.* 1973) recorded as feeding on juniper in the Old World.

Amphipyra tragopinus L., Noctuidae, the mouse.

A possible "introduced insect" according to Maw (1976) who gives its range in North America as Canada and southern PA. Apparently the only record of this species in B.C. is on apricot, plum and rose about 1938, probably in the Fraser Valley (Llewellyn-Jones 1938). It has been recorded from alfalfa in NY (Wheeler 1978) and tobacco in N.S. (Specht 1972).

A Palaearctic species (Maw 1976), reported as a minor pest of strawberry in Europe (Alford 1974) and berry crops in the USSR (Musich 1976).

Anarsia lineatella Zeller, Gelechiidae, the peach twig borer.

First observed as a pest in NY in 1872 by Glover (1874) but described 12 years earlier by Clemens (Linter 1882). It is found in the U.S. wherever peaches are grown (Jones 1935). It has been known as a pest in B.C. since 1908 where it feeds on tender shoots and fruit of peaches, apricots, plum and prune (Madsen & Arrand 1975). It is also found in Ont. (Dustan & Davidson 1973) but as of 1933 it had not been reported as being commercially important there (Ross & Putman 1933), and no recent references were found relating to its status there.

It was probably a native of Asia, the original home of peaches. (Ruhman 1928) but is now found in temperate zones of most continents being particularly well established in the Mediterranean (Talhok 1977). It is a serious pest of peach and apricot fruits (Talhok 1977; Frilli 1977) and a minor pest of almond and plum (Talhok 1977).

Aniatus plagiata (L.), Geometridae.

Deliberately introduced into the Kettle Valley, B.C. in 1967 as a biological control agent against the weed *Hypericum perforatum* L. (St. Johnswort or Klamath weed) (Harris *et al.* 1969). It was not recovered in 1968 (Harris & Peschken 1971) or subsequently.

It is native to Western and Central Europe feeding on *Hypericum* spp. (Johansson 1962).

Archips podana (Scopoli), Tortricidae.

First recorded in North America in 1937 from Vancouver, B.C. and Sycamore, Ont. (Freeman 1958). It was reported feeding on *Amelanchier* sp. at Vancouver (MacNay 1954). It is not of pest significance in the Lower Fraser Valley: Doganlar and Beirne (1978b) found it to be uncommon on apple.

It is found in Europe, Asia Minor, South Russia, Eastern Siberia to Japan (Bradley *et al.* 1973). Food plants are a wide range of deciduous trees and shrubs, and occasionally conifers (Bradley *et al.* 1973). In Europe it is common in fruit orchards and is a pest of apple (Bradley *et al.* 1973; Boness 1976; Krakowlak 1974).

Archips rosanus (L.), Tortricidae, the European leafroller.

Present in eastern U.S. by 1890 (Cornstock & Slingerland 1890). First found in Canada in 1919 simultaneously in Victoria, B.C. (Blackmore 1921) and N.S. (Gibson 1924). Found in Vancouver in 1923 (Treherne 1923). Common on apple (Doganlar and Beirne 1978b), blueberry and raspberry (Gillespie 1981) in the Lower Fraser Valley and in the Okanagan Valley as a pest on apple (Madsen *et al.* 1977). Its distribution elsewhere in North America is N.B., Ont., CT, NY, NJ, WA, and OR (Freeman 1958; Chapman & Lienk 1971). It has been recorded as a pest of filberts in the U.S. (AliNiaze 1977) and currant in N.S. (Whitehead

1926), and has also been recorded from privet (Chapman & Lienk 1971).

Occurs where deciduous trees and bush fruits are grown in Europe, the principal food plants being apple, pear, hawthorn, currant and privet (Chapman & Lienk 1971). It has been recorded as a pest of currant in the USSR (Markelova 1957) and orchard fruit trees in the USSR (Minder 1959; Markelova 1963), Poland (Krakowlak 1974), Sweden, Finland, Italy, Spain and England (Chapman & Lienk 1971).

Argyresthia conjugella Zeller, Yponomeutiae, apple fruit moth.

First found in North America in B.C. in 1896 (Fletcher 1897), it was abundant on Vancouver Island and in the Lower Fraser Valley by 1906 (Anon). Food plants include apple, cherry, plum, huckleberry, mountain ash and serviceberry (Pierce 1917). It has been recorded from the northeastern U.S. (Baker 1972) but no other records were found for Canada.

It is found in Japan and Europe (Pierce 1917) where it has been reported as a pest of apple, e.g. in Russia (Beleoseł'skaya 1963), Norway (Edland 1965) and Germany (Kruel 1966).

Caloptilia syringella (Faber), Gracillariidae, the lilac leafminer.

First found in North America in Ont. in 1923 (Murdoch 1967). It was found in WA in 1924, Victoria, B.C. in 1927, and in Vancouver, B.C. in 1928 (Murdoch 1967). Murdoch (1967) gives its distribution in North America as Southern Canada except Sask. and Man. and the northern half of the U.S. except for a strip south of Sask. and Man.

It is a pest of lilac, privet and ash in North America (Murdoch 1967), and attacks the same species in Europe (Neacsu & Dragia 1973; Murdoch 1967). Kiziroglu (1976) gives its distribution as the entire Palaearctic region.

Caradrina morpheus Hgn., Noctuidae.

First recorded at New Westminster, B.C. in 1944 (MacNay 1961) it has since been found at Mission and Kamloops, B.C. and Montreal, Que. (MacNay 1961; Sheppard 1959). It was reported from WA in 1966 (Anon 1968). Food plants include low growing plants such as lambsquarter or goose-foot (*Chenopodium album*), knotweed (*Polygonum aviculare*) and dandelion (*Taraxacum officinale*) (Anon 1968).

It is a European species (Anon 1968) recorded feeding on a variety of plants (MacNay 1961).

Cheimophila salicella (Hubner), Oecophoridae, in B.C. known as the blueberry leafroller.

First found in North America on Richmond, B.C. in 1955 (Raine 1966). It has become a pest of blueberry in the Lower Fraser Valley (Raine 1966; Gillespie 1981). It is common on species of *Salix* and *Spiraea* and occurs on *Alnus*, *Betula*, *Acer*, *Prunus*, *Myrica*, *Berberis*, *Cornus*, *Potentilla*, *Ledum*, *Kalmia* and *Rubus* (Raine 1966). It has not been

recorded from elsewhere in North America (Hodges 1974).

It is a Palaearctic species (Meyrick 1927; Hodges 1974) where it has been recorded as a pest of roses (Reichert 1932).

Cnephasia longana (Haworth), Tortricidae, the omnivorous leaf-tier.

First reported in North America in OR in 1929. (Edwards and Mote 1936) and first recorded in B.C. in 1957 as a pest of strawberry in Saanich on Vancouver Island and in the Lower Fraser Valley (Cram & Tonks 1959). It is presently restricted to the West coast of North America including B.C., WA, OR, and CA (Powell 1964). It was not found on strawberry in the Lower Fraser Valley, B.C. in 1979, 1980 or 1981 (Gillespie 1981). Its food plants include strawberry, wheat, iris, clover, (Edwards & Mote 1936) vetch and alfalfa (Rosenstiel *et al.* 1944). The North American populations are extremely polyphagous on low-growing plants (Powell 1964). It has also been reported damaging new growth of Douglas Fir in OR (Furniss & Carolin 1977).

Found in Europe, Asia and North Africa (Bradley *et al.* 1973) where it apparently is not of serious economic concern and has received little notice (Powell 1964). According to Vernon (1971) it is not a pest of strawberry in Europe.

Coleophora fuscadinella (Zeller), Coleophoridae, the birch casebearer.

First observed in North America in ME in 1927 (Salman 1929). It was found in Nfld. in 1953 (Cochran 1974) and is now found throughout the northeastern U.S. and in the Maritimes, Que., and southern Ont. (Baker 1972; Prentice *et al.* 1965). It is a pest of birch (Baker 1972; Raske 1978) but has been recorded from apple, alder and hawthorn (Prentice *et al.* 1965). First recorded in B.C. from the Lower Fraser Valley in the late 1960s (B. Wright, Curator of Zoology, N.S. Museum, 1747 Summer Street, Halifax, Canada, B3H 3A6, pers. comm.). It is common on birch in the Lower Fraser Valley.

It is found throughout Europe and can be a serious defoliator of birch and alder and has been recorded feeding on elms (Coshan 1974).

Coleophora laricella (Hubner), Coleophoridae, the larch casebearer.

First recorded in North America in MA in 1886 (Baker 1972). Collected for the first time in B.C. near Rossland in 1966 (Molnar *et al.* 1966), probably spread from infestations in northern WA, ID and MT (Dawson 1971a). Its present distribution in B.C. is along the international border from Anarchist Summit, east to Roosville and north to the Cranbrook, Lardeau, and Nelson areas (Miller 1976). Elsewhere in Canada it is common from Nfld. westward to southeastern Man. feeding on tamarack and larch (Prentice *et al.* 1965; Rose & Lindquist 1980). It can cause severe defoliation of native and exotic species of larch (Rose & Lindquist 1980).

A native of Europe where it is a pest of larches (Dawson 1971a).

Coleophora serratella (L.), Coleophoridae, cigar casebearer.

Unintentionally imported into Ont. on orchard stock about 1885 (B. Wright, Curator of Zoology, N.S. Museum, 1747 Summer Street, Halifax, Canada, B3H 3A6, pers. comm.). In Canada it has been collected in N.B., N.S. and southeastern Ont. (Prentice *et al.* 1965), where it is common on fruit trees. It is principally a pest of apples in the northern U.S. but food plants also include cherry, hawthorn, plum, quince and pear (Baker 1972). It arrived in B.C. recently, probably in the 1960's (B. Wright, *vide supra*, pers. comm.).

It infests apples and allied plants in Europe (McDunnough 1957) and occasionally causes serious injury to fruit trees in central Europe (Thiem 1943).

Croesia holmiana (L.), Tortricidae.

First recorded in North America from the Lower Fraser Valley, B.C., in 1977, by Doganlar and Beirne (1978a) on unsprayed apple and pear trees. They suggested that it could become a serious pest of apple and other fruit trees in B.C.

The natural range is north and central Europe and Asia Minor (Bradley *et al.* 1973) where it is a minor pest (Evenhuis *et al.* 1973; Miczulski and Koslinska 1976). Food plants in Europe are *Carataequs*, *Rosa*, *Rubus*, *Malus*, *Pyrus*, and *Cydonia* spp. (Bradley *et al.* 1973).

Depressaria pastinacella (Duponchel), Oecophoridae, the parsnip webworm.

First recorded in North America in Ont. in 1869 (Bethune 1869). It was found in the northeast U.S. by 1875 (Glendenning 1944) and N.S. before 1914 (Brittain & Gooderham 1916). First reported from B.C. in 1927 from Victoria (Anon 1927) and in 1929 from Point Grey (Spencer 1929). In 1938 it was a pest of parsnip grown for seed at Armstrong, B.C. (Twinn 1938) and in 1941 was reported as apparent throughout the Lower Fraser Valley (Twinn 1941b; Glendenning 1944). It was distributed in all provinces of Canada (Dustan 1932) and in the U.S. is most common in the northeast and WA but is also found in DC and AZ (Hodges 1974). It is an occasional pest of parsnips and sometimes carrots grown for seed (Dustan 1932) and may feed on seedheads of wild parsnip, water hemlock and possibly celery (Beirne 1971).

It is widely distributed in the Palaearctic region (Brittain & Gooderham 1916). Food plants include parsnip and species of *Angelica* (Hodges 1974). In Europe it feeds on unbelliferous plants (Holland 1968).

Dichomeris marginella (Fabricius), Gelechiidae, the juniper webworm.

First reported from North America near New York in 1910 (Felt 1910). It was first noted from

B.C. near Victoria in 1934 (Andison 1937). In B.C. it is a minor pest of common and ornamental junipers on the southern half of Vancouver Island, and the adjacent mainland, and in the southern interior (Andison 1937; Bauman & Sugden 1969). In North America it is also found in the East and Midwest States (Nordin & Appleby 1969) and southeastern Canada (Bauman and Sugden 1968) including southern Ont. and Que. (Prentice *et al.* 1965). It has been recorded as a serious pest of juniper in eastern North America (Nordin & Appleby 1969).

It is a Palaearctic species found in Europe and Siberia (Staudinger & Rebel 1901) feeding on juniper (Weiss & Lott 1922).

Ditula angustiorana (Haworth), Tortricidae, the small apricot or vine moth.

First reported in North America at Victoria, B.C. in 1924 (Clarke 1930) and later at Niles, CA, in 1932 (Keifer 1933). It has not become generally common in North America, and it is not known if populations still exist in CA (Powell 1964).

It is native of Europe and is distributed through Europe, Asia, and North Africa (Bradley *et al.* 1973). It has been recorded from fruit and hops (Massee 1946), from stored apples (Adkin 1931) and from oak (Matthey 1967) in England.

Epinotia nanana (Treitschke), Tortricidae, green spruce leafminer.

First recorded in North America in MA in 1907 (Kearfoot 1907). Reported in B.C. from a single record on an undetermined date before 1965 (Prentice *et al.* 1965). It is at present found in northeastern U.S. (Rose & Lingquist 1977) and in Ont. and Que. (Baker 1972) on ornamental spruces and in plantations of introduced spruces (Daviault & Ducharme 1966).

It is recorded generally in Western Europe, and is a pest of spruces there (Ehnstrom *et al.* 1974), although trees in forested regions are rarely attacked (Daviault & Ducharme 1966).

Epinotia solandriana (L.), Tortricidae.

The earliest record in North America is from a specimen collected in 1909 in B.C. (Heinrich 1923). It has been recorded from every province across Canada but is most common in Sask., Man. and Ont. (Prentice *et al.* 1965). It has also been reported from WA (Heinrich 1923) and is sometimes abundant in the Northeastern U.S. (Baker 1972). Heavy infestations in Ont. are sporadic and local (Lindquist & MacLeod 1967). Common on red alder on Burnaby Mountain near Vancouver, B.C. in 1979 and 1980. Major food plants in North America are birch, trembling aspen, willow, balsam poplar, alder and yellow birch (MacKay 1962; Prentice *et al.* 1965; Lindquist & MacLeod 1967).

It is widely distributed in Europe on birch and alder (Lindquist & MacLeod 1967) and in Japan on birch (Nakamura 1974).

Etiella zinckenella. (Treitschke), Pyralidae, lima-bean pod borer.

According to Handford (1955) it has been recorded from B.C. although the original record could not be located. There are no subsequent records of this species in B.C. The only other record for Canada is one from Oxbow, Sask. (Heinrich 1956) probably in 1955 (MacNay 1961). According to Pierce (1917) it was in the U.S. by 1917, and was at that time virtually a cosmopolitan pest of peas and beans.

It is widely distributed in the world, found in the tropical, subtropical and warmer regions of the temperate zones of Asia, Europe, Africa, Central and South America and Australia (Heinrich 1956; Naito 1961). It is a pest of peas and beans and feeds on other leguminous plants in these areas (Naito 1961).

Eurhyphara hortulata L. Pyralidae.

First recorded in North America in 1907 (Munroe 1976). It now has a wide range in the northeast, extending from Nfld. to Ont. and southward. First recorded in B.C. in 1977 (Lazorko 1977). Little is known about food plants in North America but potential host plants cultivated in gardens in B.C. are *Stachys recta*, *Mentha* sp., *Calystegia sepium* and *Ribes* sp. (Lazorko 1977).

It is native to Europe and temperate east Asia (Lazorko 1977). European food plants include nettle (*Urtica dioica*), white horehound (*Marrubium vulgare*), woundwort (*Stachys* sp.), mint (*Mentha* sp.) currant (*Ribes* sp.) and other plants (Munroe 1976).

Eutromula [Hemerophila] pariana (Clerck), Glyptopterygidae, apple-and-thorn skeletonizer.

First noted in North America in NY in 1917 (Felt 1917) as a pest of apple. It subsequently spread to N.S. (Leonard 1923) and was found in Ont. in 1929 (Caesar 1929). Complaints were first recorded in B.C. in 1937 from the Victoria region where it became a pest on unsprayed fruit trees (Twinn 1941a). It was well established on the mainland of B.C. by 1945 (Twinn 1945). It is a pest of the coast and occasionally one in the interior of B.C. on apple (Neilson 1957). Its North American distribution is in the apple growing areas of the northeastern U.S. and southeastern Canada, and in the west from B.C. to OR, ID, and CO (Heppner 1978).

It is a European species (Heppner 1978). It has been reported feeding on apple, pear and *Sorbus* in Finland with severe damage in some year (Ekholm 1958). Also attacking apple and pear in Siberia (Vorzhueva 1958) and doing conspicuous damage to apple in Austria (Bohm 1962).

Grapholitha molesta (Busck), Tortricidae, the oriental fruit moth.

Introduced to North America in 1912 or 1913 at Washington, DC (Peterson & Haeussler 1926). First found in Ont. in 1925 where it is a serious pest of peach, is injurious to quince and some varieties of pear and feeds on apples, plums and cherries (Dustan & Davidson 1973). It is now found in all

the peach growing districts of the U.S. (Chapman & Lienk 1971).

It was brought into B.C. at Summerland, in 1956, in infested fruit from WA for canning (Touzeau & Neilson 1957). It was successfully eradicated by 1958 by heavy spraying, fumigation of the cannery and removal of the orchard adjacent to the cannery (Touzeau & Neilson 1958).

It is found in South America, Europe, Asia, and Australia (Anon 1951-1952). It is a serious pest of peach, apple and other fruits wherever it occurs (Chapman & Lienk 1971).

Hedia nubiferana (Haworth), Tortricidae, the green budworm.

First recorded in North America in 1913 from N.S. (Sanders & Dustan 1919). Found in B.C. at Hatzie in 1914 and at Vernon in 1919 (Treherne 1921). It was found, but not common on apple, in the Lower Fraser Valley, B.C. in 1978 and 1979 by one of the authors and by Doganlar and Beirne (1978b). It was reported from Ont. in 1973 (Creelman 1973). It has also been recorded from P.E.I. and widely in the northeastern U.S. (Chapman & Lienk 1971). It has been recorded as a pest of apple in N.S. (MacNay & Creelman 1958).

It is a common species in Europe and Asia Minor (Gibson 1923; Chapman & Lienk 1971) where it feeds generally on Rosaceae including apple, hawthorn and species of *Prunus* and *Sorbus* (Chapman & Lienk 1971).

Hemithea aestivaria (Hubner), Geometridae, the common emerald.

First reported in North America in 1978 from New Westminster, Burnaby and Langley, B.C. (Doganlar and Beirne, 1979), it has not been reported from elsewhere in North America (Bolte and Munroe 1979).

It is found in most of Europe and in Eastern Asia (Doganlar and Beirne 1979) and has been reported from a wide variety of woody trees and shrubs (Doganlar and Beirne 1979, Bolte and Munroe 1979).

Laspeyresia nigricana (Stephens), Tortricidae, the pea moth.

First found in North America in eastern Canada in 1893 (Fulton 1947). Injury to peas was reported in Ont. and Que. in 1897 (Fletcher 1899) and it is also widespread in the Maritimes. First notes as a problem in B.C. in 1933 when a heavy infestation occurred on the Sumas Prairie (Fulton 1947). It has been suggested that it migrated to Sumas from the northwestern U.S. (Fulton 1947). It was responsible for the elimination of dried-pea and pea seed culture in B.C. from 1935 onwards (Beirne 1971). It has become established in most of the pea growing areas in North America (Fulton 1947).

This European species (Beirne 1971) has been reported as a common and important pest of peas grown for drying in England (Smith 1931; Gould *et al.* 1962). It infests cultivated peas in Finland and larvae have also been found on wild tufted vetch (*Vicia cracca*) (Ekholm 1961).

Laspeyresia pomonella (L.), Tortricidae, codling moth.

The exact date of introduction to North America is unknown (Chapman & Lienk 1971) but it was probably introduced from Europe with early colonists. Putnam (1963) suggests that it might have been introduced to Ont. in 1635. Fletcher (1894) reported damage to apple crops in Canada and Bethune (1886) reported it as widespread over the whole Dominion. First recorded in B.C. in 1900 on Vancouver Island in 1905 in the interior fruit growing districts (McLeod 1951). Reports from the time indicate that a long and losing battle was fought in B.C., with the pest being introduced, eradicated, and re-introduced at various points over a period of years (Anon 1912; Anon 1921; Treherne 1914; Brittain 1914). In the B.C. Dept. of Agriculture Annual Report for 1914 (Anon 1915) there was optimism that the codling moth would be eradicated from B.C. the following year, a hope which is still expressed from time to time! It now occurs wherever apples are grown in Canada and the U.S. (Chapman & Lienk 1971).

Probably native to southern Eurasia it is now a pest of apple wherever they are grown with the exception (as of 1971) of Japan and parts of mainland Asia (Chapman & Lienk 1971).

Loxostege sticticalis (L.), Pyralidae, the beet webworm.

This species may have been introduced into North America from Asia (Beirne 1971). Forbes (1923) suggested that the first introduction was probably in eastern North America. Recorded in Man. in 1903 (Anon 1903), it has been recorded as causing damage somewhere in the Prairie provinces every year since 1917 (Beirne 1971), especially in rape, flax and sugar beets (e.g. Gibson 1921; McDonald 1963; Beirne 1971). First known damage in Ont. in 1936 (Caesar 1937) and in B.C. in 1938 (Twinn 1939). It is considered a pest in the dry interior of B.C. as well as in southern Man., Sask. and Alta. Food plants include a large variety of plants including forage and truck crops with a preference for broad leaved plants. (Munroe 1976). Munroe (1976) gives its present North American distribution as "common in northeast, ranging across Canada and U.S. from N.S. and MA to the southern N.W.T. and Yuk., and B.C. and AZ." Recently it has caused complete loss of sugar beet, alfalfa and vegetable crops in some areas in North America (Munroe 1976).

It is a pest in the Palaearctic region, widely distributed particularly in drier areas (Munroe 1976). It was reported attacking rape in Bulgaria in 1977 (Popov 1978) and is a serious pest of pasture grasses and legumes, as well as peas, cereals, beets and other crops in the USSR (Belov *et al.* 1978).

Ocnerosstoma piniariella Zeller, Yponomeutidae, European needle miner or small Ermine moth.

First recorded in North America in 1882 at Ithaca, NY (Forbes 1924). First recorded in Canada

in 1922 at Abbotsford, B.C. from white pine (Felt 1922). Now found in the Lower Fraser Valley and Vancouver Island (Harris 1958). It has also been recorded from Ont. (Harris 1958) and Que. (Prentice *et al.* 1965) and MT (Furniss & Carolin 1977), mining needles of pine.

It is an unimportant pest of Scots pine in Europe (Harris 1958).

Operophtera brumata (L.), Geometridae, the winter moth.

First recorded in North America in N.S. in 1949 where it may have been present for as long as 30 years (Smith 1950). It has since extended its range into N.B. and P.E.I. (Prentice *et al.* 1963; Forbes *et al.* 1964). First reported in B.C. in 1976 from Vancouver Island, but the outbreak started earlier (Gillespie *et al.* 1978). Found at Portland, OR in 1978 where it appears to have been locally established from at least 1958 (Ferguson 1978). Also found at Vancouver, WA and on San Juan Island (Ferguson 1978). In the Maritimes and B.C. it is a serious defoliator of forest, urban and orchard trees and shrubs (Gillespie & Finlayson 1981; Embree 1967).

It is native and widespread across northern Africa and temperate Eurasia (Ferguson 1978). In Eurasia it is an important but cyclical defoliator (Sechser 1970) of fruit and deciduous forest trees (Wylie 1961) and is recorded as attacking the fruit itself (Briggs 1957).

Pandemis cerasana Hubner, Tortricidae.

First found in North America at Saanich, B.C. in 1964 (Evans 1966). It has spread to the Lower Fraser Valley where it was common on apple in 1977 (Doganlar and Beirne 1978b). In B.C. it feeds on a variety of hosts including *Quercus*, *Malus*, *Alnus* and *Acer* spp. (Evans 1970) and blueberry and raspberry in the Lower Fraser Valley (Gillespie 1981).

It is a Palaearctic species (Bradley *et al.* 1973) prominent in the European orchard pest control literature (e.g. Nordlander 1977; Kolev and Balevski 1978).

Pandemis heparana (Denis & Schiffermuller), Tortricidae.

First recorded in North America in the Lower Fraser Valley, B.C. in 1978, but may have been introduced much earlier (Doganlar and Beirne 1979b). Larvae were collected from apple, crabapple, pear, plum and species of *Prunus*, *Crataegus*, *Lonicera*, *Rubus*, *Vaccinium* and *Spiraea* (Doganlar and Beirne 1979b).

It is found in Europe, the Mid-east, Siberia, Korea and Japan feeding on various trees and shrubs including species of *Malus*, *Prunus*, *Pyrus*, *Tilia*, *Salix*, *Lonicera*, *Betula*, *Ribes*, *Vaccinium* and *Myrica* (Bradley *et al.* 1973). In Europe it also occasionally damages apple fruit (Adkin 1924).

Pardia cynosbatella (L.), Tortricidae.

First recorded in North America in 1978 from

Ladner, B.C. (Doganlar & Beirne 1979b) on *Rosa* spp. It is a European species not recorded previously from North America.

It is widely distributed and common in Europe and parts of the Middle East. It is recorded as feeding on a wide range of woody ornamental plants, fruit trees, and deciduous forest trees (Doganlar & Beirne 1979a).

Peridroma saucia (Hubner), Noctuidae, variegated cutworm.

May have been introduced into North America (Beirne 1971). If so, this probably happened early (Beirne 1971), for it is now distributed throughout the U.S. and southern Canada (Holland 1968; Beirne 1971). In 1900 the first serious outbreak was recorded from B.C. (Gibson 1912). In Canada it is perhaps most important as a pest in B.C., P.E.I., southwestern Ont. and N.S. in that sequence (Beirne 1971). It has a wide range of food plants with some preference for garden crops but will feed on the foliage, buds and fruit of trees and vines, tobacco, ornamentals and greenhouse plants (Metcalf & Flint 1962).

It is found in most of the cultivated areas of the world (Metcalf & Flint 1962; Morris 1980) but is relatively rare in the old world (Forbes 1954). Bibolini (1970), reported an outbreak in Italy in 1966 on lettuce and tomatoes in greenhouses.

Phthorimaea operculella (Zeller), Gelechiidae, the potato tuberworm.

Recorded in CA as early as 1856 (Graf 1917), where it is still a pest of potatoes (Bacon 1960). Holland (1968) suggests that it was probably introduced from Australia. It has been recorded damaging potatoes in VA in field and storage (Spencer & Strong 1925). It was found damaging potatoes in Duncan, B.C. in 1958 (Arnott & Arrand 1960) and at two unspecified points in 1966 in potatoes for the chipping industry (Creelman 1966). No records were found of it subsequently being present in B.C.

It is a pest of potatoes in Algiers and other Mediterranean countries (Holland 1968). Imms (1964) states that it is a widespread pest of stored potatoes, more rarely affecting the field crop and particularly in warmer countries (Jones & Jones 1964). It has been reported as a pest from many areas e.g. Rhodesia (Mitchell 1978), Peru (Arestegui 1977) and New Zealand (Foot 1979), on potatoes, and in Egypt (Shaheen 1977), on tomatoes.

Pieris rapae (L.), Pieridae, the imported cabbageworm.

First introduced to North America about 1860 at Que. (Chittenden 1905; Pfadt 1971). Spread rapidly through U.S. and Canada reaching CA by 1883 (Pfadt 1971). Observed in eastern B.C. in 1898, reached the Pacific coast in 1901, and was found on Vancouver Island in 1902 (Treherne 1915). In Canada an important pest that causes some damage in most years wherever cabbage and related plants

are grown and more or less severe damage in many years, especially in southerly districts (Beirne 1971). Harcourt (1962) stated that it can cause severe economic damage to cabbage and related crops throughout North America.

It is nearly a worldwide pest of cruciferous plants (Pfadt 1971).

Plutella xylostella (L.), Yponomeutidae, diamond-back moth.

Introduced to North America from Europe sometime before the middle of the 19th century (Metcalf & Flint 1962), now occurring wherever its host plants are grown. Food plants include all Cruciferae, also some ornamental and greenhouse plants such as sweet alyssum, stocks, candytuft, and wallflower (Metcalf & Flint 1962). Reported from B.C. in 1900 (Anon 1900) where it was very destructive to cruciferous crops in parts of Vancouver Island. It was reported as a pest in Okanagan Valley in 1914 (Ruhman 1915). It is a sporadic pest in North America reaching high numbers in limited areas in some years (Davidson & Peairs 1966; Beirne 1971).

It is common in Europe occasionally occurring in vast numbers and damaging cruciferous plants (Anon 1936) but these outbreaks are usually confined to small areas. This European species is found in Asia, Africa, Australia and New Zealand as well as America (Smith 1931).

Porthetria [Lymantria] dispar L., Lymantriidae, the gypsy moth.

Introduced to the Boston area of U.S. in 1869 (Baker 1972) from France. Severe defoliation of shade and fruit trees occurred in the New England States and despite attempts to prevent its spread it now occurs in NY, NJ, PA, MI and southeast Que. (Baker 1972) and is still spreading. In eastern North America it feeds on most hardwoods and some intermixed conifers (Furniss & Carolin 1977). Acceptable food plants include oak, willows, poplars, most birches, larch, linden and apple. First threatened western Canada in 1911 when it was intercepted at Vancouver, B.C. (Anon 1979a). Discovered in 1978 in the Kitsilano area of Vancouver evidently from eggs that arrived on a canoe from Que. (Anon 1979a). It seems to have been eradicated from B.C. by the search and destruction of egg masses and by spraying when permission was given by landowners (T. Finlayson, Prof Emerita, Simon Fraser University, Burnaby, B.C., V6A 1S6, pers. comm.). It is a potentially serious pest where introduced and has 450 known host plants (Anon 1979a). It was recorded in CA in 1970 and 1973 (Furniss & Carolin 1977) and an active infestation was found there in 1979 (Anon 1979b). Recent reports indicate that this species is now present in WA (Anon 1980).

It is found in temperate regions, extending throughout central and southern Europe, northern Africa, central and southern Asia, including Japan and Ceylon (Gerardi & Grimm 1979). It is a major pest of forest and orchards in Yugoslavia, France,

Rumania and Japan where population peaks occur at irregular intervals (Marx 1973).

Recurvaria nanella Hubner, Gelechiidae, the lesser bud moth.

Recorded in eastern U.S. as early as 1776 (Gilliatt 1934). It was recorded in 1915 from the Annapolis Valley, N.S. (Sanders 1915) and from Ont. (Gilliatt 1934), and was present in many districts in the eastern half of the U.S. (Sanders 1915). Food plants include apple, plum, apricot, pear, quince, peach, cherry and hawthorn (Gilliatt 1934). It has been recorded as a pest of apples in N.S. and B.C. (MacNay and Creelman 1958) although a first record date was not found for B.C.

Native to Europe (Sanders 1915) where it has been recorded as a pest of apple and other fruit trees in various areas e.g. Bulgaria (Nikolova 1962), the Soviet Union (Matnashvili 1975) and Switzerland (Baggiolini 1967).

Rhopobota naevana (Hubner), Tortricidae, the black-headed fireworm.

A form known as the black-headed fireworm was probably introduced to WA and OR between 1912 and 1915 from cuttings of cranberry from MA (Plank 1922). It had then been a pest of cranberry in NJ, MA, and WI for a long time (Plank 1922) and was also present in NY and CA. First reported in B.C. in 1954 as attacking cranberry on Lulu Island (Anon 1954), it is now a very serious pest of cranberry in B.C. (Cram & Neilson 1978) and is distributed throughout the cranberry growing areas of the Lower Fraser Valley (Neilson 1969). It attacks cranberry wherever the crop is grown in North America including N.B. and N.S. (Maxwell & Pickett 1957), the eastern U.S. (Franklin 1950), WA, and OR (Breakey 1960; Plank 1922).

A form known as the holly budmoth, (Kearfoot's *R. naevana ilicifoliata*) was recorded in B.C. in 1923 and is now present in WA and OR (Swenson 1958). The holly budmoth and the black-headed fireworm are thought to be very closely related (Breakey 1960). The holly budmoth is an important pest in OR holly plantings (Swenson 1958). *Rhopobota naevana* is recorded feeding on fruit trees, holly and species of *Crataegus* and *Vaccinium* in Europe (Meyrick 1927; Lucchesse 1941).

Rhyacionia buoliana (Schifferrmuller), Tortricidae, the European pine shoot moth.

First recorded in North America in 1913 at Great Neck, NY (Busck 1914). First recorded in B.C. at a nursery in Victoria in 1927 (Downes 1928) but eradicated by destroying pines (Mathers 1940). Recorded at Vancouver, B.C. in 1938 (Mathers 1940) it is now established in the Lower Fraser Valley, on southern Vancouver Island and the Gulf Islands (Prentice *et al.* 1965; Harris & Ross 1975). Transport of infested nursery stock resulted in rapid spread of the moth which is now found in WA, OR, CA, through the northeastern U.S., and in Canada

from Ont. eastward, as well as B.C. (Torgersen & Coppel 1965; Baker 1972). Distribution in central Canada is limited by the severe winter climate (Prentice *et al.* 1965). Hosts include a large variety of pines (Baker 1972) especially ornamental and shelterbelt types (Harris & Ross 1975). It is a serious pest of pines in plantations in Ont. (Prentice *et al.* 1965), ornamental pines in residential areas and pines in Christmas tree farms (Ryan & Medley 1970).

It is a European species injurious to *Pinus sylvestris* and other native pines (Busck 1914), and has been recorded damaging pine in England, Germany and Denmark (Crystal 1937) but is not a serious pest in its native range (Furniss & Carolin 1977).

Spilonota ocellana (Denis & Schifferrmuller), Tortricidae, the eye-spotted budmoth.

First reported from North America in 1841 from MA (Harris 1841). Was very common in 1912 in Vancouver (Wilson 1912) and Victoria, B.C. (Britain 1912) but rare in the Okanagan Valley (Britain 1912). It is now widely distributed in B.C., as well as Ont., Que., N.B., N.S., P.E.I. (MacNay & Creelman 1958) and wherever deciduous trees are grown in the northern U.S. (Chapman & Lienk 1971; Baker 1972) and a pest of fruit trees in B.C. (Gerber *et al.* 1980) and throughout its range (LeRoux & Reimer 1959; Prentice *et al.* 1965; Baker 1972). It is also a pest on blueberry in the Lower Fraser Valley, B.C. (Gillespie 1981). Food plants include apple, which is the most consistent food (Chapman & Lienk 1971) other orchard trees, hawthorn, larch, laurel, oak (Baker 1972) and mountain ash (Prentice *et al.* 1965).

It is a European species (Porter 1924) common in apple growing districts. Also reported from Pakistan, China, Korea, and Japan but not as yet from the southern hemisphere (Chapman & Lienk 1971).

Stilpnotia salicis (L.), Lymantriidae, the satin moth.

First recorded almost simultaneously about 1920 from the East coast of North America at Boston, MA (Burgess 1921) and the West coast at New Westminster, B.C. (Glendenning 1924, 1929). Found in the Maritimes in 1930 and Que. in 1938 (Reeks & Smith 1956). It became a serious pest of poplar and cottonwood on both coasts of North America (Glendenning 1929; Reeks & Smith 1956) and by 1956 in the interior of B.C. (Condrashoff 1956). In B.C. it is now found on Vancouver Island, along the coast and into the southern interior (Dawson 1971b). It has also been recorded from Nfld., N.S., N.B., eastern Que. (Prentice *et al.* 1962) and the New England States, WA and OR (Baker 1972). It is an occasionally serious pest of poplars, trembling aspen, and cottonwood in North America (Dawson 1971b). It may also feed on willow, oak, crabapple and Saskatoon berry (*Amelanchier*) (Lejeune & Silver 1961; Dawson 1971b).

It occurs widely through Europe and Asia (Lejeune & Silver 1961; Dawson 1971b) and is a sporadic pest of poplar and willow throughout its range (e.g. DeMeirleire 1966; Kailidis 1964; Molis 1970).

Thymelicus lineola (Ochsenheimer), Hesperidae, European skipper.

Introduced to North America at London, Ont. sometime before 1910 (Saunders 1916). In eastern North America it is now found in Que., P.E.I. (McNeil 1978), Ont., N.B., MI, OH, NY, PA, MD, NJ, CT (Burns 1966), Nfld. (Jackson 1978), N.S. and Man. (Preston and Westwood 1981). It was first found in B.C. at Terrace in 1960 (MacNay 1965). This colonization may have arisen from a new introduction from abroad (Beirne 1971). Preferred food plant in North America is timothy, *Phleum pratense*, but several other grasses are readily eaten (Burns 1966). It has reached local population densities in eastern Canada high enough to become an economic pest on hay (Pengelly 1961; Arthur 1966; McNeil 1978).

A widely distributed Palaearctic butterfly (Bergmann 1952-1955), it is restricted in Europe to headlands, forest borders, river banks, roadsides, pastures and other places not used agriculturally and is rare and of no economic importance (Carl 1968). Food plants in Europe include *Holcus lanatus* L., *Agropyron repens* (L.), *Brachypodium sylvaticum* (Huds.), *Dactylis glomerata* L., *Ar-*

thenaterium elatius (L.) and *Restuca* sp. (Carl 1968).

Tyria jacobaeae. Aretiidae, the cinnabar moth.

Intentionally introduced to the Lower Fraser Valley, B.C. in 1965 as a biological control agent against the weed *Senecio jacobaea* L. (tansy ragwort) (Wilkinson 1965). The first introduction to B.C. did not establish but later introductions have (Harris *et al.* 1975). It has also been introduced to the Atlantic provinces (Harris *et al.* 1975) and the western U.S. where it causes extensive defoliation (Hawkes 1968) of the weed it was introduced to control.

It has been intentionally spread from its native Europe (Myres & Campbell 1976) to New Zealand (Cameron 1935) and Australia (Schmidl 1972), for the same purpose.

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SIPHONAPTERA FROM MAMMALS IN ALASKA. SUPPLEMENT IV. REVISED CHECK LIST FOR SOUTHEASTERN ALASKA

GLENN E. HAAS¹, LOYAL JOHNSON², AND ROBERT E. WOOD³

ABSTRACT

The annotated check list grew to 15 taxa with the addition of *Opisodasys vesperalis* (Jordan) and *Chaetopsylla setosa* Rothschild, both new for Alaska; *Tarsopsylla octodecimdentata coloradensis* (Baker), new for southeastern Alaska; and an *Oropsylla* sp. Nine species of wild mammals and the domestic cat are reported as hosts of fleas in southeastern Alaska for the first time, increasing the total number of mammalian hosts to 25 identified species. Seventy new records for 10 islands and the mainland are combined with published records in a distribution table. Morphological variations in the posterior margin of sternum VII of females of *Monopsyllus ciliatus protinus* (Jordan) and distinguishing characters of three other taxa are illustrated.

INTRODUCTION

The addition of four fleas to our first check list of mammal fleas of southeastern Alaska (Haas *et al.* 1980) raised the total to 15 taxa. Especially noteworthy is a marmot flea of the genus *Oropsylla*. The other three fleas are known from British Columbia (Holland 1949). One of them, *Tarsopsylla octodecimdentata coloradensis* (Baker) is also known from Alaska west of the Yukon Territory (Holland 1963; Hopla 1965; Haas and Wilson 1982), but *Opisodasys vesperalis* (Jordan) and *Chaetopsylla setosa* Rothschild are new to the state of Alaska. New records are presented for all fleas in our first list except for *Myodopsylla gentilis* Jordan and Rothschild and *Chaetopsylla tuberculiceps* (Bezzi).

Mammalian hosts of the fleas are listed (Table 1). The additional ten species resulted in a total of 25 identified hosts plus an unknown species of *Microtus*. These additions are the hoary marmot, northern flying squirrel, southern red-backed vole, meadow vole, long-tailed vole, gray wolf, black bear, ermine, wolverine, and domestic cat. All new and published locality records are tabulated by named islands and the mainland (Table 2).

ANNOTATED LIST

Pulicidae

1. *Ctenocephalides felis felis* (Bouché)

This is the first record of fleas infesting a cat in southeastern Alaska.

Record — Baranof Island, Sitka: two males, six females (one gravid), on cat, I.XII.1979, L. Johnson.

Hystrichopsyllidae

2. *Hystrichopsylla dippiei spinata* Holland (Figs. 1 and 2)

Nine more specimens were collected, all from martens making a total of 16 from this mustelid and one from a mink. The assignment of southeastern Alaskan specimens to this subspecies was facilitated by dissecting male genitalia to expose tubercles near the inner angle of sternum IX (Fig. 1). Not all tubercles are in focus but enough to show more than Holland (1957) illustrated for *H. d. truncata* Holland. He showed that tubercles are absent in *H. d. dippiei* Rothschild.

The aedeagus dissected from our *H. d. spinata* specimen is shown in Fig. 2. Aedeagi of *H. dippiei* (then known as *H. gigas dippiei* Rothschild) and *H. occidentalis* (i.e. *H. o. sylvaticus* Campos and Stark) from south of Canada were illustrated by Traub (1950) and Campos and Stark (1979), respectively. Our specimen appears close to Traub's, although the sclerotized inner tube curves toward its exit (Fig. 2).

¹557 California St., No. 7, Boulder City, NV, U.S.A. 89005.

²State of Alaska Department of Fish and Game, P.O. Box 499, Sitka, AK, U.S.A. 99835.

³State of Alaska Department of Fish and Game, 415 Main St., Rm. 208, Ketchikan, AK, U.S.A. 99901.