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Organic farming research project report submitted to the Organic Farming Research Foundation:

Project Title:

Monitoring the activity of cabbage, seed corn and onion maggots on an organic farm

FINAL PROJECT REPORT

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Summary

Soil insects pose an extremely difficult problem in organic vegetable production. The soil born insects addressed in this proposal, Cabbage, Seed Corn and Onion Maggots, can greatly reduce stands of crops such as cole crops and onion and reduce the vigor and health of established plants. In San Benito County these insects are responsible for severely reducing the yields of onion, cabbage, Napa cabbage and bok choi in organic production. We do not have extensive information on the biology of these insects in California and it is never clear when they might be active and pose a threat to growers crops. In Brussels sprouts, cabbage maggot possess the greatest risk up to four weeks after transplanting (1); after this time the plants can handle up to 60 tunnels on the root system with no decrease in yield. Unfortunately, in other crops such as cabbage and Napa cabbage the maggots can enter the heads and render the heads unsalable even though tonnage may not be affected. In organic crop production, cultural recommendations include: "avoid soils with high organic matter" and "do not plant in areas with fresh organic matter"; both of these recommendations are difficult for organic growers to carry out considering the fact that they generally rely upon elevated levels of organic matter in the soil to supply adequate nutrition to their crops.

This project was designed to provide basic information on the activity of adult cabbage, seed corn and onion maggots (the maggot complex) and chart this emergence over one season. The data from spring 1993 through spring 1994 indicate that there exist definite periods of high and low populations of adult maggot activity. The months of May and August, 1993 had the lowest trap counts of maggots during the year. The rest of the year however showed significant activity of maggot adults. We observed the greatest activity of maggot larvae on the roots of cabbage in the fall, winter and spring. This study provided baseline observations of adult maggot activity and indicated that there were very small windows when adult maggots were not active. The applications and limitations of this research project are discussed below.

Objectives & Justifications

Information on the basic biology of insect pests is extremely helpful in planning control strategies for insect pests. Part of the problem with the maggot complex of insects is that they are poorly understood in California conditions. In addition, it is not readily apparent to growers when the flies are active because they are nondescript and easily confused with many other types of flies that are active and in great abundance. Monitoring for their eggs is also tedious and time consuming. This study was designed to provide information on the activity of adult the complex of cabbage, seed corn and onion maggots in the Santa Anna Valley of San Benito County. The following are the objectives and supporting justifications for the project:

1. Monitor the population of adult maggots and quantify their numbers on a weekly basis in the growers field and use this data to establish the patterns of activity of the adult maggots that occur in the field. This activity was the heart of this research project.

2. Conduct these studies for one year and evaluate the usefulness of this data with regard to modifying planting schedules of onion and cole crops to avoid problems with these insect. This project in a sense was a rough cut exploration of the biology of the maggots. If the data that we obtained looked useful we would then decide if it warranted further research effort.

Methods

1. We installed five traps per field (yellow sticky card traps used for the first four months then white sticky traps used for the remainder of the trial). The traps were examined on a weekly basis and the number of maggots per trap were counted. The adults of cabbage (Delia radicum), seed corn (D. platura) and onion maggots (D. antigua) are very difficult to separate taxonomically from each other so the maggots from these groups were lumped into what we called the "maggot complex". The weekly trapping continued from February 1993 to March 1994.

2. After completing a season of monitoring the activity of the adults of the maggot complex, determine if opportunities exist for planting to avoid flights of the maggots.

Results and Discussion

The data from this research shows some interesting trends with regards to the activity of the adults of the maggot complex (see figure 1). It basically indicates that the adults of the maggot complex were active all year long. There were lull periods in late April and May (Julian dates 118 - 153) and August (Julian dates 218 - 245). The rest of the year had periods that showed generally much greater adult fly activity. Data from the east coast indicates that there are four generations during the summer of the maggot complex species (2). Our data here indicates that the adult flies are actually much more active in the fall, winter and spring months. It is interesting to note that even in the coldest months of December and January, there were still high trap counts. The larvae were also very active in the cold months (see table 1).

The data from this study do not offer great hope for fording windows during the season when the maggot complex was not active in which crops could be established. It appears that the maggots are active most of the year and the potential for damage exists any time during the fall through spring. As a result, organic growers will need to rely upon other means to cope with the maggot problems that they encounter in their fields.

The conclusions reached in this trial are limited due to the following factors: 1) we were not able to separate out the species of adult maggots that we observed on the traps; this could be important in helping us better understand the numbers and timings of maggots that we observed on the traps. 2) the trapping is for only one season and it is clear that to have a good understanding of the activity patterns of an insect, more than one year of data is important, 3) the research was carried out at only one location and it is may not be applicable to other areas.

Reflecting on the results that we have seen here, some of the directions for further research would include: 1) investigations into alternative control measures for soil born insects such as the use of nematode materials; there are some indications that in some situations the nematodes could possibly offer some measure of control of the maggots, 2) investigations into the use of biological inoculants that help to break down crop residue and thereby reduce a breeding source for the maggots, 3) investigations into the use of compost to reduce the maggots; there are indications by some growers that the use of a humus based material reduces problems with maggots and 4) investigations into the use of trap crops, such as turnips which can attract the adults away from other crops.

Publications and Outreach

This research can be presented at the Ecological Farming Conference. It would probably be most appropriate as part of a panel on dealing with soil born insects. In addition, the information can be made available through the Lighthouse growers network.

Literature Cited

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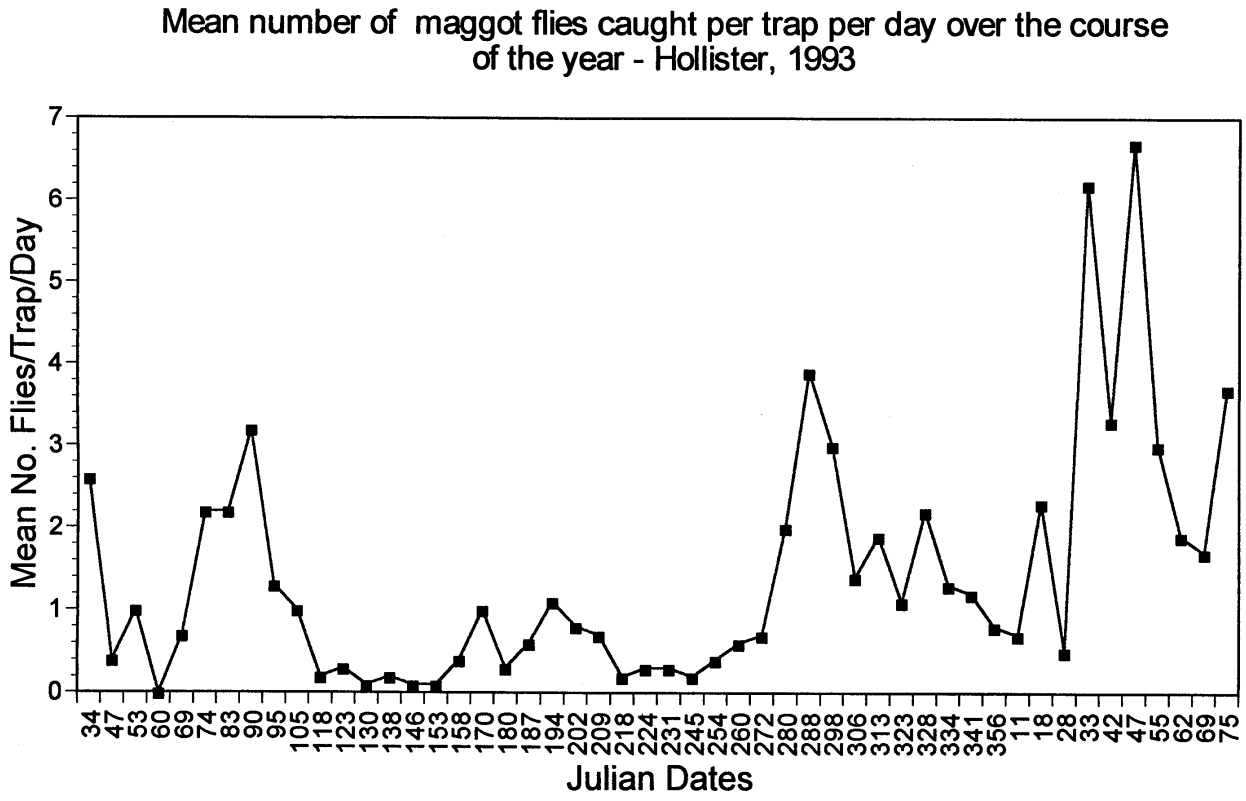
Mean number of maggot flies caught per trap per day over the course of the year - Hollister, 1993
Mean No. Flies/Trap/Day
0
1
2
3
4
5
6
7
34
47
53
60
69
74
83
90
95
105
118
123
130
138
146
153
158
170
180
187
194
202
209
218
224
231
245
254
260
272
280
288
298
306
313
323
328
334
341
356
11
18
28
33
42
47
55
62
69
75
Julian Dates

Figure 1

2MAG.XLS

DATE	Julian Date	Mean	X/TRAP/DAY	COMMENTS
3-Feb	34	13	2.6	many flies, few aphids, no thrips
16-Feb	47	4.8	0.4	many flies, few aphids, no thrips
22-Feb	53	6	1	many flies, few aphids, no thrips
1-Mar	60	0	0	many flies, few aphids, no thrips
10-Mar	69	6.5	0.7	many flies, few aphids, few thrips
15-Mar	74	11	2.2	many aphids, few thrips, onions = 1 flag leaf
24-Mar	83	19.5	2.2	many aphids & leafhoppers, few thrips
31-Mar	90	22.3	3.2	many aphids, few thrips, onions = 2 true leaves
5-Apr	95	7.8	1.3	many aphids, few thrips, onions = 2.5 true leaves
15-Apr	105	10	1	many aphids, few thrips, onions = 3-4 leaves
28-Apr	118	2	0.2	many aphids, few thrips, onions = 4-5 leaves
3-May	123	1.3	0.3	many aphids, more thrips, onions = 5-6 leaves
10-May	130	0.8	0.1	many aphids, more thrips, onions = 7-8 leaves
18-May	138	1.5	0.2	many aphids, many thrips, onions = 8-9 leaves
26-May	146	1	0.1	fewer aphids, many thrips, onions = bulbing
2-Jun	153	0.5	0.1	few aphids, many thrips, onions = bulbing
7-Jun	158	1.8	0.4	few aphids, many thrips, onions = large
19-Jun	170	3	1	few aphids, many thrips, necks falling over
29-Jun	180	0.8	0.3	few aphids, many thrips, onions maturing
6-Jul	187	1	0.6	many thrips, onions curing
13-Jul	194	2	1.1	many thrips, onions curing
21-Jul	202	1.5	0.8	onions in bags , traps moved to ajacent field
28-Jul	209	1.3	0.7	fiestas bulbing, white traps being used
6-Aug	218	1.8	0.2	onions continuing to bulb
12-Aug	224	2	0.3	onions near mature
19-Aug	231	2	0.3	necks falling over
2-Sep	245	2.3	0.2	onion harvest
11-Sep	254	3.8	0.4	trap moved to cabbage field
17-Sep	260	3.8	0.6	cabbage severely affected by flea beetle
29-Sep	272	8.3	0.7	cabbage still heavily infected with flea beetle
7-Oct	280	16.3	2	no sign of maggot damage on roots
15-Oct	288	31.5	3.9	no sign of maggot damage on roots
25-Oct	298	30.25	3	no sign of maggot damage on roots
2-Nov	306	10.8	1.4	no maggot damage on roots
9-Nov	313	13.5	1.9	no maggot damage on roots

Page 1

2MAG.XLS

19-Nov	323	11.3	1.1	some small maggots on roots	
24-Nov	328	10.1	2.2	many maggots on roots (4/plant)	
30-Nov	334	7.8	1.3	many maggots/plant	
7-Dec	341	8.5	1.2	maggots on both green and red varieties	
22-Dec	356	12	0.8	few maggots and many pupae around roots	
11-Jan	11	14.75	0.7	some pupae empty flies emerging	
18-Jan	18	16.25	2.3	many pupae empty flies emerging	
28-Jan	28	4.75	0.5	maggots on younger planting	
2-Feb	33	31	6.2	maggots on younger planting	
11-Feb	42	29.75	3.3	pupae on younger planting	
16-Feb	47	33.5	6.7	pupae on younger planting	
24-Feb	55	24.25	3	empty pupae, flies emerging	
3-Mar	62	13.25	1.9	flies emering, maggots in cabbage heads	
10-Mar	69	11.75	1.7	maggots in cabbage heads	
16-Mar	75	22.25	3.7	maggots in cabbage heads	