An investigation for activity regularity of *Rhizopertha dominica* in stored grain

Leng Yihh

Abstract

The activity regularity of *Rhizopertha dominica* in stored grain varies with variance of grain temperature. Especially for the packed grain, *Rhizopertha dominica* moves about in lower layer and bottom layer of grain pile when grain temperature is less than 20°C. When grain temperature is within the range of 28 - 32°C, *Rhizopertha dominica* moves about in upper layer and upper surface layer. It will fly to barn top, hover in the air and some will cluster over the grain piles, thus resulting in the rising of grain temperature and local grain heating. For this reason, we must check the different positions of the grain pile according to the temperature variations at that time when checking pests of the packed grain, thus achieving damage order of *Rhizopertha dominica* for grain.

Introduction

*Rhizopertha dominica* is an eating pests moving about in the torrid zone and subtropical zone. For the activity regularity of *Rhizopertha dominica*, some research articles once put forward a viewpoint: *Rhizopertha dominica* primarily distributes over medium layer and lower layer of bulk or packed grain piles with higher temperature and without obvious variance within one year. *Rhizopertha dominica* moves about in medium and lower layers of grain pile and harms grain within grain pile. *Rhizopertha dominica* likes to move about into one meter of grain pile and sometimes it can move about as deep as 1.5 m.

According to the obtained harming status of *Rhizopertha dominica* in taking part in the control of pests in grass-roots units or sorting out material from the imported grain, I have discovered that activity regularity of *Rhizopertha dominica* does not limit only in medium and lower layers of grain. Most of *Rhizopertha dominica* moves about in upper layer or upper surface layer of grain pile when grain temperature is 28°C. It moves about in lower layer or bottom layer of grain pile when grain temperature is less than 20°C. According to the investigation, Shaoguan State Grain Reserve Storehouse and the storehouses in other districts of Guangdong Province also reported that activity distribution of *Rhizopertha dominica* is from upper layer to upper surface layer.

For the several years I have collected activity regularity information of *Rhizopertha dominica* for many times. They all reflect that *Rhizopertha dominica* usually moves about in upper layer and upper surface layer of grain when grain temperature is within the range of 28 - 32°C. *Rhizopertha dominica* can be discovered in lower layer, bottom layer of grain pile, even on ground when grain temperature is less than 20°C. At this time if we check medium and upper layers of grain piles, no *Rhizopertha dominica* can be discovered. For example, when the air temperature was within the range of 28 - 32°C, one discovered that some closely nestled position of fumigation tent film (0.10 mm polyethylene or 0.14 mm polyvinyl chloride) against the surface layer gunny-bags of the packed grain had been eaten into large area of net-like holes by *Rhizopertha dominica*. Some cases occurred in a deep position of surface layer of packed grain pile (grain pile height was 4.5 - 5.2 m). The position was about 0.5 m deep from the surface layer. The clustering activity led to a local heating and the grain temperature at that position was as high as 38°C. Through pest examination, one discovered that *Rhizopertha dominica* density was up to more than 100 heads in each kilogram grain, and the grain temperature at that place was about 10°C higher than the normal grain temperature. Some *Rhizopertha dominica* climbed up to barn top (height was about 8 m). At that time all the packed grain within the barn was divided into piles and sealed with polyethylene or polyvinyl chloride film, a pesticide fumigation tent film, a pesticide fumigation was just finished. When a testing of killing spider and mite with propoxur (20% concentration) smudging agent was carrying out within the barn, that large numbers of dead *Rhizopertha dominica* quickly fell on the newspapers spread on the ground were discovered. It was confirmed that the mortal pests fell from barn top later. Since the polyethylene tent film film was broken and the sealing was not good, *Rhizopertha dominica* was not killed by pesticide fumigation. *Rhizopertha dominica* climbed up grain pile and flew to barn top. At that time it was found...
that some *Rhyzopertha dominica* still moved about on upper layer of grain pile, but no *Rhyzopertha dominica* was discovered in medium and lower layers.

The above several phenomena have shown that activity regularity distribution of *Rhyzopertha dominica* does not limit only in medium and lower layers of grain pile. When temperature is suitable, it moves about in upper layer and upper surface layer. In *Grain and Cooking Oil Storage* edited and printed by Hubei Provincial Grain School (in 1976), the activity regularity of *Rhyzopertha dominica* was described in this way: "*Rhyzopertha dominica* has a strong hovering ability. When grain temperature in barn is up to 37°C, it will climb out of grain surface and hovers within the barn.” When grain temperature is high, most of *Rhyzopertha dominica* move about in surface layer of grain pile. When grain temperature is lower, it moves about in medium and lower layers, and it especially likes to cluster toward higher temperature grain position. Large numbers of *Rhyzopertha dominica* clustering will cause grain to heat.

I think that the activity regularity of *Rhyzopertha dominica* described in the book, *Grain and Cooking Oil Storage* (in 1976) is to the point and relatively accord with reality except that *Rhyzopertha dominica* will climb out at 37°C. Recently I once again discovered that *Rhyzopertha dominica* moved about in surface layer of upper layer grain packs when grain temperature was only 28-31°C. I have collected a lot of materials. Apart from the grain temperature recordings for *Rhyzopertha dominica* made before 1994, the complete first hand materials of computer temperature detection or electronic detection for grain temperature are shown in Table 1. When *Rhyzopertha dominica* moves about in grain piles, the related descriptions for discovering *Rhyzopertha dominica* moving about in grain piles are as follows:

1. External rented barn. In the loaded grain of No. 4 Barn A1-2, there was *Rhyzopertha dominica*. The barn was fumigated in conventional method with 8g/m³ AIP on June 28, 1990. On July 24, it was found that *Rhyzopertha dominica* moved about outside medium layer and upper layer of grain piles within the tent film. The reason why *Rhyzopertha dominica* was not killed was the wrong pesticide quantity. On July 27, these grain piles within the tent film was fumigated with 8g/m³ AIP again. On September 5, no *Rhyzopertha dominica* was observed within the tent film. The temperature of upper layer of grain piles was 8-10°C higher than that of medium and lower layers. One checked pile top and discovered that the tent film closely nestled against gunny-bags had been eaten into large area, and *Rhyzopertha dominica* still moved about. On September 7, the tent film was replaced and grain piles were fumigated with 10g/m³ AIP again. *Rhyzopertha dominica* was killed and the grain temperature was reduced, thus achieving a good effect.

2. The First Grain Depot of Guangdong Provincial Grain and Cooking Oil Distribution Company. In 1994 and 1995 No. 7 Barn B5 was fumigated with pesticide twice, respectively. On November 3, 1995, local top layer of grain pile was heating and tent film was uncovered. On November 8, one checked top layer of grain pile. There was a heating sign and large numbers of eaten hollow grain. When the grain in the first layer of grain pile was checked, up to over 100 heads *Rhyzopertha dominica* in each kilogram grain was discovered. On November 9, the barn was conventionally fumigated with 11g/m³ AIP. In 1996, the stored grain was left the barn.

3. The Third Grain Depot of Guangdong Provincial Grain and Cooking Oil Distribution Company. On July 13, 1995, New 3 Middle B5 Barn was conventionally fumigated with 10g/m³ AIP. On July 22, one checked (didn’t climb up grain pile) and discovered that *Rhyzopertha dominica* moved about within the tent film, then added 8g/m³ AIP. On July 29, the company sent personnel to check and discover that there was a heating sign in top layer of grain pile, and the tent film closely nestled against gunny-bags had been eaten into large area, net-like holes. One uncovered the tent film and discovered that *Rhyzopertha dominica* was up to over 100 heads per kilogram grain in local positions. The tent film was replaced and the fumigation was carried out again in August.

4. The Third Grain Depot of Guangdong Provincial Grain and Cooking Oil Distribution Company. The fumigation applied technique testing of PH₃ was jointly carried out by the company and Guangdong Provincial Institute of Grain Science in New 3 Middle C1 Barn. The barn was fumigated with 7g/m³ AIP in slow releasing way on May 23, 1996. On August 1, it was discovered that the tent film was broken and the top tent film closely nestled against gunny-bags had been eaten into large area net-like holes, and there was still live *Rhyzopertha dominica*. After the tent film was uncovered, the testing was stopped and the barn was fumigated separately.

5. The Second Grain Depot of Guangdong Provincial Grain and Cooking Oil Distribution Company. A protective fumigation was carried out in No. 3 Barn D1 in August, 1995 and fumigated air was released in November. In middle ten days of April, 1996, during spring safety general investigation for grain and cooking oil, one discovered that *Rhyzopertha dominica* moved about on the ground around the grain pile. On April 29, the barn was conventionally fumigated with 8g/m³ AIP. On August 22, the purpose of adding pesticide in
conventional and slow releasing method was to control and kill pests. The fumigated air was exhausted in last ten days of November. Checking was carried out from the end of November to the beginning of December. There was heating sign in the top of grain pile of barn. It was found that *Sitophilus zeamais* and *Rhyzopertha dominica* were moving about.

6 The Second Grain Depot of Guangdong Provincial Grain and Cooking Oil Distribution Company. A protective fumigation once carried out in 3 - 4 piles in No 26 Barn B after grain was loaded. On May 21, 1996, a conventional fumigation was carried out with 7g/m³ AIP. On August 29, pesticide of 8g/m³ was added. On November 8, a testing for killing spider was carried out within the barn space under condition of sealing for all the grain piles. On November 10, it was discovered that large numbers of *Rhyzopertha dominica* were killed on the newspapers spread on the ground. Checking result proved that *Rhyzopertha dominica* fell from the barn top. One checked grain piles and discovered that tent films were broken and there were still *Rhyzopertha dominica* moving about in the upper layer. On November 15, the broken tent films were replaced and a fumigation was carried out again.

7 The Second Grain Depot of Guangdong Provincial Grain and Cooking Oil Distribution Company. Since large numbers of pests existed in the loaded grain in No 11 Barn front 2, a conventional fumigation with 9g/m³ AIP was carried out within one week and the fumigated air was released through uncovering the film on December 6. On March 28, 1997, a conventional fumigation was carried out with 8g/m³ and the fumigated air was released on June 6. On June 13, fumigation was carried out again and the fumigated air was released on August 5. In the end of August, it was found that *Rhyzopertha dominica* crept on the gunny-bags surface of the medium layer grain piles. On September 3, fumigation was carried out with 10g/m³. Since the tent films were not seriously checked before pesticide was spread, *Rhyzopertha dominica* was still moving about in the middle and upper layers after pesticide was spread and several positions of tent films closely nestled against gunny-bags were eaten into net-like holes. On September 5, fumigation was carried out after the tent thin film was mended and *Rhyzopertha dominica* within the tent films was thoroughly killed.

The above facts show that the activity distribution of *Rhyzopertha dominica* within grain piles varies with the change of grain temperature. Especially for the packed grain, when grain temperature is less 20°C, *Rhyzopertha dominica* moves about in lower layer and bottom layer of grain piles. When grain temperature is within the range of 28 - 32°C, *Rhyzopertha dominica* moves about in upper layer and upper surface layer of grain piles. Sometimes it will fly to barn top. Some of *Rhyzopertha dominica* hovers within the barn and some clusters in upper layer of grain piles, thus resulting in grain temperature rising and local grain heating. For this reason, we must check different positions of grain piles according to the variations of grain temperature while examining pests in the packed grain, thus the harming order of *Rhyzopertha dominica* for the stored grain can be really achieved. Author hopes that the related goods storing experts and the control experts for pests in stored grain can further investigate this problem and guide a more scientific control for pests in stored grain.

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