STUDIES ON PARASITES OF ROOT MAGGOTS (*HYLEMYA* SPP.; DIPTERA: ANTHOMYIIDAE) IN THE NETHERLANDS IN RELATION TO THEIR CONTROL IN CANADA [1])

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INTRODUCTION

Investigations of the biotic factors acting against root maggots (*Hylemya* spp.) are being conducted in Canada and in Europe as part of a general study of maggot control on cruciferous crops by the Division of Entomology. The purpose of the work is to discover whether parasites or other biotic agents are present in Europe which are not present in Canada and which might, if introduced, assist in the control of the maggots. It has been assumed that the maggots were introduced from Europe and that it is there that useful biotic agents are most likely to be found.

The most important species of maggots attacking cruciferous crops in Canada, as in Europe, are *Hylemya brassicae* (BOUCHÉ) and *Hylemya floralis* (FALL.). In Canada both species attack, in varying degrees, all varieties of *Brassica oleracea* L., *Brassica napobrassica* MILL., and *Raphanus sativus* L. Although the seed-corn maggot, *Hylemya cilicrura* (ROND.), is widely distributed it is not of primary importance on cruciferous plants. Damage to cruciferous crops from root-maggot attack has increased in Canada during the past few years and economic losses occur wherever these crops are grown. The problem has become more acute because of the recent increase in the production of rutabagas for table use. When these are used for cattle fodder a few maggots are of little significance but when they are for human consumption maggot damage lowers their value. Although commercial control can be obtained with insecticides on cabbage, cauliflower, and radish, satisfactory control of the maggots on rutabagas has not been developed.

Insect parasites of *Hylemya* spp. have been recorded by many workers in Europe. From an examination of the literature 18 species have been listed for *H. brassicae* alone. These records, however, give little precise information on the importance of the species or their interrelations. In many cases the host records are somewhat doubtful since most of the rearing appears to have been done in bulk and the identity of the host puparia was uncertain. Also, investigation has shown that many of the parasites listed are conspecific.

METHODS

Exploratory work in Europe was started in 1950, when a general survey was conducted bij one of the authors (WISHART) in France, Belgium, The Nether-

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lands, England, Scotland, Denmark, Sweden, and Norway. The following year the survey was extended and intensive studies were carried out in The Netherlands by Mr E. H. COLHOUN. Study plots were established near Wageningen, where observations were made on the biology of the host, the most important parasites, and the ecological factors governing their abundance. Large scale collections of puparia were made in the principal areas in The Netherlands where cruciferous crops are grown. The puparia were shipped by air express to Belleville, where they were placed in individual vials for incubation. The parasites and hosts obtained were identified.

RESULTS AND DISCUSSION

In the general survey in 1950 three parasites – two staphylinids, *Aleochara bilineata* GYLL. and *A. bipustulata* (L.), and a cynipid, *Trybliographa* (*Cothonaspis*) *rapae* (WESTW.) – were found widely distributed and in considerable numbers. In The Netherlands in 1951 approximately 17,000 puparia were collected from 14 localities (Table I).

TABLE I. Parasites reared from *Hylemya brassicae* and *Hylemya cilicrura* puparia collected in The Netherlands, 1951

Locality	Number of puparia incubated	Percentage of Host species		Percentage of *Hylemya brassicae* parasitized					Percentage of *Hylemya cilicrura* parasitized				
		Hylemya brassicae	*Hylemya cilicrura*	*Aleochara bilineata*	*Aleochara bipustulata*	*Trybliographa rapae*	Other parasites	Total	*Aleochara bilineata*	*Aleochara bipustulata*	*Trybliographa rapae*	Other parasites	Total
Huissen	1660	96.7	3.3	18.64	1.51	25.63	0.02 [1)2)]	45.80	1.85	0	18.52	3.70	24.07
Vleuten	744	98.5	1.5	2.88	0.26	20.16	0.28 [2)]	23.58	0	0	9.09	0	9.09
Grubbenvorst	977	98.7	1.3	1.45	0	6.95	0	8.40	0	0	0	0	0
Oosterbeek	2191	98.6	1.4	26.57	0.32	7.11	0.04 [2)]	34.04	33.33	3.33	6.67	0	43.33
Naaldwijk	1284	93.9	6.1	5.01	1.74	14.87	0.17 [3)]	21.79	6.33	0	5.06	1.27	12.66
Kampen	158	98.1	1.9	11.04	0	12.99	0	24.03	33.33	0	33.33	0	66.66
Utrecht	314	99.4	0.6	1.29	0.32	7.39	0	9.00	0	0	0	0	0
Venlo	2014	95.9	4.1	31.45	1.14	2.41	0	35.00	47.50	21.25	2.50	0	71.25
Heveadorp	2320	99.2	0.8	10.26	0.65	7.82	0.04 [1)]	18.77	31.58	0	0	0	31.58
Ruurlo	3683	99.6	0.4	0.82	0	28.39	0.08 [2)]	29.29	0	0	0	0	0
Wageningen	258	98.8	1.2	18.89	0.39	33.85	1.56 [2)]	54.69	33.33	0	66.67	0	100
Bennekom	668	60.1	39.9	38.50	3.25	5.50	0	47.25	17.36	5.28	9.81	0	32.45
Groningen	600	99.5	0.5	15.35	0	29.17	2.19 [3)]	46.71	33.33	0	0	0	33.33
Warmenhuizen	88	98.7	1.3	17.86	0	22.62	1.19 [3)]	41.67	0	0	0	0	0

[1)] *Aphaereta* sp. [2)] *Phygadeuon* sp. [3)] Unidentified

The most abundant maggot species was *H. brassicae*, which constituted over 95 per cent of the population in most areas. The only exception was at Bennekom, where 40 per cent of the puparia were of *H. cilicrura*.

The data give only an approximation of the relative abundance of the parasites in the field. *H. brassicae* and *H. cilicrura* appear to be parasitized by the same species and to about the same extent, although the data for *H. cilicrura* are not reliable because of the small numbers of this host examined. The most important parasites and clearly the most abundant species from both hosts were *A. bilineata*, *A. bipustulata*, and *T. rapae*. These were recorded previously by DE WILDE

(1947). The average parasitism of *H. brassicae* was 31 per cent, with a maximum of 54 per cent at Wageningen. *A. bipustulata* was the least abundant of the three important parasites but it was four times as abundant on *H. cilicrura*, the smaller host, as on *H. brassicae*; when found on *H. brassicae*, it was usually on puparia smaller than normal. The staphylinids may parasitize the puparia at any time when these are in the ground. If puparia are collected shortly after they are formed, as some of those collected probably were, some parasite attack will be missed. All the parasitization by *A. bilineata* and *A. bipustulata* is, therefore, not accounted for. *T. rapae* attacks the larvae and when the hosts are collected as puparia all parasitism by this species is included.

The biology of *A. bilineata* has been studied by COLHOUN (1953) and that of *T. rapae* by WISHART and MONTEITH (in preparation, a). It was found by WISHART and MONTEITH (in preparation, b) that competition occurs between *A. bilineata* and *T. rapae* and that this is harmful to both species but particularly to *T. rapae*.

Two other parasites, *Phygadeuon* sp. (Ichneumonidae) and *Aphaereta* sp. (Braconidae), were found in small numbers. Though these are definitely primary on *Hylemya* spp., their relative scarcity on the maggots suggests that they have more favoured hosts.

In Eastern Canada the populations of *H. brassicae* are similar to those occuring in The Netherlands. Any differences in commercial damage in the two countries appear to be due to variations in cultural practices rather than to differences in maggot populations. The three parasite species which are numerous in The Netherlands are present in Canada and their degree of attack does not differ significantly. The possible usefulness in Canada of *Phygadeuon* sp. and *Aphaereta* sp. is being investigated.

SUMMARY

Populations of *H. brassicae* in The Netherlands are similar to those in Eastern Canada. The most abundant parasites in The Netherlands are *A. bilineata*, *A. bipustulata*, and *T. rapae*. These are found in Canada. The investigations have tended to reduce rather than increase the number of parasites which can definitely be attributed to *H. brassicae*.

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LITERATURE

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WISHART, G. and A. ELIZABETH MONTEITH – In preparation, a. Trybliographa rapae (Westw.) (Hymenoptera: Cynipidae), a parasite of Hylemya spp. (Diptera: Anthomyiidae).

WISHART, G. and A. ELIZABETH MONTEITH – In preparation, b. Competition between a coleopteran and a hymenopteran parasite of root maggots (Hylemya spp.) (Diptera: Anthomyiidae).

AGROMYZA NIGROCILIATA HENDEL ALS GETREIDESCHÄDLING (DIPT.)

(mit 3 Text-Abbildungen)

VON

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Eine Art der blattminierenden Agromyziden, *Agromyza niveipennis* ZETT., ist seit längerer Zeit als Getreideschädling bekannt. VENTURI (1939, Redia 26, p. 47–52) hat über ihre Lebensweise und ihr Auftreten an Avena in Toscana eingehend berichtet. Sie ist im Larvenstadium durch einen kleinen dritten Zahn an jeder Mandibel von den meisten an Gramineen lebenden *Agromyza*-Arten leicht zu trennen. Diese Art galt bisher als die einzige, die nennenswerten Schaden bei Massenauftreten an Getreide verursacht. Bei einer um die Mitte Juni vorgenommenen Untersuchung der Getreidefelder von Kunnersdorf bei Görlitz konnte ich dort an Weizen und Roggen ein Massenauftreten einer *Agromyza* in den Getreideblättern feststellen; da die dort gefundenen Larven den dritten Mandibel-Zahn besaszen, glaubte ich, sie zu der genannten Art stellen zu müssen. Die Zucht ergab jedoch ausnahmslos *Agromyza nigrociliata* HENDEL, 1931, eine Art, deren Lebensweise bisher unbekannt geblieben war, die von Wien und Ungarn beschrieben worden war und nun so viel weiter nördlich festgestellt werden konnte. Bei der groszen Ähnlichkeit beider Arten in Larve und Imago soll die nun neu als Schädling aufgetretene Art genauer gekennzeichnet werden.

Agromyza nigrociliata HD. ist sicher am gemeinsamen Vorkommen folgender Merkmale zu erkennen: Das 3. Fühlerglied ist vorn gerundet, die Wangen stehen im Profil vor den Augen vor, sind so breit wie das 1. Fühlerglied. Thoraxrücken glänzendschwarz, mit mehr als 4 nach vorn an Länge abnehmenden Dorsocentralborsten. Im Flügel reicht die Vorderrandverdickung (c) nur bis zur 3. Längsader (r_{4+5}), die Schüppchen sind gelbbräunlich bis schwärzlich gewimpert. Die Mitteltibien tragen posterodorsal 2 abstehende Borsten. *A. niveipennis* ZETT. unterscheidet sich von ihr durch oben vorn geecktes 3. Fühlerglied und schneeweisze Schüppchenwimpern. Nach diesen Merkmalen sind die auf Getreide gefangenen beiden *Agromyza* eindeutig zu bestimmen.

Die ersten Larven erscheinen in der ersten Junihälfte. Sie minieren in den unteren Blättern von Roggen und Weizen sowie von Wildgräsern am Rande der Getreidefelder. Nach der Monatsmitte kann man einen zweiten „Schub"