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Impact of different foods on the development of *Rhyzopertha dominica* Fabricius (*Bostrychidae*: Coleoptera)

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Abstract

Musa, F. & Musa, S. (2025). Impact of different foods on the development of *Rhyzopertha dominica* Fabricius (*Bostrychidae*: Coleoptera). *Bulg. J. Agric. Sci., 31*(6), 1119–1125

To assess the impact of different food types on the development of *Rhyzopertha dominica* (Fab.), a study was conducted in laboratory conditions using several food types (wheat, barley, rye, corn, rice, and beans) in 2020. Several biological parameters were assessed, including egg development, egg hatching, the development period of the larvae, pupae, and imago, fecundity, oviposition, and the longevity of the pest. The egg period, on average, was lowest in wheat (6.17 days) and highest in rye (7.25 days). The larva hatching rate was lowest in beans (22.63 days) and highest in wheat (39.20 days). Larvae develop most rapidly when they feed on wheat (25.92 days), while they develop slowly (31.85 days) when they feed on beans. The pupa development was fastest when the larvae fed on wheat, with an average pupa development time of 4.01 days, and a transformation rate of up to 92% into adult insects. The impact of a food type on the development of one generation of *R. dominica* was also significant, with wheat being the preferred food for this pest. It takes 36.10 days to complete one generation. However, the development of this pest is slower when the insects feed on beans, taking 46.18 days to complete one generation.

Keywords: Coleoptera; *Rhyzopertha dominica*; storage pest; cereal and leguminous crops

Introduction

With the increasing world population, there is a growing demand for wheat, as it is a primary source of carbohydrates, proteins, minerals, and other essential nutrients. The most damage to the grains of cereals during storage is caused by insects (Ghada and Eman, 2017). During the storage of various cereal grains, the pest *Rhyzopertha dominica* (Coleoptera*: Bostrichidae*) is classified as a primary pest that can be found worldwide on various types of grains like wheat, corn, rice, and other cereal crops (Fajarwati et al., 2019; Kaoud et al., 2013).

R. dominica was described as a cosmopolitan pest among insects that affect raw grains in storage (Arthur et al., 2012). According to Buonocore et al. (2017), *R. dominica*, ancestrally a wood-boring insect, was subsequently adapted to the diet with cereal grains like wheat, rice, maize, oats, sorghum, barley, and millet, as well as their products (flour, biscuits, and pasta). According to the same authors, this pest also attacks rhizomes, dried roots, tubers, cork, paper, wooden frames, and other substrates that contain starch, etc.

This pest is considered one of the most widespread and damaging in many countries worldwide. As a polyphagous pest, *R. dominica* attacks many grains during storage (Murati et al., 2012; Awadalla et al., 2023; Astuti et al., 2023). This pest can easily spread from one location to another, infesting stored products.

Stored grain insect pests can cause reductions in weight, quality, commercial value, and seed viability (Masuma et al., 2017). Jood et al. (1992) reported that infestation with *R. dominica* affects the nutritional parameters of wheat, sorghum, and maize grains, altering the content of phosphorus, calcium, zinc, copper, manganese, and iron, among others.

Perišić et al. (2018) revealed that wheat infested with *R. dominica* significantly deteriorates the quality and technological parameters of the flour. The pest causes not only quantitative but also qualitative losses, such as nutritive loss and germination loss, rendering the wheat grains unfit for marketing and human consumption (Kosewska et al., 2024).

R. dominica is an internal feeder of various stored raw grains (Chanbang et al., 2008; Sadeghi and Ebadollahi, 2015). This is a common and highly destructive pest of wheat, barley, and other grain-stored products, regarded as the most damaging pest in many countries worldwide (Nemati-Kalkhoran et al., 2018; Agrafoti et al., 2023).

Food is an environmental factor that directly influences the population size of this pest. There are studies by different authors worldwide that report preferences for wheat as a better nutrient for this pest population development. The studies of Małgorzata (2006) supported this opinion, as the lesser grain borer population kept in wheat reached a higher number than the population that fed on oat flakes or pearl barley. Flakes of oats, however, appeared to be the best nutrient for *R. dominica* due to their easy availability, as they lack a hard-grain pericarp.

Some authors (Sudheer Kumar et al., 2017) based on their results regarding the biology of *R. dominica* in the three-grain hosts reported that corn is the least preferred host, rice is moderately preferred, and sorghum is the most highly preferred host. The other authors reported that cereals during storage are very susceptible to infestation by insects such as *R. dominica* as well as *Sitophilus oryzae* (Sadeghi and Ebadollahi, 2015).

The eggs of *R. dominica* are deposited among the frass that is produced from the insect, mostly in clusters on grain and very rarely singly. According to Edde (2012), more than 53 species of plants belonging to 31 families were reported to be potential hosts for *R. dominica*.

Some authors (Limonta et al., 2011) reported that if the moisture content of the grain is below 9%, the pest will not survive.

Imago feeds on whole or cracked grains, whereas a larva develops inside the kernels, reducing them to hollow husks (Edde et al., 2006). According to Rahul et al. (2019), the larvae are internal feeders, while the adults are free-living and have the ability to fly.

The females are highly fertile and may deposit numerous eggs, ranging from 300 to 500, which are typically laid near the seed embryo. This embryo has very soft parts, allowing the young larvae to easily enter at the first stage (Deshwal et al., 2018). According to the same authors, the egg stage duration is 5–6 days during the summer and longer in the winter.

The total developmental period was calculated from the day the eggs were laid to the emergence of the adults. It varied from 38 to 67 days in males and 78 to 107 days in females, with a mean of 52.20 ± 5.66 days in males and 95.85 ± 9.19 days in females at 30 ± 1.0°C in laboratory conditions (Chintala and Virani, 2018; Chintala et al., 2017).

Given that the pest *R. dominica* is present almost every year during grain storage, the purpose of this research was to investigate the influence of food type on certain biological parameters related to the development of *R. dominica* under laboratory conditions.

Materials and Methods

Research premises and stock colony

During this research, we investigated some of the biological characteristics of *R. dominica* when fed on six different food sources (wheat, barley, rye, maize, rice, and beans). The experiment was conducted in 2020 in laboratory conditions at the Plant Protection Department, Faculty of Agriculture and Veterinary, University of Prishtina. The grain samples of wheat (Figure 1) infested with the pest (Figure 2) were

Fig. 1. Sampling from the mills
Source: Authors' own elaboration

Fig. 2. Wheat infested (*R. dominica*)
Source: Authors' own elaboration

Fig. 3. Adult stage of (*R.dominica*)
Source: Authors' own elaboration

taken from two electrical processing mills in Kosovo (Barilevo and Prugovc). The infested grain samples were sieved through 2.5 mm diameter sieves to separate the pest from the grain (Figure 3). The male and female *R. dominica* adults were identified based on the description given by Stemley and Wilbur (1996).

The insects were initially reared on wheat seeds to initiate the stock colony and maintained under controlled conditions in a growth chamber at 30 ± 1°C, relative humidity of 70 ± 5%, and a photoperiod of 16:8 h (L:D) for two generations. The relative humidity was controlled using a saturated sodium chloride solution to maintain a humidity level in the approximate range of 70%. The observation of the investigated parameters was checked every 24 hours. Similar methodology has been used by other authors as well (Awadalla et al., 2023).

Embryonic development

The embryonic period was considered to be the period between the dates of egg laying and egg hatching. To monitor this parameter, 30 healthy, undamaged eggs of each food type were selected in 5 replications and placed in Petri dishes with dimensions of 100 mm. These eggs were then placed on yellow paper with dimensions of 90 mm.

Eggs hatching

After the eggs hatched, the percentage was calculated. Subsequently, the fresh larvae were individually transferred to new petri plates using a fine hairbrush and kept with a few grains for further development.

Larva, pupa, and imago development period

Thirty newly hatched larvae of *R. dominica* were individually transferred into Petri dishes (diameter 6 cm, depth 1 cm), containing two seeds of each food type (wheat, barley, rye, maize, rice, and bean). Petri dishes were observed daily, and the duration of larval, pupal, and imago periods, as well as other parameters, were recorded.

Total developmental period

The total developmental period (single generation) was calculated as the period between egg laying and the emergence of an adult.

Fecundity

The total number of eggs laid during the entire life span of the female was considered her fecundity. To determine fecundity, the number of eggs laid by each female was counted daily until the female's death, and the average fertility was calculated.

Oviposition

Freshly emerged male and female adults were separated and paired on a Petri plate with 100 uninfested grains of wheat, barley, rye, maize, rice, and beans. For recording observations on egg laying, the pair of adults was first shifted to a new petri plate, and then the number of eggs laid by the female was recorded daily.

Longevity

The longevity of males and females was recorded from the period between the emergence of the adult and the adult's death.

Statistical analysis

Experimental data were statistically processed using one-way ANOVA and LSD = P < 0.05 with an MSTA-C package from the University of Michigan.

Results and Discussion

Impact of food types on embryonic development

Temperature, relative humidity, and food are the basic ecological factors for the growth and development of *R. dominica*. The results from the experiment show that food also affects the embryonic development of this species (Table 1). Embryonic development, or egg stage, is shortest when adult insects feed on corn for an average of 6.01±0.19 days, while it is longer if they feed on rye for an average of 7.25±0.26 days.

Food is a very important environmental factor, which, based on the results of many authors (Begum et al., 1975; Howe, 1950; Kapoor, 1964; Khare and Agawal, 1970) and also from our research, influences the growth and development of *R. dominica*. Food type influences embryonic and postembryonic development as well. Our results differ from those reported by Begum et al. (1975), who noted that the kind of food does not affect the embryonic development of *R. dominica*. In our view, insects that feed on more suitable foods lay more vital eggs, and thus embryonic development is more successful. According to other authors, the egg stage duration is 5–6 days and varies by season, being longer in winter (Deshwal et al., 2018). The differences noticed between the different food types (wheat and corn) regarding the embryonic development of *R. dominica* were statistically not significant.

Table 1. Food impact on the development of immature stages of *R. dominica*

Food	Mean (± SD)			
	Embryonic development	Egg hatching	Larva development	Pupa development
Wheat	6.17±0.45^{b}	39.20±0.28^{a}	25.92±0.51^{d}	4.01±0.24^{e}
Barley	6.60±0.17^{c}	30.63±0.23^{b}	26.65±0.88^{d}	4.18±0.22^{e}
Rye	7.25±0.26^{a}	36.50±0.22^{a}	30.47±0.73^{b}	6.94±0.46^{b}
Corn	6.01±0.19^{b}	37.29±0.45^{a}	27.40±0.86^{c}	4.40±0.33^{d}
Rice	7.23±0.25^{a}	24.68±0.13^{c}	30.22±0.60^{b}	5.97±0.15^{c}
Bean	7.09±0.31^{a}	22.63±0.86^{c}	31.85±0.63^{a}	7.24±0.30^{a}
N	30	30	30	30
LSD 0.05	0.3232	3.6279	1.1020	0.2825

*Data are expressed in days as a mean ± SD. Means with the same small letter within the same column are not significantly different (P<0.05, LSD).

Source: Authors' own elaboration

Based on ANOVA, significant differences ($p = 0.05$) were observed in egg development among different food types for the pest.

The types of food also affect the hatching process of the larvae, as presented in Table 1. Thus, the highest number of eggs hatched when the insects were fed with wheat, with an average of 39.2 days, while the smallest, when they were fed with beans, had an average of 22.63 days. Based on ANOVA, significant differences ($p = 0.05$) were found between different food types in larva hatching.

Influence of food types on larval development

As an ecological factor, different food types have more impact on larval development than on embryonic development. Thus, larvae develop most rapidly when they feed on wheat for an average of 25.92 days, while they develop the slowest when they feed on beans for an average of 31.85 days (Table 1). According to the data obtained, it can be confirmed that *R. dominica* larvae are most affected by wheat and barley as food sources, followed by corn, while beans and rye are the least preferred food sources for the pest.

The type of food directly affects the growth and development of *R. dominica* larvae. Based on the data obtained, the most appropriate food for larval development is wheat (25.92 days), which is in agreement with the data of other authors (Begum et al., 1975; Kapoor, 1964; Khare and Agarwal, 1970; Khatibi, 1977). Based on the data of our research, young larvae of *R. dominica* are embedded in healthy and undamaged wheat grains, which agrees with the results reported by Potter (1935); however, they deviate from those reported by Howe (1950).

Based on the data obtained, we have observed that *R. dominica* larvae were unable to enter healthy and intact bean grains under experimental conditions, but were able to use those that were mechanically or otherwise damaged.

Based on the ANOVA, significant differences ($p = 0.05$) were determined between the different foods regarding the development of *R. dominica* larvae.

Influence of food type on the pupa development of R. dominica

Based on the data from this research, we can conclude that the type of food significantly affects pupa development. However, the influence was noted when this species fed on wheat and beans. Thus, pupa development is fastest when the larvae feed on grain, where the pupa development lasts from 3.65 to 4.28, or an average of 4.01 days (Table 1), while the level of transformed pupae into adult insects is up to 92%.

For beans, the development of this phase takes longer, from 6.45 to 7.70 days, with an average of 7.24 days, whereas the percentage of transformation of pupae into adult insects is lower, at 68%. Based on the ANOVA, significant differences ($p = 0.05$) were determined between the different foods regarding the development of *R. dominica* pupa. According to Linda (2010), the duration of the pupal stage was approximately 5–6 days at 28ºC and 8 days at 25ºC. Thus, the results obtained in the present investigation are largely supported by those reported by earlier workers.

Influence of food type on the development of one generation of R. dominica

In Table 2, we showed the impact of a food type on the development of one generation of *R. dominica*. The results of the experiment show that wheat is the favorite food for this pest. It takes an average of 36.10 days to complete one generation, whereas the development of this pest is slower when the insects feed on beans, taking 46.18 days to complete one generation. The other authors reported nearly identical data (Awadalla et al., 2023). Baghla et al. (2023) reported that among wheat varieties, there were different levels of susceptibility; hence, out of ten varieties screened, HI-1544 was found to be resistant against this pest. Thomson (1966) reported that 38 days were required to complete the life cycle from egg to adult at a temperature of 29 ± 0.5 °C and 75 ± 5% relative humidity, whereas Elek (1994) estimated the total development time (egg to adult) to be 44 days at a temperature of 26 °C and 56% relative humidity.

From the data reported by other authors, this parameter varied from 38–67 days in males and 78–107 days in females, with a mean of 52.20 ± 5.66 days in males, whereas it was 95.85 ± 9.19 days for the females at 30 ± 1.0ºC in laboratory conditions (Chintala and Virani, 2018; Chintala et al., 2017). Based on ANOVA, significant differences ($p = 0.05$) were found regarding different food types for the development of *R. dominica* (Table 2).

Influence of food type on female fecundity

The females of *R. dominica* that were fed with wheat laid the highest number of eggs, with an average of 307.85, whereas the lowest was when fed on beans, with an average of 46.87 (Table 2). Based on the ANOVA, a significant difference ($p = 0.05$) was found in the fertility of *R. dominica* females across different food types. According to the work of other authors, females are highly fertile and may deposit a large number of eggs, ranging from 300 to 500, indicating that our results align with their findings (Deshwal et al., 2018).

The type of food also affects the period of oviposition (Table 2). The most extended period of oviposition was observed in females fed corn, with an average of 43.2 days, while the shortest was in females fed beans, with an average of 11.7 days. According to Linda (2010), oviposition begins approximately 15 days later and can last up to 4 months, findings that align with our results.

Based on the ANOVA, a significant difference (P = 0.05) was found between the different food types and the oviposition duration of the pest *R. dominica* females.

Influence of food type on longevity

Adult *R. dominica* insects live the longest if they feed on wheat, with an average of 206.10 days, while they live the

Table 2. Food impact on different biological parameters of *R. dominica*

Food	Mean (± SE) duration days			
	One generation	Female fecundity	Oviposition duration	Longevity
Wheat	36.10±0.95^{c}	307.85±156.17^{a}	37.50±5.45^{b}	206.10±6.74^{a}
Barley	37.16±0.84^{d}	285.73±106.54^{b}	33.50±8.64^{c}	178.75±6.43^{c}
Rye	44.95±0.73^{b}	237.00±74.18^{c}	35.00±7.12^{c}	195.40±19.15^{b}
Corn	37.12±0.97^{d}	312.60±67.35^{a}	43.20±8.26^{a}	152.25±23.50^{d}
Rice	42.91±0.65^{c}	221.70±31.54^{d}	31.00±8.30^{d}	145.80±7.11^{d}
Bean	46.18±1.12^{a}	46.87±31.96^{e}	11.70±6.42^{e}	62.79±4.08^{e}
N	30	30	30	30
P 0.05	0.6069	5.3251	2.1728	8.7808

*Data are expressed in days as a mean ± SD. Means with the same small letter within the same column are not significantly different (P < 0.05, LSD).
Source: Authors' own elaboration

shortest when fed on beans, with an average of 62.79 days (Table 2). Concerning pest longevity, seasonal variation also has an impact; thus, according to Win et al. (2020), males and females live longer in the winter (36.5 and 39.3 days, respectively), whereas during the rainy season, they live shorter (29.5 and 34.9 days, respectively).

Based on the ANOVA, a significant difference (P = 0.05) was determined between different types of food regarding the life span of the imago of *R. dominica*.

Conclusions

Food represents one crucial environmental factor that affects the growth and development of *R. dominica*. Females of *R. dominica* that feed on wheat at a temperature of 30 °C and a relative humidity of 75% lay the highest number of eggs (307.85), while if they feed on beans, they lay the fewest (46.87 eggs).

The type of food influences both the embryonic and postembryonic development of the pest, *R. dominica*. When insects of this species feed on wheat at a temperature of 30 ºC and a relative humidity of 75%, the development of one generation lasts the shortest (embryonic development 6.17, larval development 25.92, and pup development 4.01 days), 36.10 days, while the beans last the longest (embryonic development 7.09, larval development 31.85, and pup development 7.24 days), on average 46.18 days.

The type of food also affects the longevity of adult *R. dominica*. Thus, the longest-lived are those insects that were fed on wheat (206.10 days), while the shortest are those that were fed on beans (62.79 days).

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References

Agrafoti, P., Arthur, F. & Athanassiou, Ch. G. (2023). Competition of *Rhyzopertha dominica* and *Sitophilus oryzae* on six sorghum varieties. *Environmental Science and Pollution Research*, *30*, 110805 – 110811.

Arthur, F. H., Ondier, G. O. & Siebenmorgen, T. J. (2012). Impact of *Rhyzopertha dominica* (F.) on quality parameters of milled rice. *Journal of Stored Products Research,48*, 137 – 142.

Astuti, L. P., Setyawan, S. & Widjayanti, T. (2022). *Rhyzopertha dominica* Fabricius (Coleoptera: Bostrichidae): Growth and Development on Six Maize (*Zea mays* L.) Varieties. *AGRIVITA Journal of Agricultural Scienc*e, *44*(20), 248 – 257.

Awadalla, S. S., El-Serafi, H. A., Ghanim, A. A. & Shalaby, M. M. (2023). The Effect of different Host Grains on the Biological Aspects of the Lesser Grain Borer *Rhyzopertha dominica* (Fab.) (Bostrichidae: Coleoptera). *Journal of Plant Protection and Pathology*, Mansoura University, *14*(4), 105 – 108.

Baghla, K., Singh Rathore, B., Saxena, S., Shivhare, R. & Mal Tetarwal, J. (2023). Varietal screening of wheat genotype against, Rhyzopertha dominica Fab. (Lesser grain borer). *The Pharma Innovation Journal*, *12*(2), 3742 – 3748.

Begum, A., Ahmed, M. & Huda, S. M. S. (1975). The effect of food on the life history of *Rhyzopertha dominica* F. (Coleoptera, *Bostrichidae*). *Biology. Abstract*, *59*(5), 25643.

Buonocore, E., Lo Monaco, D., Russo, A., Aberlenc, H. P. & Tropea Garzia, G. (2017). *Rhyzopertha dominica* (F., 1792) (Coleoptera: *Bostrichidae*): a stored grain pest on olive trees in Sicily. *Bulletin OEPP/EPPO Bulletin*, 1 – 6.

Chanbang, Y. Y., Arthur, F. H., Wilde, G. E., Throne, J. E. & Subramanyam, B. (2008). Susceptibility of eggs and adult fecundity of the lesser grain borer, *Rhyzopertha dominica*, exposed to methoprene. *Journal of Insect Science, 8*, 1 – 5.

Chintala, S. & Virani V. R.(2018). Biology and behavior of lesser grain borer, *Rhyzopertha dominica* (Fabricious) (Coleoptera: *Bostrichidae*) on stored wheat in laboratory conditions. *International Journal of Agriculture Sciences*, *10*(5), 5231 – 5234.

Chintala, S., Kirit, P. & Virani, V. R.(2017). Biology and behavior of lesser grain borer, *Rhyzopertha dominica* (Fabricious) (Coleoptera: *Bostrichidae*) on stored wheat in laboratory Conditions. *Agriculture Update, 12*(5), 1332 – 1338.

Deshwal, R., Gupta, P. K., Vaibhav, V., Kumar, N. & Kumar, A.(2018). Biology of lesser grain borer (*Rhyzopertha dominica* Fab.), under different temperatures and humidity at laboratory conditions. *Journal of Entomology and Zoology Studies*, *6*(4), 364 – 368.

Edde, P. A.(2012). A review of the biology and control of *Rhyzopertha dominica* (F.) the lesser grain borer. *Journal of Stored Products Research*, *48*, 1 – 18.

Edde, P. A., Phillips, Th. W., Nansen, Ch. & Payton, M. E.(2006). Flight Activity of the Lesser Grain Borer, *Rhyzopertha dominica* F. (Coleoptera: *Bostrichidae*), in Relation to Weather. *Environmental Entomology*, *35*(3), 616 – 624.

Elek, J. A.(1994). Methods of collecting eggs and monitoring egg hatch and immature development of *Rhyzopertha dominica* Fab. (Coleoptera: *Bostrichidae*). *Journal of Stored Products Research*, *30*, 261 – 263.

Fajarwati, D., Astuti L. P. & Himawan, T. (2019). Growth and Development of *Rhyzopertha dominica* Fabricius (Coleoptera: *Bostrichidae*) on White, Red, and Black Rice. *The Journal of Experimental Life Science,9*(2), 81 – 89.

Ghada, S. M. & Eman, T.(2017). Potency of Entomopathogenic Fungi, *Trichoderma album* Preuss in Controlling, *Rhyzopertha dominica* F. (Coleoptera: *Bostrichidae*) under Laboratory Conditions. *Journal of Plant Protection and Pathology, Mansoura Univiversity, 8*(11), 571 – 576.

Howe, W. R. (1950). The development of *Rhyzopertha dominica* F. (Coleoptera, *Bostrichidae*) under constant conditions. *Entomologist's Monthly Magazine*, *86*, 1 – 5.

Jood, S., Kapoor, A. C. & Singh, R.(1992). Mineral contents of

cereal grains as affected by storage and insect infestation. *Journal of Stored Products Research, 28*(3), 147 – 151.

Kaoud, H. A., Saeid, Sh., EL-dahshan, A. R. & El-Behary, A. M.(2013). New Methods for the Control of Lesser Grain Borer, *Rhyzopertha dominica*. *International Journal of Engineering and Innovative Technology (IJEIT)*, *3*(4), 285 – 289.

Kapoor, S. (1964). Nutritional studies on *Rhyzopertha dominica* F. (*Bostrichidae*: Coleoptera). Effects of various natural foods on larval development. *Indian Journal of Entomology*, *26*(3), 289 – 295.

Khare, B. P. & Agawal, N. S.(1970). Effect of temperature, relative humidity and food material on the biology of *Sitophilus oryzae* L. and *Rhyzoperta dominica* F. (Coleoptera*, Curculionidae* and *Bostrichidae*) *Beitraege zur Entomologie,* 20(1/2), 183 – 188.

Khatibi, P.(1977). Studies of food preference of *Rhyzopertha dominica* F. (Coleoptera, *Bostrichidae*). *Entomologie et Phytopathologie Appliques*, *45*, 16 – 17.

Kosewska, O., Nietupski, M., Koronkiewicz, S. & Wojciech Przemieniecki, S. (2024). The chemical grain composition of wheat and barley affects the development of the lesser grain borer (*Rhyzopertha dominic*a F.) and the rice weevil (Sitophilus oryzae L.). *Journal of Plant Protection Research*. eISSN 1899-007X.

Limonta,L., Morosini, M. C. & Locatelli, D. P.(2011). Development of *Rhyzopertha dominica* (F.) (Coleoptera *Bostrichidae*) on durum wheat kernels and semolina. *Journal of Entomological and Acaralogical. Research, Ser. II, 43*(1), 33 – 38.

Linda, J. M.(2010). Lesser grain borer *Rhyzopertha dominica* (Fab.) Stored Product Pests. Purdue Extension (E), 238.

Małgorzata, K. (2006).Nutritional preferences of the lesser grain borer *Rhyzopertha dominica* F. (Coleoptera*, Bostrichidae*) under conditions of free choice of food. *Journal of Plant Protection Research, 46*(4), 359 – 367.

Masuma, A., Shanjida, S., Tangin, A. & Shefali, B. (2017). Oviposition preference and development of rice weevil, *Sitophilus oryzae* (Lin.) (Coleoptera: *Curculionidae*) in different stored grains. *Bangladesh Journal of Zoology*, *45*(2), 131 – 138.

Murati, G., Musa, F.& Ramadani, S.(2012). Investigation of the presence of the most important wheat grain pest from the order Coleoptera in some processing mills in Kosovo. *Section 10: Plant Protection–Phytomedicine. International Symposium for Agriculture and Food*. Skopje, Macedonia, 1088 – 1093.

Nemati-Kalkhoran, M., Razmjou, J., Borzoui, E. & Naseri, B.(2018). Comparison of Life Table Parameters and Digestive Physiology of *Rhyzopertha dominica* (Coleoptera: *Bostrichidae*) Fed on Various Barley Cultivars. *Journal of Insect Science*, *18*(2), 1 – 9.

Perišić, V., Hadnađev, M., Perišić, V., Vukajlović, F., Dapčević-Hadnađev, T., Luković, K. & Đekić, V.(2018). Technological quality of wheat infested with *Rhyzopertha dominica* F. (Coleoptera: *Bostrichidae*). *Advanced technologies*, *7*(1), 35 – 40.

Potter, C. (1935). The biology and distribution of *Rhyzopertha dominica* F. *Transactions of the Royal Entomological Society*. London, *83*(4), 449 – 482.

Rahul, K. Ch., Suresh, M. N., Manju, Sh., Subramanian, S., Srivastava, Ch. & Paul Khurana. S. M.(2019).Insecticidal and repellent activities of eucalyptus oil against lesser grain borer *Rhyzopertha dominica*(Fabricius). *J. Microbiol. Biotech. Food. Sci*., *9*(3), 525 – 529.

Sadeghi, R. & Ebadollahi, A.(2015). Susceptibility of *Rhyzopertha dominica* (F.) (Coleoptera: Bostrichidae) and *Sitophilus oryzae* (L.) (Coleoptera: *Curculionidae*) to Spinosad (Tracer®) as an Eco-friendly Biopesticide.*Ecologia Balkanica*, *7*(1), 39 – 44.

Stemley, P. G. & Wilbur, D. A. (1966)**.** A color characteristic for sexing live adult lesser grain borers. *Journal of Economic Entomology*, *59*, 760 – 761.

Sudheer Kumar, P., Uma Maheswari, T. & Padmakumari, A. P.(2017). Comparative Biology of *Rhyzopertha dominica* (Fab.) in Major Cereals. *Internacional Journal of CurrentMicrobiology and Applied Sciences, 6*(7), 2205 – 2210.

Thomson, V. (1966). The biology of the lesser grain borer, *R. dominica* Fab. *Bulletin of Grain Technology*, *4*(4), 163 – 167.

Win, N., Rolania, K. & Yadav, S. S.(2020). Effect of seasonal variation on the biology of lesser grain borer, *Rhyzopertha dominica*, (Fabricius) on paddy. *Journal of Entomology and Zoology Studies, 8*(3), 694 – 699.

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