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Identification Of Insect Pests on Retail Rice in Three Markets in Serang Regency.

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Abstract. This study identifies insect pests attacking retail rice in three traditional markets in Serang Regency and analyses their effects on rice quality based on SNI 6128:2015. The research was conducted from March to May 2025 using a Nested Design, with the first factor was the market (Tirtaysa market, Begog market, and Dukuh market) and the second factor was brand of rice (SLYP Super RL Macho, SLYP Super OS, and SLYP Super KM Karya Makmur) as treatment factors and random sampling. Observations included pest species, population size, sex ratio, degree of milling, moisture content, and foreign matter. Results showed that only one pest species was found, *Sitophilus oryzae*, a primary storage pest capable of damaging whole rice grains, with populations ranging from 120–185 individuals at market level and 129–186 individuals at brand level. Pest infestation did not significantly reduce rice quality, as all parameters remained within SNI limits for medium-grade rice. These findings indicate that storage environment supports *S. oryzae* development but does not yet cause deterioration beyond quality standards. Improving drying systems, humidity regulation, and storage sanitation is essential to suppress pest populations and maintain rice quality.

***Keywords**:* rice brands, rice quality, *Sitophilus oryzae*, SNI, warehouse pests.

INTRODUCTION

Rice is the main staple food for most Indonesians and plays a vital role in supporting national food security (BPS, 2023). The quality of rice on the market is crucial because it directly affects consumer satisfaction and health. However, rice quality often declines due to poor post-harvest handling and storage, particularly in traditional markets (Mishra and Sharma, 2019). One of the main problems in rice storage is the attack of warehouse pests, particularly *Sitophilus oryzae*, or the rice weevil. This pest can reproduce rapidly and damage rice grains, thereby reducing the product's physical quality and nutritional value (Juniarti et al. 2021).

Serang Regency is one of the regions with a relatively high level of rice trade. In this region, rice is sold under various brands and qualities in traditional markets such as Tirtayasa market, Begog market, and Dukuh market. The rudimentary storage conditions of rice in conventional markets, such as stacking in open sacks and storing at humid room temperatures, are factors that support the development of warehouse pests (Rahma et al. 2024). This not only reduces the quality of the rice but can also cause it to spoil quickly and become unfit for consumption if stored for too long (Pangerang and Rusyanti, 2018).

This study aims to identify the pest species and population found in retail rice across the three markets and analyse their impact on rice quality. Observed parameters include pest type and abundance, sex ratio, degree of milling, moisture content, and foreign matter. Initial findings indicate that degree of milling, moisture content, and foreign matter remain within the quality limits of SNI 6128:2015 for medium-grade rice, although pest presence requires attention to prevent further quality degradation.

Environmental conditions and market storage systems significantly influence the level of pest infestation (Malik et al. 2019). Therefore, improvements in sanitation, airflow, humidity regulation, and routine monitoring are essential to maintain rice quality and ensure consumer food safety in Serang Regency (Ikhwansyah and Sidrait, 2020).

METHODOLOGY

This research was conducted from March to May 2025 in three traditional

markets in Serang Regency: Tirtayasa market, Begog market, and Dukuh market. The aim was to determine the quality of retail rice and the level of warehouse pest infestation for three brands: SLYP Super RL Macho, SLYP Super OS, and SLYP Super KM Karya Makmur. Samples were randomly selected from the most-sold brands in each market, with five samples per brand. The analysis was carried out in the Basic Science and Plant Protection Laboratory of the Faculty of Agriculture, Sultan Ageng Tirtayasa University, using a stereo microscope, an Optilab, paintbrushes, small paint containers, a seed moisture meter, and an analytical balance. The parameters observed included the type and number of pests, the ratio of male to female *S. oryzae*, degree of milling, water content, and the number of foreign objects. Insect identification was carried out according to Schnitzler et al. (2014), and water content measurements were performed according to SNI 6128:2015. The study used a nested design, including market factors and rice brands, to describe the relationships among storage conditions, pest attacks, and the decline in rice quality in traditional markets in Serang Regency (Ikhwansyah and Sirait, 2020).

Identification of Rice Pest Insects

Identification of pests in retail rice was carried out by taking samples from three traditional markets in Serang Regency, namely Tirtayasa market, Begog market, and Dukuh market, as well as from three brands of rice, namely SLYP Super RL Macho, SLYP Super OS, and SLYP Super KM Karya Makmur. Samples were analyzed in the laboratory using a stereo microscope and an optical microscope to observe the type and number of insects. Based on morphological observations, all pests found were classified as *Sitophilus species. oryzae*. The number of individuals was counted quantitatively, including the ratio of males to females in each market and rice brand. These results served as the basis for assessing the level of pest infestation and its impact on the quality of rice sold in traditional markets.

Identification of Rice Quality

The physical quality of rice was assessed using several parameters, including whole grains, broken grains, rice grits, water content, and foreign matter. Samples were weighed on a digital scale, and water content was measured with *a seed scale. A moisture meter* is used to determine the shelf life and quality of rice (Sujito and Yunus, 2016). Rice grains are separated into whole, broken, and rice grits to determine percentages, while foreign objects such as husks, gravel, and dirt are visually observed in accordance with SNI standards. Data are analyzed descriptively and presented in tables and bar charts for easy comparison between markets and brands. These observations provide an overview of the physical quality of rice and the effects of pests, milling, packaging, and storage on rice quality in the market (Ikhwansyah and Sirait, 2020).

Data Analysis

Research data covering the number and type of pests, degree of milling, water content, and foreign matter were analyzed quantitatively and qualitatively. The analysis was conducted using ANOVA with a nested design at a 5% confidence level to examine the effects of the market and rice brand on quality and pest attacks. If there is a significant difference, the BNT test is continued. Data are processed in Microsoft Excel and RStudio, then presented in tabular form and described descriptively to understand the distribution of pests and grain damage, and the effect of the storage environment on rice quality.

RESULTS AND DISCUSSION

The results showed that only *S. oryzae* is the only pest across all observation locations. The only was found at the SLYP Super RL Macho brand at Tirtayasa market,

which has the highest temperatures and humidity. Based on the analysis, it can be concluded that environmental conditions and market storage systems significantly influence pest infestation levels in rice warehouses. *S. oryzae* pest attacks rice quality in three traditional markets in Serang as on location observation. The number of pests, degree of milling, water content, and foreign matter content differed between markets and rice brands. Storage conditions, such as temperature, humidity, and post-harvest handling, influenced these differences. The poorer the storage conditions, the higher the pest population and the lower the rice's physical quality (Malik et al. 2019). Data on the number of pests found are shown in **Table 1.**

Table 1. Number of insect pests found in three markets and on three brands of rice (individuals)

Treatment	Types of Insects	Total Insect Count	Number of Male Insects	Number of Female Insects
Traditional Market				
Tirtayasa	*Sitophilus oryzae*	185 a	90 a	95 a
Begog	*Sitophilus oryzae*	120 a	90 a	30 a
Dukuh	*Sitophilus oryzae*	179 a	91 a	88 a
Brands of Rice				
SLYP Super RL Macho	*Sitophilus oryzae*	129 m	96 m	33 n
SLYP Super OS	*Sitophilus oryzae*	169 m	90 m	79 m
SLYP Super KM Karya Makmur	*Sitophilus oryzae*	186 m	85 m	101 m

Description: Values followed by the same letter in both rows and columns indicate that the difference is not significant based on the Least Significant Difference (LSD) test at the 5% level.

Based on **Table 1**, the type of insect found in all rice samples from three markets and three rice brands in Serang Regency was *S. oryzae*, or rice weevil. This major warehouse pest reduces rice quality during storage. The total number of insects found in the three markets ranged from 120 to 185, with males ranging from 90 to 91 and females ranging from 30 to 95. These values indicate that the *S. oryzae population* across the three markets is relatively balanced and not statistically significantly different, suggesting that storage conditions in each market are similar, including temperature, humidity, and air circulation systems.

According to Mastuti et al. (2019), *S. oryzae* thrives optimally at temperatures around 29°C with high humidity, conditions commonly found in traditional markets. This population uniformity indicates that the storage environments across the three markets are quite conducive to pest development. Juniarti et al. (2021) noted that the presence of this pest can reduce the physical and chemical quality of rice, including hollow grains, discoloration, and an unpleasant aroma. Therefore, although population differences between markets are not significant, control efforts are still necessary to prevent pest populations from increasing.

Meanwhile, across the three brands of rice observed, the total number of *S. oryzae* insects ranged from 129 to 186, with the number of males ranging from 85 to 96. However, there was a significant difference in the number of female insects, with the highest number found in the SLYP Super KM Karya Makmur brand at 101, followed by SLYP Super OS at 79, and the lowest in SLYP Super RL Macho at 33. This difference indicates variations in storage or packaging conditions between brands, which can affect the level of female infestation. According to Simanjuntak and Farida (2025), the number of female insects

can increase the potential for pest reproduction because females can produce large numbers of eggs throughout their life cycle.

Mishra and Sharma (2019) explained that a storage temperature of 28–32°C with humidity above 65% is an ideal condition for the development *of S. oryzae*, especially in rice stored in open containers. Malik et al. (2019) also emphasized that this pest not only causes physical damage in the form of hollow grains, but also reduces the shelf life and chemical quality of rice. Overall, the results in Table 1 show that the population of *S. oryzae* in the market and across various rice brands in Serang Regency is generally within a similar range, except for the number of females, which shows significant differences. This indicates the need for routine pest monitoring and control, especially during storage of rice brands with a higher female population, to maintain rice quality and ensure it remains safe for consumption.

Number of Male and Female Insect Pests

The numbers of insect pests on rice from three markets were carefully recorded and analyzed to determine the average population and the most common species. Classification: *Sitophilus oryzae* is included in the Kingdom *Animalia*, Phylum *Arthropoda*, Class *Insecta*, Order *Coleoptera*, Family *Curculionidae*, Genus *Sitophilus*, and Species *Sitophilus oryzae*. In addition to counting the total number, the insects were also separated into males and females (**Figure 1**) to examine the population composition. Male *S. oryzae* have smaller bodies and shorter beaks, while females are larger with longer beaks, so this difference helps in recording accurate numbers.

The identification results show that the most frequently found species is *S. oryzae*, or rice beetle, is a primary storage pest capable of destroying whole grains of rice (Mastuti et al. 2019). This pest can develop rapidly at high temperatures and humidity, especially in open storage areas such as traditional markets (Pangerang and Rusyanti, 2018). The damage caused includes holes in rice, decreased physical quality and sales value, and reduced shelf life. This condition indicates the need to improve storage, drying, and routine monitoring systems to maintain rice quality in Serang Regency.

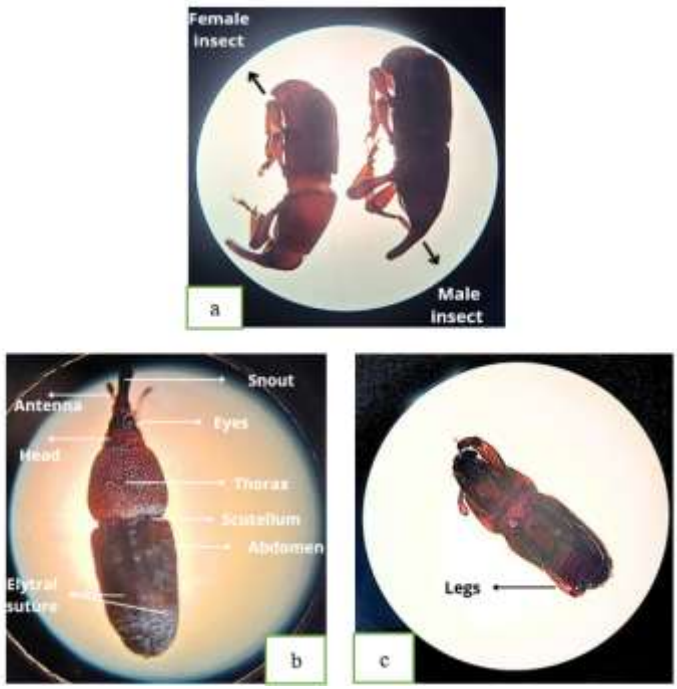

Figure 1. (a) *S. oryzae* female and male, (b) anatomy of *S. oryzae* from above, (c) anatomy of *S. oryzae* from below (Source: Research Documentation, 2025)

Pest Spread

Tirtayasa market, Begog market, and Dukuh market show almost the same pattern because the quality of rice sold at the three markets is generally classified as medium with relatively similar water content and shelf life, so the opportunity for the development of warehouse pests such as *S. oryzae* is also not significantly different (**Figure 2**). Compared with premium rice, variations in pest distribution are likely to be more pronounced because the milling, packaging, and storage processes for premium rice are usually better, reducing the risk of pest attack. This is in line with research by Hendrival and Melinda (2017) which states that the level of pest attack is influenced by grain quality, moisture content, and post-harvest treatment, and is supported by Rahmat (2023) who explains that storage conditions and rice quality are the main factors determining warehouse pest attacks. Mukaromah et al. (2022) also added that medium to low quality rice is more susceptible to attack because it has an intact aleurone layer and is stored under less controlled conditions. Therefore, the uniformity of rice quality in the three markets results in relatively similar pest distribution patterns.

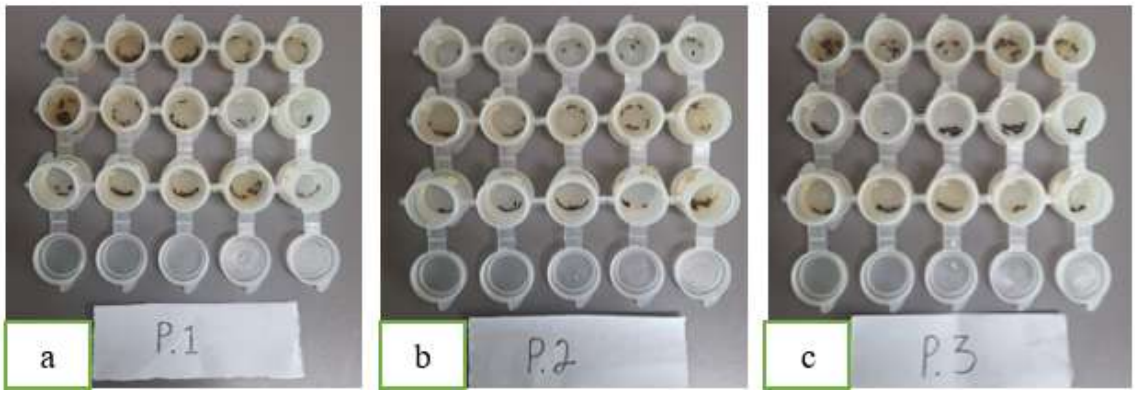

Figure 2. Results of pests found in: (a) Tirtayasa market, (b) Begog market, (c) Dukuh market

Table 2. Percentage of rice quality observations in three markets and three rice brands (percentages)

Treatment	Degree of Milling			% Water content	% Foreign object
	% Whole rice grains	% Broken rice grains	% Rice grits		
Traditional Market					
Tirtayasa	62.93 a	16.12 a	21.62 b	8.5 b	0.0015 a
Begog	64.37 a	17.27 a	18.07 a	9.4 a	0.0021 a
Dukuh	64.87 a	16.71 a	18.16 a	11.5 a	0.0014 a
Brands of Rice					
SLYP Super RL Macho	62.27 m	18.04 m	20.06 m	9.16 m	0.0014 m
SLYP Super OS	64.88 m	16.04 m	18.84 m	9.12 m	0.0014 m
SLYP Super KM Karya Makmur	65.00 m	16.75 m	18.95 m	9.09 m	0.0022 m

Description: Values followed by the same letter in both rows and columns indicate that the difference is not significant based on the Least Significant Difference (LSD) test at the 5% level.

Based on the observations in **Table 2**, the quality of rice across the three markets in Serang Regency did not differ significantly. The percentage of whole rice grains ranged from 62.93% to 64.87%, broken rice grains between 16.12% to 17.27%, and foreign matter content between 0.0209% to 0.0318%. These values indicate that the physical quality of rice across the three markets is relatively comparable and still classified as good in the medium rice category according to SNI. Setyawati et al. (2020) stated that a high proportion of whole rice grains indicates a good milling and storage process, while Mukaromah et al. (2022) added that the level of broken rice grains is influenced by the drying process, grain moisture content, and mechanical stress during distribution.

However, there were significant differences in the levels of rice grits and moisture content between markets. The highest percentage of rice grits was found at Tirtayasa market at 21.62%, followed by Dukuh market at 18.16%, and the lowest at Begog market at 18.07%. This difference indicates variations in the physical quality of rice, where higher levels of rice grits indicate suboptimal milling or storage processes. Setyawati et al. (2020) explained that high levels of rice grits can be caused by substandard grain moisture content or high-pressure milling, while Mukaromah et al. (2022) added that distribution conditions and storage room humidity also affect the level of broken rice grains.

Moisture content also showed significant differences between markets, with the highest at Dukuh market (11.5%), followed by Begog market (11.4%) and the lowest at Tirtayasa market (10.4%). Pangerang and Rusyanti (2018) stated that the ideal moisture content for rice storage is 12–14%, so the moisture content in all markets remains within safe limits. The lower value at Tirtayasa market indicates better drying and storage processes, as excessively high moisture content can trigger mold growth and the activity of warehouse pests such as *S. oryzae* (Susanti et al. 2022).

Meanwhile, across the three rice brands, all rice quality parameters showed values that ranged and were not statistically significantly different. The percentage of whole rice grains ranged from 62.27% to 65.00%, broken rice grains from 16.04% to 18.04%, rice grits from 18.84% to 20.06%, moisture content from 11.07% to 11.17%, and foreign matter from 0.0014% to 0.0022%. These values indicate that the three brands have comparable physical rice quality, indicating uniformity in the milling, drying, and storage processes.

The results in Table 2 indicate that rice quality in Serang Regency, both in traditional markets and across packaged brands, is generally uniform and meets the Indonesian National Standard (SNI) for medium-quality rice. Although most parameters show no significant differences, variations in rice grits and moisture content across markets indicate that post-harvest handling, drying, and storage conditions still require attention. Monitoring humidity, implementing modern sorting systems, and storing rice in closed containers are crucial steps to maintain stable rice quality and ensure its safety.

Degree of Milling

The degree of milling is an essential indicator of rice quality because it shows the extent to which the outer layers of the grain, such as the pericarp, testa, aleurone, and germ, are removed during polishing. The higher the polishing degree, the whiter and cleaner the rice appears, though some nutrients may be lost. According to the Indonesian National Standard (SNI), the polishing degree is a key parameter of rice quality. It is measured by weighing a 200 g sample and then separating whole, broken, and flaked grains to calculate the percentages. This allows for an objective assessment of polishing degree and rice quality.

Water content

Moisture content is the amount of water contained in rice. This amount significantly determines the quality and shelf life of rice. If the moisture content is too high, the rice will spoil quickly and develop mold, while if it is too low, the rice will be less palatable when cooked. The Indonesian National Standard (SNI) stipulates that the moisture content of rice should not exceed 14% to maintain its quality and shelf life.

Foreign object

The presence of foreign matter, a mixture of dirt, bran, or gravel in rice, indicates its cleanliness level. The lower the foreign matter content, the better the rice's quality. According to the Indonesian National Standard (SNI), 0.02–0.03% of medium-grade rice is permitted.

CONCLUSIONS AND SUGGESTIONS

Based on the research results, it can be concluded that only of insect pest found in retail rice sold in three markets in the Serang regency is *Sitophilus oryzae*, with a market population of approximately 120 to 185 individuals. Meanwhile, the number of individuals who purchased the three rice brands sold in Serang Regency ranged from 129 to 186. Pest attacks on retail rice did not cause a decrease in quality in either the three markets or the three brands of rice tested, as measured by degree of milling, moisture content, and the presence of foreign matter. The standard quality parameters remained within or below the limits set by the Indonesian National Standard (SNI) for medium rice. As a suggestion, further research should differentiate rice quality classes, such as premium, medium, and low, so that consumers have choices according to their needs and economic capabilities. This quality difference can also help producers increase the market value of premium rice and maintain other rice quality standards, thereby maintaining consumer confidence and market rice quality.

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