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SUMMARY

The loss of food grains during storage due to insect pests is a serious problem. This study was carried out in Plant Protection Research Institute, Sakha Agricultural Research Station, Kafr El-Sheikh during two successive seasons 2011/2012 and 2012/13 on wheat, rice and its products. The obtained results of this study could be summarized in the following points :

1. Monthly average number and percentage of the insect pests attacking wheat grain:

- The rice weevil *Sitophilus oryzae* in both years of 2011/12 and 2012/13 were of active and recorded a major insect pest from May (after wheat storage) till October. *R. dominica* the highest percentage recorded during September (12.9 %) in the first year, while the highest percentage recorded during September (12.5 %) in the second year with an average number 2.3 and 2.6 indiv. during the two years, respectively.
- Khapra beetle *Trogoderma granarium* population increased in August 2011 (10.8 indivi.) and recorded the highest numbers during September 2011. While populations recorded the highest numbers in August and September 2012 . On the other hand, the lowest populations of the pest was observed from December 2012 till March 2013. *T. castaneum* infestation was initiated during May 2011 (0.2 indivi.), then the population increased gradually from

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June 2011 (1.0 indivi.) till reached its the maximum in August 2011 (3.2 indivi.).

2. Monthly average number and percentage of the insect pests infesting wheat flour:

- The red flour beetle *Tribolium castaneum* population increased from 0.2 to 10.2 indivi. during May 2011 and September 2011, respectively. But *T. castaneum* population decreased from October 2011 till reaching February 2012. On the other hand, *S. paniceum* numbers increased during June 2011 and reached the maximum during September 2011 (1.2 indivi.). After that, *S. paniceum* population decreased sharply in the following months.
- Khapra beetle *Trogoderma granarium* population fluctuated during the year months in storehouses. The insect numbers increased during June 2011 (0-2 indivi.) and reached the maximum during September 2011 (4-5 indivi.). After that, *T. granarium* population decreased gradually during October 2011 (2.2 indivi.) until the following months.

3. Monthly average number and percentage of the insect pests infesting wheat bran:

- The red flour beetle *Tribolium castaneum* population in the year 2011/12 increased from June 2011 until reached to the maximum during September 2011 (20 indivi.), then the pest population decreased from October 2011 until April 2012 (0.8 indivi.). *R. dominica* population reached to the maximum during September

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2011 (5.2 indivi.) in the year storage 2011/12, while the pest population reached to the maximum during September 2012 (6.1 indivi.) in the year storage 2012/13. *T. granarium* population maximum in the first year storage (1.5 indivi.) lower than the pest population maximum in the second year storage (1.7 indivi.).

4. Monthly average number and percentage of the insect pests attacking rice grains:

- The rice weevil *Sitophilus oryzae* population increased from August 2011 (0.1 indivi.) until November 2011 (2.5 indivi.), then decreased from December 2011 until March 2012, then increased from April 2012 until June 2012 (3.5 indivi.). *R. dominica* population increased from August 2011 until November 2011, then decreased from December 2011 until February 2012, then increased from February 2012 until June 2012 (11 indivi.). *R. dominica* population in the year storage 2012/2013 similar to the pest population in the year storage 2011/2012. *T. granarium* population increased from August 2011 until November 2011, then decreased from December 2011 until February 2012, then increased until reached to the maximum population during June 2012 (2.6 indivi.). *T. granarium* population in the year storage 2011/12 similar to the pest population in the year storage 2012/13.

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5. Monthly average number and percentage of the insect pests attacking shelled rice:

- The rice weevil *Sitophilus oryzae* population increased until reached to October 2011, then decreased until reached to February 2012, then again increased until reached to the maximum during June 2012 (3.5 indivi.). *T. granarium* population increased until reached to November 2011, then decreased, after that again increased until reached to June 2012. But, *T. granarium* population content in the second year storage was higher than those of the first year storage. *C. cephalonica* population increased until reached to November 2011, then decreased. After that, increased from February 2012 until reached to the maximum during June 2012. But, *C. cephabonica* population content in the second year storage was lower than those of the first year storage except the maximum population.

6. External and internal damage caused by the insect pests:

- The percentage of external and internal damage of wheat grains caused by the insects in the first year 2011/12, as external damage. The highest percentage recorded in October 2011 (55%), followed by September 2011 (45%) and August 2011 (39%). While, the lowest percentage recorded during January 2012 (7 %) with an average of 26.7 %. On the other hand, the percentage of external and internal damage of rice grains caused by the insects in the first year 2011/12, as external damage. The

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highest percentage recorded in June 2011 (40%), followed by May 2011 (35%) and November 2011 (30%).

7. Preferability of different wheat and rice varieties to lesser grain borer

R. dominica infestation:

- In non-choice test found that, Sakha 93, Sakha 94 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties. On the other hand, Sakha 105 was the most preferred rice varieties, while Giza 181 and Giza 177 were the least preferred rice varieties.
- In free choice test found that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties. On the other hand, Sakha 105 was the most preferred rice varieties, while Giza 181, Giza 177 and Egyptian jasmens were the least preferred rice varieties.

8. Preferability of different wheat and rice varieties to *T. castaneum* infestation:

- In non-choice test found that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12 was the least preferred wheat varieties. On the other hand, Sakha 105 was the most preferred rice varieties, while Giza 181, Giza 177 and Egyptian jasmens were the least preferred rice varieties.
- In free choice test found that, Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12 was the least preferred

Summary

wheat varieties. On the other hand, Sakha 105 was the most preferred rice varieties, while Giza 181, Giza 177 and Egyptian jasmens were the least preferred rice varieties.

9. Toxicity of spinosad and orange oil :

- Spinosad was effective against the two tested insect species at the all rates and exposure periods. Mortality increased with the increasing of concentration and exposure periods with the two tested insects, where 12.5 pm spinosad achieved 9 and 23% mortality after 24 and 72 h of treatment, while % mortality reached 37 and 87% at 24 and 72 hr by 100 ppm with *T. castanenum* post treatment.
- Orange oil was effective against both *T. castaneum* and *R. dominica* adult using thin film technique after 48, 96 and 120 h post-treatment. For *R. dominica* % mortality increased from 7.4 to 26.7 after 96 and 120 h, respectively at concentration of 234.4 ppm, while 3750 ppm achieved 28.5 and 67% mortality after 48 h and 120 h. The same trend showed with *T. castaneum* where 1875 ppm caused 6.7 and 47% mortality after 48 h and 120 h, respectively,

10. Repellent effect of spinosad and orange oil :

- The percentage repellency ranged from 74 to 34%, 60 to 40% and 94 to 100%, 86 to 66% with spinosad and orange oil against *T. castaneum* and *R. dominica* through the time of exposure (24 h), respectively. Except orange oil against *T. castaneum* the effect of materials tested decreased through the 24 h, time of exposure. Also, resulted that the effect decreased

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with the decreasing of concentration and time of exposure either with orange oil or spinosad against both *T. castaneum* or *R. dominica*. Spinosad showed nearly similar effect on the two tested insects, while *R. dominica* was found to be more tolerant than *T. castaneum* with orange oil.

11. Fumigation effect of spinosad and orange oil :

- Natural insecticide spinosad had an insecticidal effect on *R. dominica* increased with the increasing of concentrations and exposure periods while the same insecticide does not have any effect on *T. castaneum* adults at the tested concentrations in this study. Also, spinosad completely prevented laying eggs till four weeks after treatment for *T. castaneum*.
- *T. castaneum* was more tolerant than *R. dominica* to orange oil where there was no mortality with *T. castaneum* one week after treatment while orange oil caused mortality ratios ranged from 3 to 13% at the same period of exposure.

Conclusion

Conclusion

1. The rice weevil *Sitophilus oryzae* in both years of 2011/12 and 2012/13 were of active and recorded a major insect pest from May (after wheat storage) till October.
2. The lesser grain borer *Rhizopertha dominica* the highest percentage recorded during September (12.9 %) followed by April (10.7 %) and August (10%) in the first year,
3. Khapra beetle *Trogoderma granarium* population increased from August 2011 until November 2011, then decreased from December 2011 until February 2012, then increased until reached to the maximum population during June 2012 (2.6 indivi.).
4. The percentage of external and internal damage of wheat grains caused by the insects in the first year 2011/12, as external damage. The highest percentage recorded in October 2011 (55%), followed by September 2011 (45%) and August 2011 (39%). While, the lowest percentage recorded during January 2012 (7 %) with an average of 26.7 %.
5. Sakha 93, Sakha 94 and Shandweel were the most preferred wheat varieties, while Seds 12, Gemeiza 11 and Egypt 2 were the least preferred wheat varieties to infestation by *R. dominica*.
6. Sakha 105 was the most preferred rice varieties, while Giza 181 and Giza 177 were the least preferred rice varieties to infestation by *R. dominica*.

Conclusion

7. Sakha 93 and Shandweel were the most preferred wheat varieties, while Seds 12 was the least preferred wheat varieties to infestation by *T. castaneum* .
8. Sakha 105 was the most preferred rice varieties, while Giza 181, Giza 177 and Egyptian jasmen were the least preferred rice varieties to infestation by *T. castaneum* .
9. Spinosad was effective against the two tested insect species at the all rates and exposure periods. Mortality increased with the increasing of concentration and exposure periods with the two tested insects where 12.5 pm spinosad achieved 9 and 23% mortality after 24 and 72 h of treatment, while % mortality reached 37 and 87% at 24 and 72 hr by 100 ppm with *T. castanenum* post treatment.
10. Natural insecticide spinosad had an insecticidal effect on *R. dominica* increased with the increasing of concentrations and exposure periods while the same insecticide does not have any effect on *T. castaneum* adults at the tested concentrations in this study.