with four fuscous longitudinal lines interrupted on each segment by the ground colour, thus giving the appearance of a chain of dashes.

Pupa. Pupation about June 1st. Length 7 mm. x 2.5 mm., dark brown in colour, cremaster consisting of two diverging slightly curved spines. Some of the larvae became sluggish and listless during the close of the last instar, and failed to pupate; only a small percentage of those hatched reached the pupal stage. No cocoon was formed, the larvae merely creeping under debris or between old leaves and pupating after lying quiescent for a day or two.

Remarks. From the ease with which *Epirrhoe plebeculata* fed and thrived, *Galium aparine* is evidently a perfectly satisfactory food plant. At all times the larvae were vigorous and there were no deaths. *Euphyia lacteata*, on the other hand, while readily taking to *Montia* and in fact refusing other plants offered, did not thrive in the final stages, a hint that something was wrong. Possibly the food plant was too succulent, or in nature they changed to some other species of plant. Future investigations may clear the matter up.

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STATUSES OF SOME INTRODUCED PARASITES AND THEIR HOSTS IN BRITISH COLUMBIA[1]

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From 1949 to 1953 the statuses of the parasites and predators introduced into British Columbia to aid in the control of 11 insect pests were investigated. The methods used were mainly empirical because more accurate methods are not known. The value of a parasite was determined by its ability to provide commercial control over a long period, including intervals of host abundance and scarcity. All biological control projects in British Columbia have been started during periods of host abundance. Species that have reduced the host populations to and maintained them at economic levels for 14 years or more are classed as effective control agents.

This arbitrary method of evaluating parasites has many weaknesses. Commercial control can be achieved at widely different host population levels, *e.g.*, a population up to 10,000 of a lecanium scale or 1,000 of larch sawfly larvae per tree would not be economically important, but 100 codling moth larvae per tree would be.

In this paper, percentage parasitism does *not* indicate the effectiveness of a parasite species, but is used to indicate the relative numbers of the various species that attack the same host or to indicate the numbers of a parasite in relation to those of its host. The numerical relationship between the parasite and host populations necessary for commercial control varies greatly and is dependent upon the effectiveness of other mortality factors.

Apple Mealybug, Phenacoccus aceris (Sign.)

The apple mealybug, *Phenacoccus aceris* (Sign.), was discovered in British Columbia in 1913 and by 1935 was causing serious inconvenience to the fruit growers in the Kootenay Valley. The excretion from the insects promoted the growth of a sooty fungus that rendered the fruit unsalable unless washed.

From 1938 to 1943 colonies of *Allotropa utilis* Mues. totalling 6,602 adults

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were released at 11 selected points throughout the infested area. By 1943 this parasite had become well established. In 1944 and 1945, four colonies comprising 4,549 individuals obtained at the original release points were released in the Kootenay Valley. In 1948 a colony of 133 adults was released in a small area of infestation near Royal Oak on Vancouver Island.

The apple mealybug has been controlled by *A. utilis* in the Kootenay Valley since 1943 and on Vancouver Island since 1949. An important factor in the effectiveness of *A. utilis* is its ability to survive sprays of dormant oil lime-sulphur whereas many of the apple mealybugs are killed by this treatment. When the spray is applied, *A. utilis* is in the pupal stage and is protected by the mummified remains of the host, in which it pupates.

Marshall (1953) stated that *A. utilis* must be one of the outstanding examples in Canada of biological control by an introduced parasite.

Codling Moth, Carpocapsa pomonella (L.)

The codling moth, *Carpocapsa pomonella* (L.), was first reported on Vancouver Island in 1900 and in the interior of British Columbia in 1905. The menace of this pest to the fruit industry was recognized at an early date and rigorous eradication regulations are credited by Marshall (1952) with preventing serious losses until the regulations were relaxed in 1925. During the next 20 years the codling moth increased in destructiveness. Since 1945 the use of DDT and the development of more efficient spray equipment have controlled the codling moth in commercial orchards (Marshall, 1953). The general use of DDT is believed to be responsible for the rapid increase in orchard mite populations and for this reason substitute insecticides are being sought.

Biological control of the codling moth was attempted through the introduction of three species of parasites: *Ascogaster quadridentata* Wesm., *Ephialtes caudatus* (Ratz.), and *Cryptus sexanulatus* Grav. Stock of *A. quadridentata* was obtained in Ontario and propagated at the Entomology Laboratory, Belleville, Ontario. A total of 50,800, in colonies of 291 to 33,250 individuals, were released at various points throughout the Okanagan Valley in 1934, 1935, 1936, 1937, and 1939. *A. quadridentata* became established but its numbers have not yet increased sufficiently to affect the codling moth population.

Small numbers of *E. caudatus* and *C. sexannulatus* were imported from France and both species were propagated at the Belleville laboratory. Colonies of 54 and 4,199 adults of *E. caudatus* were released in the Okanagan Valley in 1942 and 1946, respectively. Colonies totalling 3,030 of *C. sexannulatus* were released at six points in the interior of British Columbia in 1941, 1946, and 1947. Neither species has been recovered. The search for effective parasites of the codling moth is continuing.

European Earwig, Forficula auricularia L.

The European earwig, *Forficula auricularia* L., was first reported from British Columbia in 1916. In 1929 Buckell reported that on the Pacific coast the European earwig had become firmly established and was a serious garden and household pest.

Small colonies of *Bigonicheta setipennis* (Fall.) obtained from England and released at New Westminster between 1928 and 1931 did not give evidence of becoming established. In 1933 breeding stock of this parasite was obtained from the City of Portland, Oregon. More than a quarter of a million parasites were propagated at the Divisional laboratory at Victoria and were released at selected points from 1934 to 1939.

B. setipennis became established and in 1945 seventy per cent. parasitism was recorded in Vancouver by Spencer (1947). In 1951, the range of parasitism at seven widely separated points on Vancouver Island was from 10.9 to 50.0 per cent.; at 10 on the mainland, from 1.6 to 30.4 per cent. Further data on the parasitism in the Vancouver area were obtained when

mass collections of the earwigs were reared to obtain *B. setipennis* for transfer to other infested areas in Canada. The numbers of *B. setipennis* and of *F. auricularia* and the percentage parasitism for collections made in 1950, 1951, and 1952 were respectively: 6,211, 52,500, and 11.8; 8,097, 42,800, and 18.9; 7,669, 71,300, and 10.8.

B. setipennis is the only parasite that has been reared from the European earwig in British Columbia and is a more important control factor than predators or disease. One of the most important predators is a carabid, *Feronia melanaria* Ill. Spiders have been observed feeding on the earwig. The common house spider, *Parasteatoda tepidariorum* (C. L. Koch), is an efficient predator of arboreal earwigs.

B. setipennis puparia are parasitized by a pteromalid, *Dibrachys* sp. *Dibrachys cavus* Wlkr. was reported by Thompson (1943) as a parasite of *B. setipennis* in England; but Dr. O. Peck, Entomology Division, Ottawa, who examined specimens reared from *B. setipennis* in British Columbia, reported (in litt.) that these secondaries through *B. setipennis* are distant from *D. cavus* and presumably of a new species.

B. setipennis is not numerous enough to control the earwig, but with other control agents it has prevented the earwig from becoming a major insect pest in British Columbia.

Lecanium Scales

The identities of lecanium scales in British Columbia are obscure. It is believed that there is a mixed population of two or more species, including the European fruit lecanium, *Lecanium corni* Bouché, and the hazel nut scale, *L. coryli* (L.), both of which were introduced accidentally from Europe. Glendenning (1933) stated that since 1925 the lecanium scale had been one of the most destructive insects in the coast region of British Columbia. A colony of 263 adults of *Blastothrix sericea* (Dalm.), obtained from England, was released in 1928; and two colonies totalling 779 adults were released in 1929. Glendenning (loc. cit.) reported that the colonies of *B. sericea* released in 1928 and 1929 became established and by 1932 had spread over the entire area of infestation, which at that time was 200 square miles. The number of scales per foot of twig was reduced from an average of 35 in 1930 to a maximum of two in 1932. The parasitism of the few adult scales present in 1932 ranged from 90 to 100 per cent. Lecanium scales have not since been of economic importance in British Columbia.

Clausen (1951) proposed the theory that a "fully" effective parasite would achieve control at the colonization points within three host generations or within three years after the parasites are released. He assumed that certain requirements had been met, and included in the list "that releases were synchronized with the time of abundance of the preferred host stages." The colonies of *B. sericea* that were introduced into British Columbia were released from June 24 to July 27, when the host is in the egg or early "crawler" stage and is not suitable for parasitism. Graham and Prebble (1953) stated that in southwestern British Columbia the first-generation eggs of *B. sericea* were never found in the nymphal scales earlier than September 18, although adults of *B. sericea* emerged from the fully formed female scales in the latter half of June, and the young scale crawlers were on the foliage from early June onwards; there was thus an interval of more than two months when the parasite was apparently not associated with the scale. Investigations by the author in 1952 and 1953 confirmed these findings. It was also found that *B. sericea* females of the summer generation do not become sexually mature until shortly before oviposition occurs, in late September. This is an example, therefore, of an introduced parasite having controlled a host within three years although its release was not synchronized with the time of abundance of the preferred host stage.

The simultaneous increase in the population of *B. sericea* and decrease in that of *L. coryli* reached its climax in 1931 and was followed by a long period of low host population. During their

investigation, from 1941 to 1945, Graham and Prebble (loc. cit.) found that although the *L. coryli* infestation had remained at a low level it had spread about 70 miles eastward on both sides of the Fraser River. It had also spread westward to Vancouver Island, where it was well established in the Victoria district. By 1951 it had spread northward on Vancouver Island to the Saanish Peninsula. *B. sericea* has followed its host to all the new areas of infestation.

Spiders in the field and European earwigs in the laboratory have been observed feeding on *L. corni*, but predators are not believed to be an important control factor. A few specimens of a native parasite, *Aphycus* sp. near *kincaidi* Timb., have been obtained from several thousand scales reared in the laboratory. No secondary parasites of *B. sericea* have been reared. Although recent investigations have shown that there is seldom more than 40 per cent parasitism of the overwintering scale population, this additional mortality factor is probably responsible for the continued low level of the lecanium scale population in British Columbia.

Greenhouse Whitefly, Trialeurodes vaporariorum (Westw.)

The greenhouse whitefly, *Trialeurodes vaporariorum* (Westw.), has been a pest of many greenhouse crops since it was first reported in British Columbia in 1907. With the development of more efficient and economical fumigation material and equipment, many growers have been able to control the whitefly without serious difficulty. Other growers, whose greenhouses are unsuitable for effective fumigation or who produce crops that are easily injured by fumigants, have used the parasite *Encarsia formosa* Gahan extensively.

In British Columbia *E. formosa* was first used successfully in greenhouses in 1934; and for 20 years from 100,000 to 475,000 of these parasites, propagated at the Belleville, Ontario, laboratory, have been shipped annually on request to greenhouses and conservatories in British Columbia. It is necessary to recolonize *E. formosa* each year because of the methods of handling greenhouse-grown crops.

Improved methods of propagating and shipping *E. formosa* have been developed and the optimum number of the parasites required for satisfactory control may be calculated from the size of greenhouse, the crops grown, the degree of infestation, and the temperature at which the greenhouse is maintained (McLeod, 1936).

Holly Leaf Miner, Phytomyza ilicis (Curt.)

The holly leaf miner, *Phytomyza ilicis* (Curt.), was accidentally introduced into British Columbia with imported nursery stock, and by 1931 it was causing considerable injury and was widely distributed over the holly-growing area (Downes, 1931).

Five species of parasites were imported from England and colonies were released on Vancouver Island from 1936 to 1938 and on the mainland in 1939 as follows:—

	Vancouver Island	Mainland
Chrysocharis gemma (Wlkr.)	34,564	11,393
Chrysocharis syma Wlkr.	1,978	179
Cyrtogaster vulgaris Wlkr.	2,227	471
Opius ilicis Nixon	33	10
Sphegigaster flavicornis Wlkr.	6,359	852

On Vancouver Island the first recoveries were obtained in 1940 (Downes and Andison, 1941). *C. gemma* was obtained in large numbers at one of the release points and "a survey of the plantation revealed the fact that approximately 80 per cent of all *Phytomyza* mines were parasitized." *O. ilicis* was also established in 1940, although no recoveries had been obtained in 1938 from the caged tree on which 33 individuals were released in 1937.

From 1949 to 1953, collections from Vancouver Island and the mainland yielded specimens of all species that had been released except *C. syma*, but *C. gemma* was recovered only on Vancouver Island and *C. vulgaris* only on the mainland. The percentage parasitism from these collections was not so high as that reported by Downes and Andison (loc. cit.), the highest being 60 and the average about 30

on both Vancouver Island and the mainland. On Vancouver Island *C. gemma* was responsible for more than 90 per cent of the parasitism and on the mainland *O. ilicis* was responsible for 80 to 90 per cent. *S. flavicornis*, although present in both areas, was of minor importance.

It is remarkable that *O. ilicis* attained its present status on the mainland as the original colony consisted of only four males and six females. This species is a relatively unimportant parasite of the holly leaf miner in England; Cameron (1939) stated that it was a rare species and that only 0.3 per cent of the mines were attacked by it.

No native parasites were reared from the holly leaf miner during this investigation; but several specimens of *C. vulgaris* were reared from a native species of grass leaf miner, *Phytompza nigra* Mg., which has apparently been adopted as an alternate host.

The usefulness of these parasite species is difficult to evaluate. The holly bud moth, the strawberry root weevil, and the black vine weevil often require chemical treatment for their control in commercial holly plantations, and these treatments also control the holly leaf miner. However, there are thousands of holly trees in ornamental plantings in the area and few of these receive chemical treatment. The introduced parasites undoubtedly contribute materially to the control of the holly leaf miner in such plantings.

Larch Sawfly, Pristiphora erichsonii (Htg.)

In British Columbia the larch sawfly, *Pristiphora erichsonii* (Htg.), was first reported in 1930 (Hopping, Leech, and Morgan, 1943). In 1933 cocoon samples were obtained and no evidence of parasitism was found. Colonies of parasites were introduced in 1934, 1935, 1936, 1941, and 1942. The larch sawfly infestation started near Fernie, in the southeastern part of the province, and spread westward. The parasite releases in 1941 and 1942 were made on the western fringe of the infestation to hasten establishment of the parasites over the entire area of infestation.

Three species of parasites were released as follows:—*Bessa harveyi* Tns. (=*selecta* Mg. of American authors): 1942, 5,995; *Mesoleius tenthredinis* Morley: 1934, 673; 1935, 2,196; 1936, 781; 1941, 624; 1942, 702; *Zenillia* nox Hall.: 1935, 1,265.

M. tenthredinis became established and increased rapidly. *B. harveyi* became established, but has not increased enough to be of economic importance. *Z. nox* has not been recovered.

Tritneptis klugii (Ratz.), a European species that was not released, has also become established. This species may have spread into British Columbia from contiguous areas of larch sawfly infestation in Montana. The usefulness of *T. klugii* is doubtful because it oviposits in larch sawfly cocoons indiscriminately and destroys many of the host larvae that have already been parasitized by *M. tenthredinis*.

Specimens of *Endasys* (*Endasys*) sp. and *Euceros* sp. have been reared from mass collections of larch sawfly cocoons. Both are hyperparasites of *M. tenthredinis*, but neither species is abundant enough to be of economic importance.

At no time since it became established in British Columbia has the larch sawfly reached outbreak proportions except in small, isolated areas. The population in each of the heavily infested areas for which there are records became heavily parasitized by *M. tenthredinis* and subsided without serious injury to the trees.

From 1948 to 1951 samples of larch sawfly cocoons were obtained from a localized infestation and were dissected to determine the degree of parasitism and mortality. The results (Table I) showed that a large part of the mortality during this period was due to parasitism by *M. tenthredinis*. In 1952 and 1953 the larch sawfly population had dropped to such a low level that it was impractical to collect cocoons to determine the degree of parasitism.

TABLE I

Mortalities and parasitism of larch sawfly larvae in cocoons in British Columbia, 1948 to 1951

Condition of Larvae	1948		1949		1950		1951	
	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.
Cocoons dissected	1,500	100	536	100	441	100	1,200	100
Dead	248	16.5	40	7.5	53	12.0	102	8.4
Parasitized by *M. tenthredinis*	829	66.2*	305	61.5*	213	54.9*	747	68.0*
Parasitized by *T. klugii*	10	.8*	23	4.6*	5	1.3*	7	.7*
Living	413	27.5	168	31.3	170	38.5	344	28.7

* Based on number of living larch sawfly larvae.

Oystershell Scale, Lepidosaphes ulmi (L.)

The oystershell scale, *Lepidosaphes ulmi* (L.), has been a pest of fruit and other deciduous trees in British Columbia for at least 50 years. In 1914 Treherne included it among the more important pests of the lower Fraser Valley. The oystershell scale is not now an important pest in commercial orchards, as it is kept under control by the regular spray schedule for other pests. However, commercial orchards are continually subject to reinfestation from infested wild host plants.

The introduction of the predacious mite *Hemisarcoptes malus* (Shimer) in 1917 marked the first attempt in Britissh Columbia to control insect pests through their natural enemies. Colonies totalling approximately 1,000 of *H. malus* were released at one point on Vancouver Island, two points in the Fraser Valley, and one point in the Okanagan Valley. Glendenning (1931) reported that at Agassiz and Vernon the mite survived, and under certain conditions effected excellent control.

Recent investigations by the author have shown that *H. malus* is now widely distributed in British Columbia. The population of this species was greatly reduced during the winter of 1949-50, when the temperature dropped below −30° F. at many points in the interior of the province. It is known, however, that *H. malus* has at times been an important control factor.

Pea Moth, Laspeyresia nigricana Steph.

The pea moth, *Laspeyresia nigricana* Steph., was first reported from British Columbia in 1933. It soon became a serious pest in the Fraser Valley, where most of the canning peas in British Columbia are grown. Wishart (1947) stated that from 1934 until 1945 it increased steadily on Sumas Prairie and in 1945 eighty per cent of the pods were infested.

Four species of parasites were imported from England and colonies were released from 1937 to 1939 as follows: *Ascogaster quadridentata* Wesm., 5,291; *Glypta haesitator* Grav., 1,543; *Horogenes* spp., 35; *Pristomerus vulnerator* (Panz.), 5. *A. quadridentata* and *G. haesitator* became established and the numbers increased rapidly. The percentage parasitism was reported for the release area by Wishart (loc. cit.) for 1941, 1942, 1943, 1944, and 1945 as follows: *A. quadridentata,* 0.34, 1.24, 7.59, 10.80, and 76.39; *G. haesitator,* 0.14, 1.87, 0.70, 3.00, and 3.74; total parasitism, 0.48, 3.11, 8.29, 13.80, and 80.13. *Horogenes* spp. and *P. vulnerator* have not been recovered.

In 1946 the pea moth infestation dropped from 80 to 35 per cent in the parasite release area. In that year an important change occurred in pea-growing practices in the area. The growing of dried peas was discontinued and only canning peas were grown commercially. When dried peas are produced, the crop is not harvested

until after the pea moth larvae have left the infested pods and entered the soil to pupate. When canning peas are produced, the crop is harvested before the pea moth larvae have completed their development and many of them are destroyed. The 45 per cent reduction in infestation that occurred in 1946, however, could not have been caused exclusively by this change in cultural practice, for an infestation of 76 per cent was recorded in areas where the parasites had not yet become established.

Between 1947 and 1953 the population of the pea moth remained at an extremely low level in cultivated peas. In 1949, of 8,921 pods examined, 196 were infested; in 1950, 1951, 1952, and 1953 the infestation was less than one per cent.

Yet there was a relatively large population infesting wild host plants, the most favoured of which is a species of vetch, *Vicia angustifolia* L. Larvae in these plants were heavily parasitized by the introduced parasites. In 1951, 61.6 per cent of the larvae were parasitized, 45.1 per cent by *A. quadridentata,* 13.8 per cent by *G. haesitator,* and 2.7 per cent by undetermined Hymenoptera.

The low population of recent years is probably due in part to the abandonment of the production of dried peas. The introduced parasites *A. quadridentata* and *G. haesitator* are, however, an important contributing factor. There are many thousands of home gardens in the infestation area. In most gardens peas are grown and some are left to ripen. Although home gardens and wild host plants are potential sources of infestation, infestations in cultivated peas have been extremely light and chemical control has been unnecessary. The high percentage parasitism in the wild host plants is probably the most important factor in the continued low population of the pest.

Satin Moth, Stilpnotia salicis (L.)

The satin moth, *Stilpnotia salicis* (L.), was first reported from British Columbia in 1920. The infestation developed to serious proportions in the willow and cottonwood stands of the lower Fraser Valley (Glendenning, 1931). Four species of parasites were introduced from New Brunswick and Massachusetts between 1929 and 1934 as follows: *Apanteles solitarius* (Ratz.), 1933, 737; *Compsilura concinnata* (Mg.), 1929 to 1934, 3,592; *Eupteromalus nidulans* (Thoms.), 1933, 4,313; *Meteorus versicolor* (Wesm.), 1934, 520.

All species except *E. nidulans* became established and *A. solitarius* increased and spread rapidly. The infestation of the satin moth abated and no widespread outbreak has occurred since 1934. In 1951 there was a light infestation on two willow trees on the University of British Columbia campus. From 259 satin moth larvae collected from these trees, 50 adults of *C. concinnata,* 102 of *M. versicolor,* and 14 of *A. solitarius* were obtained, the combined parasitism was 64.1 per cent.

The three species of introduced parasites were parasitized by native secondary parasites. *Dibrachys cavus* Wlkr. parasitized all three species and *Gelis tenellus* (Say) parasitized *M. versicolor.* However, these secondary parasites were not abundant enough to seriously affect the primary parasites. Although no species of native primary parasites have been reared from the satin moth during the present investigations, Glendenning (1932) reported having reared five species of Diptera and three of Hymenoptera from larvae and pupae. He stated that none of these native parasites had been noticed in recent years and they could not be relied upon to check this pest to any appreciable extent. The introduced parasites have survived through an extended period of low host population and continue to be effective control agents.

Woolly Apple Aphid, Eriosoma lanigerum (Hausm.)

The date when the woolly apple aphid, *Eriosoma lanigerum* (Hausm.), became established in British Columbia is not known, but in 1914 Treherne included it in a list of economically important insects in the lower Fraser Valley. *Aphelinus mali* (Hald.) is the most important parasite of the aphid

and has been introduced into most of the countries where the latter occurs.

A. mali was introduced from Ontario to the lower Fraser Valley in 1921 and to the Okanagan Valley in 1929. Reports on the introduction, establishment, and distribution of *A. mali* in the Okanagan Valley were given by Venables (1931, 1937).

The past and present statuses of both the woolly apple aphid and its parasite *A. mali* have been succinctly stated (in litt.) by Dr. J. Marshall, Officer-in-charge, Entomology Laboratory, Summerland, B.C., as follows: "Twenty-five years ago the woolly apple aphid was the most troublesome pest of the British Columbia apple industry. It malformed the trees, smutted the fruits, and made picking highly unpleasant, and, most important, its feeding was associated with the development of the serious fungus disease, perennial canker. The fungal organism develops only in tissue that has been fed upon by woolly aphids. With the equipment of the time, chemical control of the aphid was unsatisfactory. Consequently, work was begun to establish biological control, and it was accomplished within a few years by introduction of the parasite *Aphelinus mali,* which was introduced into the province through the Entomology Laboratory, Belleville, Ontario. The aphid became a minor pest and remained so until DDT was generally used for codling moth control, in 1945. As DDT proved innocuous to the aphid but toxic to the parasite, once again the aphid is a major pest. Investigations are to be undertaken to re-establish the effectiveness of the parasite either by substituting for DDT in the apple spray schedule a chemical non-toxic to the parasite, or by developing a DDT-resistant strain of the parasite."

Discussion

Introduced parasites achieved commercial control for 14 years or more of five pest species, *i.e.*, the apple mealybug, the larch sawfly, lecanium scales, the pea moth, and the satin moth. A sixth insect pest, the woolly apple aphid, was controlled for at least 10 years, until DDT was used for the control of the codling moth.

The times required for the parasites of these six insect pests to give evidence of commercial control conformed, with one exception, with Clausen's (loc. cit.) conclusion that a "fully" effective parasite or predator will achieve control near the colonization points within three host generations or three years after release. The one pest that was not brought under control within three years was the pea moth; *A. quadridentata* has continued to be the most abundant parasite species since it became established, but it did not become an effective control agent until six years after the last colony was released.

Three of the insect pests investigated were controlled only in some areas and in some years, *i.e.*, the oystershell scale, the European earwig, and the holly leaf miner. The degree of control that has resulted from the establishment of the parasites and predators of these pests is difficult to assess. There has not been an important outbreak of any of the pests mentioned since the establishment of their natural enemies in British Columbia.

The parasites of the codling moth have been ineffective. Two species did not become established; the third became established, but though widely distributed, is ineffective. The requirements for commercial control of the codling moth are so rigid as to entail practical elimination of the pest. It is doubtful whether a biological control agent can be found that will by itself achieve such a degree of control. However, a new combination of chemical and biological control for the codling moth may solve the present extremely complex problem of orchard mite control, presumably brought about through the use of DDT and the absence of effective biological agents to control the codling moth.

E. formosa, the parasite of the greenhouse whitefly, is effective under suitable temperature conditions, but because of the methods employed in handling greenhouse-grown crops it is

necessary to recolonize the parasites at frequent intervals.

The insect pests that have been discussed are all introduced species. There is no evidence that any native parasite attacks any of these pests in appreciable numbers. There are two species of exotic parasites and one exotic predator that are relatively important. *T. klugii* has become established as a parasite of the larch sawfly, but it also destroys large numbers of the effective introduced parasite *M. tenthredinis*. *A. mytilaspidis* is a widely distributed parasite of the oystershell scale, but the population is not large enough to provide control. The carabid beetle *F. melanaria* is a predator of the European earwig but is not abundant enough to be effective.

A few indigenous species of secondary parasites are known to parasitize some of the introduced parasites, but none are economically important except possibly *Dibrachys* sp. This species may at times be an important secondary parasite of the European earwig through *B. setipennis*.

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