ABUNDANCE OF APHIDS AND SOME INSECTS THAT PREY ON THEM IN SUFFOLK, AS SHOWN BY CATCHES ON STICKY TRAPS

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OCCASIONALLY aphids ("greenfly" or "blackfly"), or the insects such as coccinellid beetles ("ladybirds") and syrphid flies '('hover-flies") that prey on them, are so numerous as to be news-worthy and are reported in the press or on the radio. In 1970, green aphids were unusually abundant in the air during mid-July and gave rise to newspaper headlines such as: "Greenfly invasion puts holiday-makers to flight" (*Daily Express*, 18th July) and "*Super-breed* of greenflies can't be halted" (*Sunday Mirror*, 19th July). Most of these aphids, which caused annoyance to many holiday-makers in Suffolk, Norfolk, and elsewhere, were *Metopolophium dirhodum* the "rose-grain aphid", which bred in large numbers on the leaves of cereals during 1970.

Insects that prey on aphids are also sometimes seen in vast numbers. For example, Dunning (1869) reported countless syrphids at Walton-on-the-Naze during August, 1869, and George (1960) and Johnson (1961) reported a similar "plague" at East Coast towns in early August, 1960. Baron de Worms (1961) described a plague of ladybirds on the East Coast in 1961. It is impossible to estimate the actual numbers of insects creating these plagues, but some indication of the increase or decrease of the population in recent years is given by the numbers that are caught in traps.

Sticky yellow cylindrical traps (Broadbent *et al.*, 1948) have been operated each year since 1961 in sugar-beet fields in East and West Suffolk (part of a series of such traps in Central and Southern England) to determine when aphids were flying, and these traps also catch some aphid predators. One trap was always on the farm of Broom's Barn Experimental Station at Higham, near Bury St. Edmunds (although not always in the same field), and another on one of several farms within a ten mile radius and to the south and west of Ipswich. The traps were always sited well away from hedges and trees and on a post five feet from the ground. The beet in the fields containing the traps seldom became heavily infested with aphids as the growers treated the crops with insecticides when they considered it necessary to do so but, as the traps caught insects flying or blown by the wind from neighbouring fields, in addition to those flying within the field itself, they show the relative numbers of small insects flying each year.

The sticky covers of the traps were changed weekly and the aphids, coccinellid beetles, syrphid flies, chrysopids ("lace-wings"

or "golden-eyes") and other predators of aphids counted. The *Aphis fabae* (the "black bean aphid") and *Myzus persicae* (the "peach-potato aphid"), both of which attack sugar-beet plants, were counted separately, as were the different species of ladybirds.

Aphids

The mass flight of aphids reported by the press in July, 1970, was assumed to have been an invasion from Northern France, but I think it equally probable that they left ripening cereals in East Anglia and landed on the coast. Some may even have been blown out over the North Sea and then back to be deposited on the coastal strip; winds blow in from the sea along the East Coast most of the time. More *M. dirhodum* were trapped during 1970 than during any year since 1961 (Heathcote, 1970); they formed 50% of the total catch of aphids at Broom's Barn in the week ending 13th July, and 36% of the catch of the week ending 20th July.

Although very many *M. dirhodum* and many *A. fabae* were trapped during 1970 (TABLE 2), the total catch of aphids was not exceptionally large. Three times as many aphids were trapped during 1961 as during 1970, but although many *M. dirhodum* were trapped then at Broom's Barn, other aphids formed a large proportion of the catch. At Ipswich, *Cavariella aegopodii* (the "willow-carrot aphid") and *Hyalopterus pruni* (the "mealy plum aphid") were unusually abundant in 1961. The years in which one species of aphid is abundant are not necessarily those in which all aphids are abundant. The total number of aphids trapped each year from 1961-1970 is shown in TABLE 1.

Coccinellids

Ladybirds eat many aphids, and might be expected to play a large part in controlling aphid populations. For example, given limitless food, Ellingsen (1969) found that *Adalia 2-punctata* ("two-spot ladybird") ate on average 188 *M. persicae* during its larval life, and two adults ate 3,096 aphids during two months. However, it cannot be assumed that all species of ladybirds will attack all species of aphids. Some species of aphid are actually poisonous to some ladybirds. For example, *Aphis sambuci* (the "elder aphid"), which is eaten by *A. 2-punctata*, contains a glycoside (sambunigrin) that is poisonous to *Coccinella 7-punctata* (the "seven-spot ladybird"). As might be expected, the highly-coloured aphids are usually the poisonous ones, just as the brightly-coloured ladybirds are distasteful to birds (ladybirds give out an unpleasant glandular secretion from the joints of their legs when disturbed).

Different species of ladybirds tend to live in different kinds of surroundings and not all colonise arable fields equally. *A. 2-punctata* feed at shrub level (e.g., attacking blackfly *A. fabae* on spindle bushes), whereas *C. 7-punctata* occur near the ground on herbaceous plants (Blackman, 1967) (e.g., on fat-hen *Chenopodium album* infested with blackfly). My sticky traps do not catch all species of ground-living ladybirds, for some do not fly. *Rhyzobius litura* is wingless, but was one of the commonest species recorded by Eastop and Pope (1969) near Kew Gardens. TABLE 3 lists the commoner species of ladybirds caught in Suffolk.

In England, ladybird adults hibernate (hidden in plant debris under trees for example), emerge during late April or early May, feed actively and then lay eggs in groups of from about six to ten on leaves of aphid-infested plants. The bright yellow, barrel-shaped eggs hatch to give active black and yellow or black and white spotted ("warning-coloured") larvae, little cannibals whose first act is often to eat any unhatched eggs. When fully grown, the larvae pupate, and emerge as adults during July. As the larvae, the adults eat aphids, but pollen and fungi form part of their diet. They store fat in their bodies and hibernate late in autumn. In England, *C. 7-punctata* does not lay eggs during the summer, but *A. 2-punctata* may have two generations each year.

There is evidence that there are alternate early and late "ladybird years", associated with alternate "aphid" and "non-aphid" years (Eastop and Pope, 1969). When many ladybirds hibernate, many may emerge in spring and destroy aphid colonies. This leaves little food for ladybirds later in the year, so many starve and few remain to hibernate. Next year, few ladybirds emerge from hibernation, so aphids can multiply rapidly and there is ample food for ladybirds later in the year. TABLE 1 suggests that early and late cycles of ladybirds do not always alternate; if they do, the sticky traps catch too few beetles to show the cycles.

Syrphids

The larvae of some fifty-four "common" or "frequent" British species of hover-flies prey on aphids (Coe, 1953), but the adults feed only on "honeydew" of aphids, nectar, and pollen. A *Syrphus corollae* larva may eat an average of 867 medium-sized aphids during the ten days of its development (Bombosch, 1962). Syrphid adults need a landscape with flowers, and they lay their eggs mainly near aphids (Chandler, 1968). The larvae, which are maggot-like and eye-less, find their prey by touch (as do ladybird larvae). Aphids do not attempt to escape when approached by larval syrphids. When mature, the larvae form drop-shaped pupae attached to leaves. The wasp-like adults that emerge are strong, active fliers. In August, 1969, very many hover-flies made

their way into houses and some people were frightened by what they thought to be wasps, but hover-flies do not sting (TABLE 1).

Chrysopids

The larvae of lacewings also eat aphids, seizing them in their long curved jaws and sucking out their body contents, leaving behind an empty skin. When still they are not easily seen, for some camouflage themselves by fixing debris to long hairs on the upper surface of their bodies, but they can move rapidly. Chrysopid adults are better known, and have bright green bodies, delicate, lace-like wings, and large golden eyes. Chrysopid eggs are fixed to leaves by long stalks, out of reach of their parasites and predators.

I have not caught many lacewings on sticky traps in Suffolk (TABLE 1), and their larvae probably play little part in controlling aphid populations. However, many adults were flying during mid-October, 1970. Forty-three were caught in a light trap on 13th October, and seventy-four in a large suction trap operating at 40 feet on 14th October at Broom's Barn.

Control of aphids and virus disease by insect predators

In addition to damaging plants by their feeding, aphids can transmit viruses from infected to healthy plants of many different kinds. One such virus causes yellows of sugar beet, a damaging disease. The percentage of sugar beet plants with yellows (as estimated by fieldmen of the British Sugar Corporation) each year from 1961 to 1969 is shown in TABLE 2, as an average of the estimates from the Bury St. Edmunds and Ipswich Sugar Factory areas. Yellows spread widely in 1961, a year in which some aphids were very numerous, but *M. persicae* not especially so (athough this is the main virus vector), and neither the number of aphids nor predators trapped is clearly related to the extent to which virus spread in any year.

Conclusions

Most predators of aphids were trapped, and have been seen in large numbers, only after the aphid population had begun to decline in late July (TABLE 4), but the most effective control of aphid populations by insect predators probably takes place early in the season when they are relatively few but active, and the aphids are just beginning to colonise crop plants. None of the predators mentioned here harm man, but there is little evidence that they play an important part in controlling aphids when these pests are multiplying rapidly.

TABLE 1

Total numbers of aphids and some insects that prey upon them trapped in Suffolk, 1961-70.

Year	Aphids	*Ladybirds* (*total catch*)	(*catch to end of June*)	*Hoverflies*	*Lacewings*
1961	33,797	133	(10)	8	39
1962	5,092	12	(4)	4	16
1963	16,906	42	(13)	109	5
1964	3,627	24	(5)	1	37
1965	6,085	17	(7)	4	3
1966	4,747	4	(1)	12	4
1967	10,501	9	(0)	3	9
1968	4,291	35	(3)	36	0
1969	19,797	26	(2)	291	6
1970	10,531	148	(12)	15	12

TABLE 2

Percentage of sugar-beet plants with yellows at the end of August and annual catch of *A. fabae* and *M. persicae* in Suffolk.

Year	% *plants with yellows*	*A. fabae* (*blackfly*)	*M. persicae* (*greenfly*)
1961	40·1	976	99
1962	4·2	538	143
1963	4·2	4,064	38
1964	3·7	246	41
1965	9·5	1,078	209
1966	19·4	385	15
1967	17·6	530	20
1968	7·6	64	49
1969	7·5	3,201	57
1970	10·0	1,657	92

TABLE 3

Total numbers of some ladybird beetles trapped in Suffolk, 1961-70

Year	*2-spots* (*A. 2-punctata*)	*7-spots* (*C. 7-punctata*)	*10-spots* (*A. 10-punctata*)	*14-spots* (*P. 14-punctata*)*	*Others*
1961	10	31	47	42	3
1962	5	2	0	5	0
1963	9	2	4	22	4
1964	3	5	3	12	1
1965	5	0	1	5	6
1966	1	0	0	2	1
1967	0	0	0	8	1
1968	0	0	12	16	2
1969	2	4	2	16	2
1970	15	20	77	32	4
Total	55	64	146	160	24
(% *of Total*)	(12%)	(14%)	(32%)	(35%)	(5%)

**Propylea 14-punctata*

TABLE 4

Average numbers of aphids and of some insects that prey on them trapped per month (1961-70) in Suffolk.

	May	*June*	*July*	*August*	*September*	*October*
Aphids (all species)	301	1803	2547	875	241	32
M. persicae	1·2	4·5	20·0	10·3	1·4	0·6
A. fabae	1·4	13·3	350·4	253·8	16·8	1·5
Ladybirds (all species)	1·2	1·7	5·1	11·5	2·9	0·2
Hover-flies (all species)	0·1	0·2	0·6	16·9	2·8	0·2

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