IS THE SCAB GNAT A POTATO PEST?

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of deep-pitted scab on potatoes (e.g., Johannsen 1912, Gui 1928, Shands and Landis 1964).

In 1895, Hopkins demonstrated that the potato scab gnat, <u>Pnyxia scabiei</u> (Hopkins), (Family Sciaridae), fed on healthy living tissue and caused deep wounds in potato tubers. He proved this by showing a potato tuber with his surface-scarred initials enlarged after it had been kept in a scab gnat rearing jar. Since then the scab gnat has been commonly accepted as one of the causative agents

However, Afanasiev (1937) showed that another fly, <u>Sciara inconstans</u> (Fitch) (also Family Sciaridae) fed on dead tissues within the deep-pitted potato scab lesion and only made the lesion appear larger. In addition, he showed that the fungus <u>Streptomyces scabies</u> (Thaxter) Waksman and Henrici was the causal agent of common scab, which causes a shallow cocky wound on tubers, further it was also capable of producing deep-pitted scab in the absence of these or other larvae. Since he did not include the potato scab gnat in his studies, it was still accepted as a causative agent of deep-pitted scab.

In Washington during the past few years, the research emphasis has been placed on the chemical control of the scab gnat to reduce the incidence of deep-pitted scab (Landis et al. 1972). However, during the course of our studies, several observations in the field and laboratory shifted the emphasis of our study to the question of whether the scab gnat is really a causal agent of deep-pitted scab.

Laboratory Studies:

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In our laboratory studies, we were able to rear scab gnat larvae on deactivated brewers' yeast (fungus) alone; thus, we became skeptical of the ability of the insect to feed and survive on healthy living tissue in the tuber. Also, we repeated the demonstration of Hopkins (1895). Thus we pin pricked the surface of a tuber and left it in a rearing jar of scab gnats. However, in our test, we placed the potato tubers with the pricked initials face down in moist soil because those that had the initial face-up and were exposed to the air quickly suberized. During the first few days, the initials were barely visible, but by the 3rd day, they were enlarging, and larvae were found in the wounds. As many as 22 scab gnat larvae were observed in 1 initial. Thus, larval feeding was apparently enlarging the wounds. The appearance was nevertheless misleading.

We had also placed a control tuber with initials in soil without scab gnats, and these initials had enlarged to the same size as those infested with scab gnats. Even after 54 days, there were no discernible differences in the depth and width of the initials, though the wounds of the tuber in the jar with scab gnats were cleaner because of the lack of fungus growth and so appeared larger.

Field Studies: "To consist a stat floe reloar state the life entry of the test as the state of as the state of

In Eureka, Washington, scab gnat seasonal life history studies were conducted in a small block of potatoes inside an 80-acre circle planted in sugarbeets. The larvae were found in plant debris throughout the year, and the seed piece of volunteer potato plants served as a host. In late spring, larvae were found in decaying sections of these planted seed piece; and nearly all the pieces were disintegrated by the end of August. About midsummer larvae were found in scab wounds in the roots.

Of course the most serious economic concern was the possible larvae damage done to the tubers; therefore, detailed studies of scab and scab gnat on the potato tubers were conducted as shown in Table 1. The number of deep-pitted scab lesions and the depth of deep-pitted scab

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generally showed an increasing trend as the tubers matured. Although deep-pitted scab was present, larvae were not found in the first 2 inspection periods (July 9 and 23).

	No. of tubers	Average/tuber						
		Area (square mm) of			No. of	Depth of	% of deep-pitted scabs infested with	
Sampling date		Tuber	Shallow scab lesion	Deep-pitted lesion	deep-pitted scabs	deep-pitted scabs (mm)	Fungus gnat1	Other micro- organisms ²
July 9	101	1182	56		.8	1.5	0	11
23	106	3165	113	14	3.3	1.8	0	1
Aug. 6	155	5621	221	46	4.2	2.2	1.2	4
20	117	7342	557	59	4.3	2.8	2.4	11
Sep. 3	127	11870	1468	263	8.4	3.9	2.5	10
17	87.	14394	5062	196	6.8	4.2	1.2	15

Table 1.--Infestation data of scab and organisms found in the wounds of potatoes.

1/ 84% emerging flies were scab gnats.

2/ Nematodes, mites, and oligochaetes.

The first scab gnat larvae were found in deep-pitted scab lesions from samples taken on August 6 and in every sample to the last sampling date, September 17. However, only 1.2 to 2.5% of the deep lesions had fungus gnat larvae present, and of these, 84% were identified as the potato scab gnat. Other micro-organism such as oligochaetes, mites, and nematodes were found in 1 to 15% of the deep-pitted scab lesions.

In our overwintering studies from January to April, 96% of the scab gnats found during these months were 4th-instar larvae. The other 4% overwintered in the pupal stage. All the overwintering larvae were found in plant debris in the upper 6 inches of soil; decreasing quantities of plant debris were found in soil samples 6-12 and 12-18 inches deep.

CONCLUSIONS

The potato scab gnat larvae are primarily fungus feeders and do not normally feed on healthy living tissue of potato; therefore, in our opinion, insecticidal control of the scab gnat is not a practical method of controlling deep-pitted scab. We base this opinion on the following experimental evidence (1) scab gnat cultures can be maintained on fungus alone (yeast; (2) wounds on the surface of tuber made from pin pricks will enlarge in moist soil in the absence or presence of the scab gnat larvae. (3) scab gnat larvae do not enlarge wounds but do clean out the fungal growth in wounds, which give the appearance of a larger wound; (4) scab gnat larvae were found only in the fungus matting or decaying plant tissues; and (5) no more than 2.5% of the deep-pitted scab lesions were infested with fungus gnats; therefore, even if scab gnats are one of the causal agents of deep-pitted scab, the role is still minor because of the low incidence of infestation.

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