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Report on the suitability of *Celerio euphorbiae,* the spurge hawkmoth*,* for biological control of *Euphorbia esula* and *E. cyparissias* in Canada

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[Editor's note: Portions of the original text are illegible or missing altogether. The historical importance of the report demanded that it be included on this CD-ROM anyway.]

Introduction

The purpose of this study was to determine whether the spurge hawkmoth, *Celerio euphorbiae*, can be liberated in Canada to help restrict the noxious weeds *Euphorbia esula* and *E. cyparissias* without damage to any desirable plant. *E. esula* (leafy spurge) is a most serious problem weed: the area involved approaches 35,000 to 40,000 acres, most of it in western Canada although the weed was unknown in the region until the early part of this century (Selleck, Coupland and Frankton 1962). *E. esula* is resistant to both chemical and cultural control and thrives in a wide variety of sites where it tends to crowd out other vegetation to form solid stands. *E. cyparissias* (Cypress spurge) is found chiefly in eastern Canada. It has most of the noxious properties of *E. esula*, but spreads more slowly since most stands are sterile; however, fertile stands, such as the one at Braeside, Ontario, which is scattered over approximately nine square miles of pasture, woodland and waste areas, are serious (Moore and Linsay 1953). Both spurges are toxic to animals and most insects and can cause severe dermatitis in man. In Europe, where neither species is considered to be particularly noxious, they are attacked by a complex of specialized insects, one of which is the spurge hawkmoth, *C. euphorbiae*. In Canada, I have visited stands of these spurges in the provinces from Ontario to the West Coast, but have found no insects attacking them, nor signs of insect damage. Their only pathogen apparently was a rust *Gromyces striatus* Schroet, which alternates on alfalfa and other clovers.

This report is divided into three parts. The first part is largely a literature review of the life history and host plants of the moth in Europe.

[Editor's note: Three pages of the original document are missing here.]

The ability of *C. euphorbiae* to thrive on spurge is apparently due to an immunity to a toxic substance in the plant. Potier and Busnel showed that although injection of spurge juice into *C. euphorbiae* resulted in increased activity followed by immobilization, the larvae recovered completely within 5 to 8 hours. Other lepidopterous larvae injected with the juice died within 2 hours after violent muscle tetany. *C. euphorbiae* was also used for a number of other laboratory studies, presumably chosen for its size and ease of rearing, that do not concern this study. There is also an extensive literature on colour aberrations, the naming of new forms, and the production of hybrids that is not reviewed here.

Part 2. Larval feeding tests on plants

Newly hatched and third instar larvae were confined individually in petri dishes on leaves of various test plants and a record kept of feeding activity until pupation or death. These tests give the larvae the opportunity of feeding or starving to death on the test plant so that they can be used to determine the range of plants on which the larvae can feed and survive; however, they do not necessarily indicate that these plants are liable to be attacked in nature. If the feeding tests are to be a real guarantee of safety they must show that the acceptance of plants by the insect fits a predictable pattern. This pattern may coincide with botanical taxonomy, or may be related to physical or chemical features of the plants. Feeding tests on plants selected merely because they grow in the same habitat or are of economic importance are of less value as they only indicate that these species are immune and give little assurance for other plants.

The test plants were divided into the following four groups: Euphorbiaceae; latex and rubber plants; food plants of closely related Sphingids; and economic plants. The first three groups include several plants that are economically important species but these are not relisted.

Euphorbiaceae

The Euphorbiaceae include some plants with valuable economic products, such as rubber (*Hevea*) and Tung oil (*Aleurites*). These plants are all tropical and so need not be considered further. In Canada several members of the family are used as houseplants, the most important being Poinsettia (*Euphorbia pulcherrima*); however, even though house plants may be suitable hosts for the moth, they are not susceptible to attack by large insects. The most important ornamental used out-of-doors is the Castor oil bean (*Ricinus communis*). Several species of spurge are also used as ornamentals: *E. epithymoides, E. marginata,* and *E. cyparissias*, but they are not particularly important or widely used. Furthermore two of them, *E. marginata* and *E. cyparissias* are weedy in North America (Morely 1945). *E. lathyrus* has also been tried in various parts of the world as an oil plant. It is understood that it has no potential value for Canada but it is not known if this also applied to the United States.

Table 1 shows that within the family Euphorbiaceae the larvae were only reared on a species in the subgenus Esula of *Euphorbia*. Also all the *Euphorbia* spp. mentioned as hosts in the literature are in this subgenus. It is also possible that the moth can be reared on *E. marginata* which is in the subgenus Agaloma, as in my feeding test there was only enough foliage available to rear the larvae to the third instar.

Table 1. Feeding and survival of *C. euphorbiae* on plants in the Euphorbiaceae.

	Plant		1st instar larvae			3rd instar larvae		
Genus	Subgenus	Species	No	Feeding Response	No Pupating	No	Feeding Response	No Pupating
Euphorbia	Esula	*cyparissias*	10	****	10	10	****	9
		epithymoides	5	****	a			
		esula	10	****	9	5	****	5
	Agaloma	*marginata*	5	****	a			
	Poinsettia	*pulcherrima*	4	0		4	*	
			2	*	0	2	**	
						3	***	0
	Chamaeayce	*vermiculata*	3	0		2	0	
			2	*	0	2	*	
						1	***	0
Ricinus		*communis*	5	0	0	4	0	
						1	*	0

0 - No feeding
* - Nibbling, under 5 mm^2 eaten.
** - Unsustained feeding up to 2 sq. cms. eaten.
*** - Sustained feeding prolonging larvel life, but not maintaining growth.
**** Sustained feeing accompanied with larval growth.
a - Rearing terminated in 3rd instar.

Latex and rubber plants

Plants in the genus *Euphorbia* all contain a milky latex. This is also found in plants of other families, some of which are listed in Table 2. *Solidago* sp. lacks latex but is included in the table because it has a high rubber content. The table shows that none of the plants tested were suitable for rearing the larvae; however, three of the species were eaten before the larvae died. Bland and succulent plants, such as lettuce, are eaten by many phytophagous insects when confined and starved. Thus, *Apocynum* and *Asclepias* may also be bland and succulent to the larva or they may contain a particular compound (presumably also present in *Euphorbia*) of interest to the larva. The host record of *C. euphorbiae* on *Apocynum sibiricum* supports the latter viewpoint. However, neither plant is likely to be attacked in nature: on *Apocynum* only two of the 14 first instar larvae reached the second instar and none reached the third instar; while on *Ascelepias* they only nibbled. Both plants are economically unimportant in North America: *Apocynum* was formerly used as a fiber plant and is the source of alkaloids and glycosides of theoretical interest in medical research. *Asclepias*, common weeds of waste places in North America, are rarely cultivated, although species have been offered by dealers in native plants (Bailey 1947).

Table 2. Feeding and survival of *C. euphorbiae* larvae on latex and rubber plants.

Plant		1st instar larvae			3rd instar larvae		
Family	Species	No	Feeding Response	No Pupating	No	Feeding Response	No Pupating
Compositae	*Solidago* sp.	5	0	0	5	0	0
	Latuca sativa	9	0		4	0	
		1	*		1	***	0
Asclepiadaceae	*Asclepias syriaca*	2	0		7	0	
		3	*	0	2	*	
					1	**	0
Moraceae	*Ficus* sp.	5	0	0	5	0	0
Araceae	*Syngonium podophyllum*	5	0		5	0	0
Anocynaceae	*Apocynum androsaemifolium*	12	***		5	0	0
		2	****a	0			

0 - No feeding.
* - Nibbling, under 5 mm^2 eaten.
** - Unsustained feeding, up to 2 cms^2 eaten.
*** - Sustained feeding prolonging larvel life, but not maintaining growth.
**** - Sustained feeding accompanied with larval growth.
a - Reached 2nd instar.

Food plants of closely releated sphingids

Most of the species in the genus *Celerio* and of the closely related genera *Deilephila* and *Hippotion* feed on one or more of the following plants: *Vitis*, *Epilobium, Fuchsia, Galium* and *Lythrum*. Unrelated plants may be attacked by some of the more polyphagous species but this is not the rule. Merz (1959) tested *C. euphorbiae* on various plants and found that the older larvae could not be induced to feed in confinement on approximately the same range of plants as other species of *Celerio*. Several of these plants were retested in this study. Table 3 shows that it was possible to rear the larvae on *Lythrum salicaria*, although this was accompanied by heavy mortality and slow development. The duration of the larval stage at 30º C was 22 days compared with 15 days on *E. esula*. The larvae also fed extensively on young grape foliage obtained by incubating dormant twigs during the winter, but grape foliage obtained during the summer was only sparingly eaten. Presumably normal grape foliage has a deterrent that inhibits larval feeding. There was no visible nibbling on any of the remaining plants, although on *Genothera*, *Lonicera* and *Symphoricarpo* several first instar larvae produced minute specks of frass before they died.

The results in Table 3 differ from those given by Merz in two respects: the older third instar larvae were no more inclined to feed on the test plants than the first instar larvae, and the overall feeding range was much narrower. The probable explanation of these differences is that Merz's "older larvae" were in the last instar. Mature larvae are much more inclined to eat non-host plants in confinement even if only to obtain enough moisture and sustenance to form a starvation cocoon. To check this hypothesis five mature larvae were put on *Fuchsia*: three of them did not eat, one nibbled, and one ate several leaves before dying.

Table 3. Host plants of other Celerio, Deilephila and Hippotion species

Family	Plant Genus	Species	1st instar larvae No	Feeding Response	No Pupating	3rd instar larvae No	Feeding response	No Pupating
Lythraceae	Lythrum	salicaria	3	*		8	0	
			2	**		1	*	
			4	***	3	1	**	0
Vitaceae	Vitia	riparia (summer	4	0		3	0	
		foliage)	1	*	0	6	*	
		(bursting buds)				1	**	0
						5	****	a
Caprifoliaceae	Lornicera	tartarica	2	0				
			6	*	0	5	0	0
	Symphoricarpus	albus	10	*	0	5	0	0
Onagraceae	Epilobium	angustifolium				5	0	0
	Oenothera	biennis	3	0				
			7	*	0	5	0	0
	Fuchsia	hybrida	10	0	0	1	0	0

0 - No feeding.
* - Nibbling, under 5 mm^2 eaten.
** - Unsustained feeding, up to 2 cms^2 eaten.
*** - Sustained feeding prolonging larval life, but not maintaining growth.
**** - Sustained feeding accompanied with larval growth.
a - Foliage obtained by incubating dormant twigs. Rearing terminated after 7 days for lack of foliage.

Economic Plants

C. euphorbiae larvae were tested on the standard series of economic plants that we have used for screening other insects introduced for the biological control of weeds. The plants were chosen to represent some of the most important families of agricultural plants grown in Canada. Table 4 shows that the larvae did not feed on any of the test plants, although bean and apple were nibbled. It was also noticed that on apple the nibblings had been spat out as if distasteful.

Summary of feeding tests

The feeding test showed that *C. euphorbiae* is highly restricted in the plants that it will eat, even under the pressure of confinement and starvation. The larvae could be reared on spurge in the subgenus *Esula* and possibly in the subgenus *Agaloma*. Other subgenera of spurge tested were marginal or submarginal hosts. The larvae could be reared with difficulty on *Lythrum salicaria*, and they fed but could not be reared on *Lactuca*, *Vitis*, *Asclepias* and *Apocynum*. Thus the most favoured plants and the only ones likely to be attacked in the field are a group closely related to *E. cyparissias*; but the larvae can also be induced to feed on some unrelated plants that contain latex and on some of the favoured host plants of related moths. To the extent that the tests showed that the larvae fed on three groups of plants they are unsatisfactory unless supported by more evidence to relate these groups or explain this pattern of feeding. Thus an investigation was made into the chemical basis of host specificity in *C. euphorbiae* larvae.

Table 4. Feeding and survival of *C. euphorbiae* on representative economic plants.

		1st instar larvae			3rd instar larvae		
Family	Species	No	Feeding Response	No Pupating	No	Feeding Response	No Pupating
Gramineae	Wheat	5	0	0	5	0	0
Chenopodiaceae	Mangel	5	0	0	5	0	0
Cruciferae	Radish	5	0	0	5	0	0
Rosaceae	Apple	5	0	0	2	0	
					3	*	0
Leguminosae	Bean	2	0		5	0	0
		3	*	0			
Umbeilifera	Carrot	5	0	0	5	0	0
Binaceae	Flax	5	0	0	5	0	0

0 - No feeding
* - Nibbling, under 5 mm^2 eaten.

The basis of food selection by *C. euphorbiae* larvae

The purpose of this part of the study was to determine if *E. cyparissias* contains a chemical substance that makes it one of the preferred food plants of *C. euphorbiae*. Recent studies by Hamamura *et al*. (1962) indicate that substances such as sugar, cellulose and inositol are release stimuli, or triggers, for biting, chewing and swallowing. Normal feeding occurs only if the correct series of these stimuli, which may be visual and tactile as well as chemical, are present. The polyphagous insect utilizes a series of stimuli common to most plants and consequently will feed on most plants unless they contain a repellent or deterrent. Preliminary studies on host selection in a polyphagous insect were reported by Goodhue (1963) for *Schistocerca gregaria*. Monophagous insects utilize many of these widely-distributed stimuli but have an additional requirement that is restricted to a small group of plants. Thus, *Calophasia lunula* would only eat extracts of *Linaria* if sucrose was added (Harris 1963). Another example reported by Frankel (1963) is the Catalpa sphinx which feeds only on plants containing catalpaside; but if extracts containing this substance are smeared on lettuce, bean, or cabbage, these plants are readily consumed. Studies such as Fraenkel's, which relate host specificity to the presence of certain chemical substances, should become standard procedure for establishing the safety of an insect for weed control.

The acceptability of various extracts and fractions of *E. cyparissias* was measured by incorporating them in a nutritative agar diet and giving the larvae a choice between diet with and without the test extract or a choice between mutually exclusive fractions. The larvae, 4th or 5th instar, were confined individually in petri dishes for the test and a record was kept of which diet was most extensively eaten in 24 hours. Invariably some larvae near the end of the instar moulted or started to pupate instead of feeding, and larvae stored too long at 13º C would not feed even on fresh foliage, but the number not feeding does not affect the ratio selecting each diet. The agar diet used is described by Berger, (1963), except for the omission of the anti-microbial agents included in his diet. This diet is readily accepted by lepidopterous larvae and can be used for rearing most species.

Two extracts of *E. cyparissias* contained substances selected by the larvae in feeding tests, but neither of them was volatile or aromatic so it is likely that the moth, which is active at night, uses another substance for finding its host plant. One of the extracts was made by boiling the foliage in water and was partially purified by dialysis. The undialysable fraction, (the preferred fraction) was passed through DOWEX 2 and DOWEX 50 ion exchange resins. The active substance was removed by the anion exchange resin but was not absorbed by the cation exchange resin as shown by the following feeding test: 22 larvae selected the cation exchange fraction, 1 selected the anion exchange fraction and 2 fed on both fractions. Thin layer chromatography showed that the cation exchange fraction contained a number of different substances but the amounts separated of each were too small for further feeding tests. The partially purified water fraction still retained the immobilizing effect when injected into the larvae that was noted by Potier and Busnel (1951) when they injected spurge juice. This effect is possibly due to an acetyl-choline-like substance in *E. cyparissias* that causes the skin irritation in humans (Geisler 1955).

A diethyl ether extract of *E. cyparissias* foliage dried at 100º C was also selected by the larvae in feeding tests. The active material was not isolated but tests were made to eliminate several classes of compounds. Thus the fact that the substance remained in the ether fraction after saponification indicates that it is not an acid or phenol (Test no. 1 in Tables 5 & 6). The active substance was absorbed in a slurry of silicic acid in pentane from which it was eluted with difficulty with a mixture of ethyl alcohol and diethyl ether (Test no. 4), indicating that it is not a hydrocarbon. This is also indicated by the destruction of the substance with potassium permanganate when this reaction was completed and the fact that I could not obtain urea adducts. The substance was also not precipitated with sodium bisulphite or sodium sulphite, indicating that it is unlikely to be an aldehyde or ketone (Tests no. 7 & 8). It was not removed by precipitation with cigitonin, indicating that it is not a 3B-hydroxy sterol. Finally it was not affected by acetylation with acetic anhydride (Test no. 9), but this treatment does not affect many of the tertiary alcohols. An extraction with water (Test no. 10) was included to show that the substance in the ether extract is different from the active substance in the water extract. These methods for eliminating specific chemical groups are by no means complete, but the tests do clearly demonstrate the presence of feeding release stimuli that can probably be isolated.

Table 5

1500 grams of *E. cyparissias* dried at 100° C	
Extracted with diethyl ether	
18.6 grams (Fraction la)	
Saponified	
9.6 grams unsaponifiables (Fraction 2a)	Saponifiables (Fraction 2b)
Filtered at -12° C	
6.6 grams Solubles (Fraction 3a)	Insolubles (Fraction 3b)
Adsorbtion on Silicic acid	
Adsorbed compounds (Fraction 4a)	Unadsorbed compounds (Fraction 4b)
Precipitation with digitonide	Digitonides (Fraction 5b)
	Non-digitonides (Fraction 5a)
	Addition of KMn04 Solubles (Fraction 6a)
Precipitation with Sodium bisulphite	Non-aldehydes (Fraction 7a)
	Aldehydes (Fraction 7b)
Precipitation with Sodium sulphite	Non-aldehydes + non-ketones (Fraction 8a)
	Aldehydes + keytones (Fraction 8b)
Acetylation with Acetic anhydride	(Fraction 9)
Extraction with water	Water insolubles (Fraction 10a)
	Water solubles (Fraction 10b)
Extraction with Petroleum ether	Solubles (Fraction 11d)
	Insolubles (Fraction 11b)

Table 6. Number of fourth or fifth larvae feeding on each of the following paired Euphorbia extracts incorporated in a nutritative agar diet.

	Test	a	b	both	No larvae tested*
Fraction	1a vs basic diet	24	3	2	42
	2a vs 2b	15	2	2	20
	3a vs 3b	6	0	0	14
	4a vs 4b	7	1	0	25
	5a vs 5b	5	1	0	10
	6a vs basic diet (KMn04 reaction incomplete)	8	1	1	11
	7a vs 7b	7	0	0	10
	8a vs 8b	8	0	0	10
	9a vs basic diet	7	1	0	10
	10a vs 10b	6	0	0	10
	11a vs 11b	6	0	0	10

* The difference between the total number tested and the sum of the other columns is the number of larvae not feeding within 24 hours.

It cannot be determined whether the host range of *C. euphorbiae* is restricted by the presence of one or both of the substances from *E. cyparissias* until they have been isolated; however, it is possible to investigate the role played by these substances. They are not essential for nutrition or for feeding to occur, as *C. euphorbiae*, in common with most, if not all other lepidopterous larvae, can be reared on the basic diet without the addition of any plant extract. The substance is not a feeding stimulant as the larvae ate almost identical amounts per day in the fifth instar regardless of whether the ether extract was included in the agar diet (Table 7). It is probable that with most other so-called "feeding stimulants" the reaction is independent of the size of the stimulus, so that they should be called feeding release stimuli. The ether extract of *Euphorbia* did overcome to some extent the deterrent effect of methyl parahydroxybenzoate in the diet (Table 7), but the difference is not so much that they ate faster when the extract was included but that they started feeding sooner.

Table 7. Average daily consumption and weight gain of fifth instar *C. euphorbiae* larvae on a nutritive agar diet with various additives.

The larvae were kept in petri dishes and the agar diet changed and weighed daily. The diet suffered a loss of approximately 0.18 grams per day from evaporation. The larvae were weighed at the beginning of the experiment and on death, on reaching the prepupal stage or after 5 days, whichever was first.

Additives in agar diet	Average larval consumption per day	Average larval weight gain per day
Ether extract of spurge	1.65 ± 0.26	0.47 ± 1.10
No additives	1.67 ± 0.26	0.32 ± 0.05
Antimicrobial agents*	0.29 ± 0.14	0.04 ± 0.03
Ether extract if spurge and antimicrobial agents.	0.75 ± 0.21	0.24 ± 0.05
Ether extract of Hypericum	0.18 ± 0.01 (no feeding)	-0.09 ± .01
Ether extract of Hypericum and ether extract of spurge	0.18 ± 0.01 (no feeding)	-0.09 ± .01

* 0.15 grams methyl parahydroxybenzoate and 0.03 grams Aureomycin was added to the diet of Berger. (1963).

The major role of the substances in the two extracts seems to be in food recognition. The normal behaviour of a hungry larvae is to walk; in the petri dishes they walked around and over food in the form of the agar diet for several hours, many without attempting to even bite it, but when a piece of spurge is put in the dish they immediately stop walking and start feeding. To a lesser extent, the same reaction happens when the hungry larva is given the spurge extracts in the agar diet, as shown by the selection of this diet over the control in the feeding tests in Table 6. That the extracts contain factors by which the larvae recognize their food that they do not result in feeding or even holding the larvae in the vicinity which they are supported by other feeding stimuli. However, as starvation progresses, the need for the specific spurge factor is replaced by other more general release stimuli such as certain sugars and salts. These stimuli will result in more feeding providing there is no strong repellent or deterrent. The larva partly satisfies its immediate hunger and then resumes walking. Ordinarily this means that the larva wanders away but in the petri dish it returns again to the same food. Gradually the larva becomes accommodated and settles down to feed normally, providing the food is nutritionally satisfactory. This type of accommodation was also found in *Calophasia lunula* which, when placed on an open grown snapdragon, wandered away after a few bites, but when confined with snapdragon in a petri dish, could be reared to maturity (Harris 1963). Accommodation must be a rare occurrence in the field or there would be no such thing as a monophagous insect; presumably in the field the wandering larva is subjected to changing stimuli and so does not become accommodated. Furthermore, most plants have an insect deterrent, often an aromatic chemical substance, which protects them against all insects not adapted to this deterrent. For example, when an ether extract of *Hypericum perforatum* was incorporated in the agar diet it was not eaten by *C. euphorbiae* regardless of whether or not the spurge extract was present (Table 7) but this *Hypericum* extract was not deterrent to *Anaitis plagiata* or *Semasia hypericana*, two lepidoptera that normally feed on *Hypericum*. The immunity to specific plant deterrents is obviously inherited in insects so that it is not surprising when closely related species show the same immunity. This is the explanation for *C. euphorbiae*, under the pressure of starvation and confinement, feeding on grape, *Lythrum*, and other favoured host plants of related sphingids, but as these plants are not attacked in the field they presumably lack the specific feature by which the larvae recognize their food.

Summary

C. euphorbiae, a common moth over a large part of Europe and Asia, is mentioned frequently in the literature as being specific to the genus *Euphorbia*. One record of the moth attacking *Apocynum sibiricum* was found, but this is apparently an uncommon occurrence, as it is not mentioned in other papers discussing the insects attacking *Apocynum*. It was shown with feeding tests that within the genus *Euphorbia* the moth could be reared on closely related species but not on more distant species. It was also reared on *Lythrum salicaria* and ate several other plants such as grape, *Fuschia, Apocynum* and *Asclepias*, all of which are either the favored host plants of related species of sphingids or contain latex. To explain this feeding range, even though the plants were not suitable for rearing the insect, it is necessary to consider the basis of host selection in phytophagous insects. Briefly, feeding can be thought of as a chain of behaviour responses released or triggered by a series of stimuli. In a polyphagous insect the release stimuli are characters common to many plants and the rejection of a plant usually indicates a repellent or deterrent. In a monophagous insect the first links in the chain, host plant recognition, are initiated by characters restricted to a few plants, but the subsequent chain involving ingestion is much the same as for the polyphagous insect. Accommodation brought about by confining a monophagous insect to a certain plant or food gradually overcomes the lack of the specific release stimulus providing there are no deterrents and the remaining links of the chain are present, feeding may occur. It can be expected that the same plants will lack deterrents for closely related species of insects.

Attempts to isolate the specific chemical involved in host plant recognition were only partly successful. It has been shown that an ether and a water extract of *E. cyparissias* contain different substances that help initiate feeding on a nutrient agar gel. These ex-

tracts have been partially purified, but no active components have been isolated, largely due to the difficulty of bioassay on the larva.

Recommendations

The moth *Celerio euphorbiae* is likely to attack all *Euphorbia* in the subgenus *Esula*. If there are any plants in this subgenus of potential economic importance in North America, the moth should not be introduced. If there are plants of potential economic importance in other subgenera of *Euphorbia* they should be subjected to feeding tests before a decision is made to introduce the moth. Possible uses of *Euphorbia* mentioned in the literature are as a source of fast-drying oils, pharmaceuticals, rubber, pulp fiber and a base for chewing gum. As far as I am aware, none of these uses has proved to be practical, and enquiries made in Canada have not revealed any economic interest in the genus, but I have not made enquiries in the United States. Apart from reservations about some species of *Euphorbia* I believe that the moth can be liberated in Canada without danger that it will attack any plant other than the two noxious weeds *E. cyparissias* and *E. esula*. Furthermore, *C. euphorbiae* is the most promising insect for biological control of a weed in Canada that I have come across.

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