Survey of Insects in Flour Mills

KSU study counts bugs in traps, flour samples in Kansas and Nebraska facilities

In the second quarter 2003 issue of Milling Journal (pages 46-47), I referred to a survey conducted by N.E. Good in 1934-35. Good's survey of insects was from 21 flour mills in Kansas, Oklahoma, and Texas. Other researchers surveyed insects in flour mills during the 1950s, reporting on the types of species found and making casual observations on the cleanliness of the mills and the likelihood of finding insects.

In general, mills that were cleaned every two weeks had fewer insect species than mills that were not regularly cleaned.

It has been more than 60 years since Good's comprehensive survey of insects in static and moving mill stock. Today, the availability of commercial food- and pheromone-baited traps makes sampling insects much easier.

Recent Study

My graduate student, Andy Allen, recently completed a survey of insects found in four commercial mills—two in Kansas and two in Nebraska. He used commercial food- and pheromone-baited traps (pitfall as well as aerial sticky traps) and also removed product samples from each mill to determine types and numbers of insect species present.

A total of 23 stored-product beetle species and three moth species were associated with the four mills *(see table, page 41)*.

Eight of the 26 insect species were present in all four mills. The hairy fungus beetle was the most abundant insect species captured in pitfall traps inside the mill, followed by the red flour beetle and foreign grain beetle.

Pest Management

Dr. Bhadriraju Subramanyam

A lot of species were captured in pitfall traps placed outside the mills. Of the species captured outdoors, the red flour beetle was the most abundant, followed by the sawtoothed grain beetle. Interestingly, 10 times more Indianmeal moths were captured outdoors than indoors in sticky traps.

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Table 1

Relative abundance (% of total captured) of adult stored-product insects associated with four commercial flour mills.

Order/Species Common Name	Relative Abundance: Inside Traps	Outside Traps	Products	No. Mills w/Insects
Coleoptera				
Ahasverus advena (Waltl) Foreign grain beetle	15.82	0.46	0.06	4
Alphitophagus bifasciatus (Say) Two-banded fungus beetle	0.09	0.00	0.00	2
Anthrenus spp. Carpet beetle	0.14	0.00	0.00	2
Carpophilus dimidiatus (F.) Corn sap beetle	1.91	0.13	0.00	4
Cryptolestes spp. Flat or rusty grain beetle	*10.39*	*0.76*	*7.32*	*4*
Cynaeus angustus (LeConte) Larger black flour beetle	0.22	0.04	0.00	2
Dermestes lardarius (L.) Larder beetle	0.09	0.34	0.00	3
Gibbium psylloides (C.) Humped spider beetle	0.27	0.00	0.00	1
Latheticus oryzae (Waterhouse) Longheaded flour beetle	0.05	0.02	0.00	1
Mezium americanum (Laporte) American spider beetle	0.00	0.02	0.00	1
Oryzaephilus surinamensis (L.) Sawtoothed grain beetle	1.58	4.61	0.38	2
Palorus ratzeburgii (Wissman) Small-eyed flour beetle	0.09	0.00	0.00	2
Palorus subdepressus (W.) Depressed flour beetle	0.05	0.02	0.00	1
Rhyzopertha dominica (F.) Lesser grain borer	0.05	0.05	1.21	3
Sitophilus granarius (L.) Granary weevil	0.19	0.00	0.00	2
Sitophilus zeamais (M.) Maize weevil	0.04	0.00	0.06	2
Tenebrio molitor (L.) Yellow mealworm	0.05	0.00	0.00	1
Tenebroides mauritanicus (L.) Cadelle	0.00	0.02	0.00	1
Tribolium audax (Halstead American black flour beetle	1.27	1.85	0.00	3
Tribolium castaneum (Herbst) Red flour beetle	21.89	8.19	35.07	4
Tribolium confusum (J. du Val) Confused flour beetle	12.52	0.70	55.00	4
Trogoderma variabile (Ballion) Warehouse beetle	1.20	0.85	0.57	4
Typhaea stercorea (L.) Hairy fungus beetle	23.81	1.40	0.00	4
Lepidoptera				
Cadra cautella (Walker) Almond moth	0.00	0.31	0.00	3
Plodia interpunctella (Hubner) Indianmeal moth	8.18	80.18	0.33	4
Sitotroga cerealella (Olivier) Angoumois grain moth	0.09	0.05	0.00	2

Insect Survey from p. 40

The activity of Indianmeal moths outdoors is well known. The presence of insects outdoors suggests that these insects could re-infest the mill following any insect pest management intervention such as fumigation or heat treatment.

Product samples from mills revealed the presence of nine insect species. Nearly 90% of the total insects found in product samples were red flour and confused flour beetles.

In three of the mills, there were no statistically significant differences in the number of insects found in dirty wheat, moving mill stock, processing equipment, rebolt sifter scalps, and floor sweepings. However, in one mill, the rebolt sifter scalps had a significantly higher number of insects than the other product fractions.

Traps vs. Product Samples

Generally, more insect species are captured in traps than in product samples. Therefore, the information provided by traps does not truly represent insect infestation in products.

The food- and pheromone-baited commercial trap for beetles tends to capture multiple species, many of which may be incidental species.

Leaving doors and windows open permits outdoor insects to enter the mill. The type of lures or attractants used may have selectively captured more numbers of some species than others. More Indianmeal moths were trapped outdoors. However, their source is unclear and warrants further study.

Insects found in product samples have implications from a product safety and integrity point of view. The large numbers of flour beetles in product samples is not surprising, as these species prefer floury materials.

The presence of insects in dirty wheat, moving stock, processing equipment, rebolt sifter scalps, and the floor suggests that sanitation is important for reducing insect populations breeding in product samples.

The results mentioned above suggest that capture data from insect traps must be interpreted with caution and compared with insects found in product samples.

Furthermore, assessment of insect populations using traps and product samples provides a better picture of effectiveness of responsive treatments such as heat treatment or fumigation.

Contact Subi for a copy of the mill survey report.

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Subi Honored

Milling Journal columnist Bhadiraju Subramanyam (Subi) was honored by the Environmental Protection Agency (EPA) in April for his technical achievements in helping protect the earth's stratospheric ozone layer.

Subi, a professor in the Department of Grain Science and Industry at Kansas State University, was one of eight individuals to receive the EPA's 2004 Stratospheric Ozone Protection Award.