International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 28-09-2021, Accepted: 14-10-2021, Published: 29-10-2021
Volume 6, Issue 5, 2021, Page No. 221-228

Life cycle, morphometrics, fungal identification and effect of preventive treatments in sesame seeds of *Tribolium castaneum*

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Abstract
The red flour beetle (*Tribolium castaneum*) pest infestation could be a terrible major problem as various life stages of insects cause economic damage and deteriorate the standard of food grains—the insect *T. castaneum* and its body parts were dissected and measured were recorded based on calibration readings. In sesame seeds maintained, an experimental setup has roasted and unroasted viz BOD incubator, refrigerator, water spray, sundry and regular room temperature applied sesame seed to prevent *T. castaneum* pest infestation at 15 days interval for analyzing the germination test and germination index. Infected dead *T. castaneum* pests were collected, and fungi were isolated by culture plate technique with frequency percentage. The *T. castaneum* faecal matter was tested in a field emission scanning electron microscope (FESEM). A result indicates that the measurements and the complete life stages of *T. castaneum* were recorded. *Rhizopus stolonifer, Rhizomucor* fungus culture were identified from the roasted and unroasted water spray treatment. *Aspergillus* (57.1%), *Penicillium* (14.2%), *Acremonium* (14.2%), *Mucor* (14.2%) were the most dominant fungi among those isolated from infected red flour beetle of sesame seed samples. FESEM analysis in the excreta of *T. castaneum* toxic or adverse health effects.

Keywords: *Tribolium castaneum*, sesame seed, seed germination, FESEM

Introduction

Tribolium castaneum Herbst (Red flour beetle) is one of the most widespread and destructive pests of stored products, feeding on different stored-grain and grain products [21, 42].
Reproductive performance of *Tribolium* exposed to various conditions like temperature, humidity, food availability, and structural complexity poor storage facilities promote stored pests to diffuse, leading to considerable losses in grain weight, germination ability, increase in temperature and humidity, the spread of grain diseases and reduce their nutritional value [39, 27, 16]. However, each larva and adult feed on grain dust and broken grain, not unbroken whole grains, and spend their entire life cycle outside the grain kernels [15]. Adult females *Tribolium* species have a long life span and can lay eggs relatively continuously throughout their lives [13, 45] and had been reported to put up to 1,000 eggs throughout their lifetime [29].
Morphometric characterization has been used to measure the size variability of the pest reared in numerous kinds of culture and verify whether or not the food preference has a bearing on the morphology of the insect according to [9]. Size is a vital indicator of fitness in insect ecology [5]. The image's morphometric data, including body length, thorax length, thorax width and length-width between thorax and abdomen, is measured using ImageJ 1.52a software [1].
Sesame (*Sesamum indicum*) is the Pedaliaceae family [33]. Before consumption and oil extraction, sesame seeds are subjected to many pre-treatment processing methods, such as roasting, dehulling, moistening, steaming, and heating, to enhance the oil recovery and quality [34, 43]. Roasting enhances sesame seeds' colour, flavour, and texture [44]. Microwave and conventional oven roasting treatments increased bioactive compounds such as tocopherols, phytosterols, resveratrol, flavonoids, and lignans in sesame oil [18, 19, 31, 22].
Seed throughout storage might be influenced by factors like temperature and relative humidity of the storage environment, nature of the seeds, seed moisture content and storage periods [26]. Suma *et al*., (2013)[37] reportable that frequent fluctuation in temperature, wet content, and storage time create the challenging process and storage of seeds. *A. sesame, F. oxysporum, M. phaseolina* and eight other fungi are seed-borne and cause different diseases [30].
A warm climate favours the multiplication of microorganisms and damaging stored product pests [38]. Fungi have extensive epidemic potential and can spread quickly through an insect population and cause its collapse [12, 20, 32].
The study aimed to analyze the morphometric character and the life stages of *T. castaneum,* the prevention methods to protect the sesame seeds from the infestation of pestiferous insects, fungus identified on the exoskeleton and extraction of excreta of *T. castaneum.*

Materials and Methods

Sampling

Experiments were conducted in the Laboratory of the Zoology Department at 34ºC room temperature and 87% relative humidity conditions. Samples were collected in different stores, grocery markets, departmental stores, households and agricultural traders in Coimbatore. The sample was weighed in the electric weighing balance, then taken each 5g of stored grains transferred in reared clean plastic containers and closed with a holed lid to allow good aeration and prevent the insect's escape. This experimental setup was maintained in three replicates [40].

Identification

Culture of sesame seeds of stored grains pest *T. castaneum* was maintained. A well-grown adult was selected with the help of a small soft camel hairbrush, and the insect was fixed with the help of forceps and microneedle on paper. Then selected insects were placed under a dissection microscope for identification. The selected pest was anaesthetized using chloroform examined under a stereo binocular microscope (Carl Zeis stemi dv4) for magnifying and capture images. Identified based on the species morphological key features were obtained from [41].

Morphometric analysis

Identified freshly emerged adult *T. castaneum* pests were introduced in sesame seed at plastic containers in three replicates analyzed for morphometric analysis. Few *T. castaneum* pests were anaesthetized using chloroform for morphometric analysis, placed under the dissection microscope view and dissected by three regions: head, thorax, and abdomen. Each part was dissected in turn by head-antenna, thorax-fore leg, mid-leg and hind leg, fore wing, hind wing and abdomen-posterior region. Dissected pest is placed on the clean slide and measured length and breadth of each dissected three regions by using ocular and stage micrometer. The microscope's ocular lens is removed and unscrewed, and the ocular micrometer is inserted on the circular shelf with the engraved side down. Then the ocular lens is replaced with the microscope. The stage micrometer is mounted on the microscopic stage. The stage micrometer scale is centered on the low power objective and then switched to the high power. The ocular lens is rotated until the lines of the ocular micrometer are superimposed on those of the stage micrometer. The micrometer is adjusted to superimpose a line on the ocular disc upon one of the lines on the stage micrometer. With the lines of the two-micrometer coinciding at one end of the field, the spaces of each micrometer to the point at which the lines of the micrometers coincide again is counted. The Number of ocular divisions is noted down. Using the fact that each division of the stage micrometer equals 0.01mm or 10 mm, the distance between two lines of ocular micrometer has arrived. The observation and calculations are recorded. The stage micrometer is removed. Dissected stored grain species placed on a glass slide is mounted on the microscope stage. By rotating the ocular micrometer, the diameter of the pest is measured, and the

$$\text{One ocular division} = \frac{\text{Number of divistion in stage micrometer}}{\text{Number of divistion in ocular micrometer}} \times 10$$

$$= 80 \div 5 \times 10$$

Calibration value for one ocular division = 16µ

Morphometric measurements were recorded based on calibration readings with 10x magnification power of the microscope. The calibration readings include the division of stage micrometers (10, 20, 30, 40, 50) and the division of ocular micrometers (6, 12, 18, 24, 30) [23].

Life cycle and biology

A study on the life cycle of *T. castaneum* was conducted in the Laboratory from November 2020 to April 2021 at 23^{o}C - 33^{o}C temperature and 42-76% humidity condition. Ten pairs of freshly emerged adult red flour beetle (*T. castaneum*) were selected for mating and covered with muslin cloth for mating. The adult females were observed regularly at an interval of eight hours for their oviposition. After mating, the female moth laid eggs on the sesame flour. Collected eggs were taken in a petri dish, the incubation period was observed, and the hatching percentage of eggs was recorded daily. Then the newly hatched first instar grubs were carefully collected with the help of a soft camel hair brush and were individually transferred in glass vials containing 3 mg of sesame flour supplied as food in each vial. Pupae were examined using a binocular microscope to differentiate between male and female pupae. Three replicates were maintained in a laboratory. The experimental setup was observed regularly at an interval of eight hours for oviposition. Finally, the duration of each stage, egg, larva stage and pupal period and an adult were recorded [10].

Treatments of roasted and unroasted sesame seed

Take 5g of roasted and unroasted sesame seed were maintained as three replicates such as BOD incubator, refrigerator, sundry, water spray treatment and room temperature treatment as control. Sesame seeds were observed regularly at every 15, 30, 45, 60, 75 days interval and recorded [3].

Seed Germination in Sesame seeds

After observing 5g of sesame seeds from various treatments such as BOD incubator, refrigerator, water spray, sundry and room temperature treatment as control, this seed was introduced into germination as three replicates and seeds were kept moist every day for six days. Germination percentages were calculated by expressing the Number of seedlings in a replicate that emerged seven days after planting as a percentage of the Number of seeds planted [14]. Germination index (GI) was calculated by taking the germination counts at 5 and 7 days after planting, and the data were substituted into the following formulae:

$$\text{Germination index (G I)} = \frac{\text{Seedlings germinated on day 5}}{\text{Days of first count}} - \frac{\text{Seedlings germinated on day 7}}{\text{Days of final count}}$$

Identification of fungus from water spray sesame seed treatments: 20 ml of lactic acid and 40 ml of glycerol was dissolved with distilled water, 20g of phenol crystals were added to the above contents and heated to dissolve thoroughly. 2 ml of 1% aqueous cotton blue was added and mixed well. A drop of lactophenol cotton blue stain was placed on a clean glass slide. Using a flamed needle for sterilization, a small piece of young fungal culture (5 - 7 days old) with spores was added to the stain separately. The sample was mixed gently with the stain using two teasing needles, and a coverslip was gently placed on the preparation and examined under a camera microscope, and observed [2, 6]

$$\text{Frequency percentage} = \frac{\text{Number of fungal colonies for each fungus}}{\text{Total number of fungal colonies for the isolated fungi}} \text{ X } 100$$

Infected *T. castaneum* fungus culture

The insects existing in the flour were separated and identified as *T. castaneum* according to the key given by [11]. Infected dead 3 *T.castaneum* pests were collected and

ground with the motor pestle with 1ml of distilled water. It forms supernatant. The culture plate technique isolated the fungi.
Taken about 0.1 ml of the diluted effluent suspensions was added into separate Petri dishes containing sterile rose bengal chloramphenicol agar medium and mixed gently to get uniform distribution of the effluent inoculum. The plates were allowed to solidify and incubated at room temperature for 5-7 days.
The fungal isolates were cultured in a rose bengal chloramphenicol agar medium. A drop of lactophenol cotton blue was placed on a clean glass slide. Using a flamed needle for sterilization, a small piece of young fungal culture (5 - 7 days old) with spores was added to the stain separately. The mould was mixed gently with the stain using two teasing needles, and a coverslip was gently placed on the preparation and examined under a 40x camera microscope. Bosly and El-Banna, (2015) [6]

$$\text{Frequency percentage} = \frac{\text{Number of fungal colonies for each fungus}}{\text{Total number of fungal colonies for the isolated fungi}} \times 100$$

Fesem

The excess material of faecal matter of *T. castaneum* was carried out by fluorescent Emission Scanning electron microscope (FESEM- 6300, JEOL) by secondary electron (SE) imaging mode [24].

Results

Collected stored grain (sesame seed) pests were identified based on the severity of the damage and subdivided as internal and external feeders based on their feeding behaviour. This group of insects feed on germ and endosperm from outside. The pest may attack the whole seed from outside and damage the terminal portion of the seeds.
Red flour beetle (*Tribolium castaneum*)
Phylum: Arthropoda
Class: Insecta
Order: Coleoptera
Family: Tenebrionidae
Genus: Tribolium
Species: castaneum

The red flour beetle, *Tribolium castaneum*, is cosmopolitan; the red flour beetle causes severe damage to grain products. Adults are flat, 5-6 mm in length, and bright reddish-brown when young and a darker brown when older. Antennae are abruptly much larger than the other segments, forming enlarged tips.
The apical portion of the antenna is clubbed. Adult or larvae can usually damage sound grains but feed only on those grains already damaged by other insects. The damage caused by feeding, this insect imparts a rancid smell and style to the fabric it infests.
The presence of larval stage, dead and live adults, and odour represent damaged material.
It usually feeds on broken grains and results in dust formation. Adults live from two hundred days to two years and fly up to a thousand eggs per female in warm heat conditions, loosely scattered throughout the commodity. The development period from egg to adult is 26-30 days in summer.

Morphometrics of *Tribolium castaneum*

Table 1: Morphometric analysis of *Tribolium castaneum* pest using in ocular and stage micrometer

Different parts of *Tribolium castaneum*	Length (mm)	Width (mm)
1. Head 	0.0208	0.03 ± 0.0208
2. Antenna 	0.0502	0.0008 ± 0.0002
3. Thorax 	0.0405	0.07 ± 0.0605
4. Fore wing 	0.09	0.0104 ± 0.0005
5. Hind wing 	0.3008	0.0708 ± 0.0705
6. Fore leg 	0.1105	0.0105 ± 0.0004
7. Mid leg 	0.0908	0.0108 ± 0.0004
8. Hind leg 	0.1205	0.0108 ± 0.0004
9. Body 	0.22	0.08 ± 0.07

Life cycle of *Tribolium castaneum*

Tribolium castaneum is a polyphagous pest that is found in sesame seeds. The developmental stages of *T. castaneum* survive in the temperature between 23ºC-33ºC and humidity between 42-76% .The different life cycle stages of *T. castaneum* from egg to adult were shown in Figure 1.

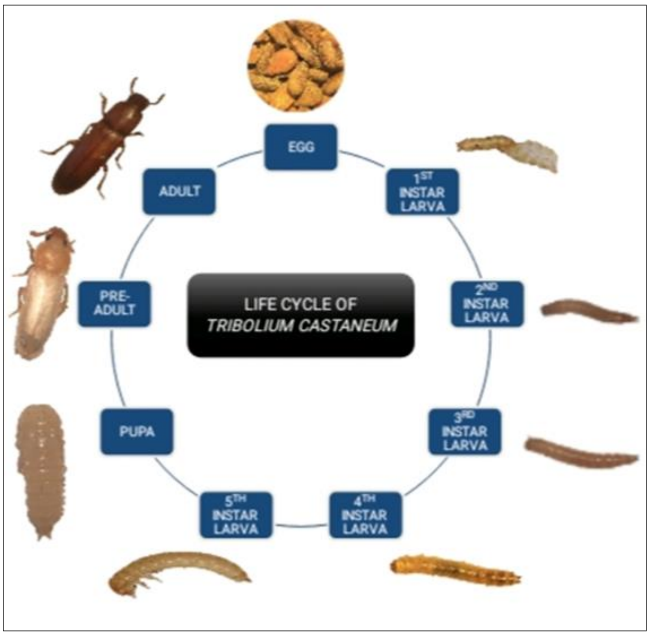

Fig 1: Life cycle of red flour beetle (*T. castaneum)* pest

Eggs: Clumps of whitish substances like minute particles attached on the sides of sesame seeds and identified have high-resolution eggs. A whitish and tiny egg was observed under the microscope. The period ranged from 3 to 10 days. The length of eggs ranged from 0.60±0.02, while the width ranged from 0.22±0.02 mm.

Larva: The body of the first instar larva is the creamy white, light brown colour head with dark brown eyes, semi-transparent had six legs. The last abdominal segment was wholly or partly hides ventral with a pair of pseudopods. The duration of the first instar ranged from 17 to 18 days. The length of the first instar larva ranged from 0.95±0.02 mm, while the width ranged from 0.20±0.02 mm, respectively. Following moulting, the second instar larva emerges with a yellowish-white body, slender and cylindrical shape and covered with fine hairs. The head was pale brown, and also the last segment of the abdomen had two improved dark, pointed structures. Duration of the second instar ranged from 10 to 14 days. Length of the second instar ranged from 1.85±0.07 mm, while the width ranged from 0.24±0.02 mm, respectively. The third instar was structurally just similar to the second instar except in size. Duration of the third instar ranged from 7-10 days. The dark brown patches were developed in the last 2-3 abdominal portions. The length of the third instar larva ranged from 2.43±0.14 mm, while the width ranged from 0.51±0.03 mm, respectively. The fourth instar larva came out from the body covering of the third instar larvae. The fourth instar larva was similar to the third instar in colour, but they differ in size and shape. Duration of the fourth instar larva ranged from 7 to 10 days. The body length of the fourth instar larva ranged from 3.30±0.10 mm, while the width ranged from 0.53±0.03 mm, respectively. The fifth instar ranged from 8 to 10 days. The body length of the fifth instar larva ranged from 4.67±0.12 mm, while the width ranged from 0.83±0.04 mm, respectively.

Pupa: The pupa has dark wings, sclerotized legs and fully developed eyes. The pupa did not have a cocoon, and initially, it was white at the first stage and then gradually turned to yellowish at the second stage then finally turned to brown. Its dorsal side was covered with fine hair. At this stage, the insect was dormant and not intake. The male and female pupal period ranged from 4-7 days for males and 7-9 days for females. The length of the male pupa was 3.79±0.03mm, and the width was 1.05±0.03 mm. The length and width of the female pupa were 4.14±0.01 mm and 1.17±0.02 mm, respectively.
The female pupae are distinguished from males, the presence of papillae, two finger-like structures, just anterior to the pointed urogomphi (paired "horns" at the posterior tip of the abdomen of larvae and pupae), which are much larger than those of the male. The male papillae are small, and they look like just sharp fingertips.

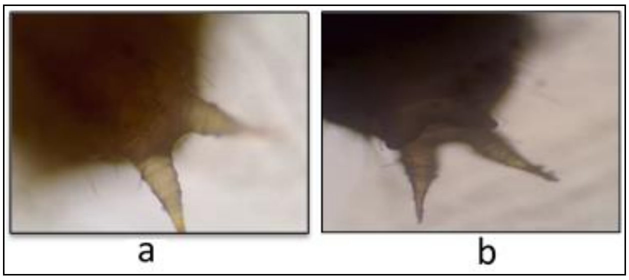

Fig 2: a) Male *T. castaneum* pupa b) Female of *T. castaneum* pupa

Adult- Adult beetles were reddish-brown, flattish curved sided bodies. The head was visible from above, and the thorax had slightly curved sides. The antennae were enlarged at the tip or capitates, with the last three segments more comprehensive than the preceding segments. Male has a setiferous patch on the posterior side of the foreleg borne, whereas females don't have such setiferous patches. The pre-adult and adult periods ranged from 36-50 days and 72-78 days. The length of pre-adult was 3.07±0.03 mm, and width were 1.13±0.03 mm, whereas the length and width of adult beetle were 3.67±0.01mm and 1.30±0.31mm, respectively. This study observed that *T. castaneum* had a long-life cycle from October to March under laboratory conditions. It was nearly six months, depending on the food supply, temperature and humidity.

Preventive methods of *T.castaneum* treatments in sesame seed and germination

Roasted and unroasted sesame seed was observed in BOD incubator, refrigerator, water spray, sundry and room temperature treatment as control at every 15,30,45,60 and 75 days interval of 15 days. These treatments are preventive methods of *T. castaneum* pest in sesame seed. Following the germination of sesame seeds, monitor the growth of the treatments.
First germination from 2 to 4th day in BOD incubator and refrigerator treatments with average temperature 24-32o C and humidity 55-62% respectively. On the 5th day, roasted ordinary room temperature sesame seed started germination with average temperature 29-30o C and humidity were 62-65% respectively.
On the 6th-day sundry sesame seed treatment started germination with an average temperature of 31-32 o C and humidity were 53-54%, respectively. BOD incubator, refrigerator and average room temperature treatments of sesame seed have healthy germination growth, roasted average room temperature and sundry treatment sesame seed have poor or less germination. Roasted BOD incubator, roasted refrigerator, water spray, roasted water spray and roasted sundry have no germination growth.

Table 2: Difference between germination test and germination index of sesame seed treatments

Treatments	Germination (%)	Germination index (GI)
Roasted sesame seeds		
BOD incubator	1.0	2.00
Refrigerator	2.0	4.00
Water spray	-	-
Sun dry	-	-
Room temperature	1.0	1.50
Unroasted sesame seeds		
BOD incubator	79	259.55
Refrigerator	76	232.44
Water spray	-	-
Sun dry	24	20.00
Room temperature	77	223.22

Identification of fungus from the water spray treatment

Sample of water spray treatment of sesame seed was examined for the presence of fungi.
On the 15th day of plating, seeds were reviewed under stereomicroscope and identification was made based on the growth pattern in this 40x power microscope was used, and the identified fungus is *Rhizopus stolonifer*, *Rhizomucor*.
The average fungus number of colonies and their frequency ranges are given in Table 3.

Table 3: Identification of fungus in sesame seed water spray treatment

Sesame seed treatments	Identified fungi	Number of fungus colonies	Frequency (%)
Water spray in unroasted sesame seed	*Rhizopus stolonifer*	15	60
water spray in roasted sesame seed	*Rhizomucor*	10	40

The fungi isolated were *Rhizopus stolonifera* (60%) and *Rhizomucor* (40%).

Fungus culture from infected pests of *T.castaneum*

Results indicate that *Aspergillus* (57.1%), *Penicillium* (14.2%), *Acremonium* (14.2%), *Mucor* (14.2%) were the most dominant fungi among those isolated from infected red flour beetle of sesame seed samples. The average fungus number of colonies and their frequency ranges are given in Table 7.

Table 4: Identification of fungus in infected *T. castaneum*

Identification of fungus	Number of fungal colonies	Frequency (%)
Aspergillus	4	57.1
Penicillium	1	14.2
Acremonium	1	14.2
Mucor	1	14.2

Analysed *Tribolium castaneum* faecal matters from Field Emission Scanning Electron Microscopy test

Element	Weight %	Atomic %	Error %
C K	51.8	61.31	6.34
O K	40.07	35.6	10.43
MgK	0.85	0.5	13.16
AlK	0.35	0.19	23.54
SiK	0.52	0.26	14.01
P K	0.97	0.44	13.53
MoL	1.17	0.17	31.21
K K	1.93	0.7	12.03
CaK	2.32	0.82	10.71

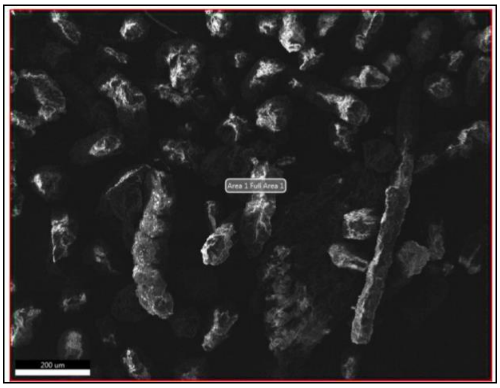

Fig 3

The *T. castaneum* faecal matter from the given result shows the amount of potassium element was high compared to carbon and oxygen. The minimal amount of carbon and oxygen were present in excretory of medium level in T. *castaneum.* Aluminium, Potassium, silica and calcium *T. castaneum* were present in a low level of faecal matter organism.

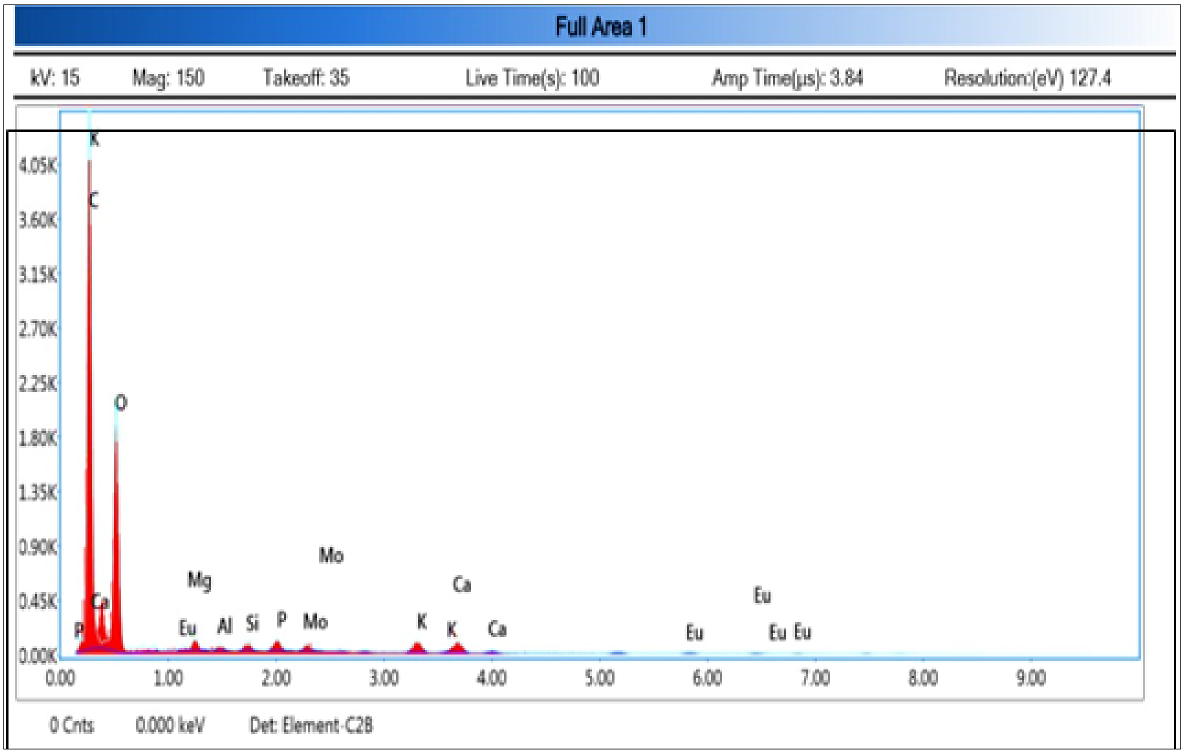

Fig 4: Energy dispersive X-ray spectroscopy of sample

The element is highly present from the given amount of carbon, and the amount of calcium is current at a low level. The toxic aluminium elements are present in the sample *Tribolium castaneum* faecal matters. Exposure to aluminium is lead to neurotoxicity. Other elements are essential for human life.

Discussion

Most stored grain insect pests belong to the orders Coleoptera and Lepidoptera [17]. The studies analyze storage pests are mainly occurred by two major groups: Coleoptera and Lepidoptera. Coleoptera causes more destruction in stored food grains as compared to Lepidoptera. Based on their feeding patterns, these might be classed as exterior or internal feeders [7]. In the present study, *T. castaneum* (red flour beetle) is the Coleopteran pest, and it causes more damages in sesame seeds.

Body size varies a lot between species and populations within species, and there are a lot of recurring patterns. In insect ecology, size is a crucial determinant of fitness [5]. The influence of food preferences on the life history of insects was explored using morphometric characterization. In *T. castaneum,* pest populations have been maintained under the same environmental conditions. The present study on the emerged adult of *T. castaneum* showed meaningful results: length and width of eggs, every instar larva, pupa, and adult measured under the ocular micrometer repeatable pattern.

The total life cycle was 164-194 days [10]. This study observed that *T. castaneum* had a long-life process from October to March under laboratory conditions. It took six months, depending on the food supply, temperature and humidity. The observed life cycle of *T.castaneum* pest life cycles includes egg, larva (1st instar, 2nd instar, 3rd instar, 4th instar and 5th instar larva), pupa, and adult stages. In insects, body size differences between males and females are widespread; females are often larger than males [28]. In Curculionidae, sexual dimorphism is common in the rostrum, i.e., the female rostrum is generally more extensive and flatter than that of the males [36]. T. castaneum female pupae are recognized from males by the presence of papillae, two finger-like structures just anterior to the pointed urogomphi (paired "horns" at the posterior tip of the abdomen of larvae and pupae) that are significantly larger than those of males, according to the results of this study.

Sesame seeds were roasted at 150, 180, 200, and 220 °C for 10 min, and thermal process contaminants including 5hydroxymethylfurfural, acrylamide, furan, and dicarbonyl compounds (1-deoxyglucosone, 3-deoxyglucosone, methylglyoxal, and diacetyl) together with glycation markers namely N-ε-fructosyllysine, N-ε-carboxymethyl lysine, and N-ε- carboxyethyllysine, were monitored. It was roasting induced the formation of 5 hydroxymethylfurfural, acrylamide, and dicarbonyl compounds, except furan, significantly ($p < 0.05$) [4]. Roasting conditions and growing sites changed the physicochemical composition and bioactive components of seeds. Such elements can impact the quality of sesame seeds and oil and should be taken into account during processing [3]. The above results coincided with the present study explaining the effects of sesame seed observed in BOD incubator, refrigerator, water spray, sundry and room temperature treatment as control at every 15, 30,45,60,75 hours interval of 15 days. These treatments are prevention methods of *T. castaneum* pest in sesame seed. The NO produced by SNP application was favourable, increasing seedling germination, vigour, and growth [8]. The highest germination (94%) was recorded at a temperature of 35ºc though it was at par with the germination percentage obtained at a temperature of 30ºc. However, at 40ºc germination percentage decreased (86%). Whereas the lowest germination percentage (53%) was recorded at room temperature (25ºc) [25].

The study concludes that the freezer compartment at -4 to -2°C temperature was the best storage environment and could retain germination and vigour of sesame seeds for a more extended period than other storage environments [2]. Observed germination shows BOD incubator, refrigerator, and average room temperature is maintained in the treatment sesame seed have healthy germination growth, roasted average room temperature, and sundry treatment sesame seed have less germination. Roasted BOD incubator, roasted refrigerator, water spray, roasted water spray and roasted sundry have no germination.

Sesame, F. oxysporum, M. phaseolina and eight other fungi are seed-borne and cause different diseases [30]. The present studies were to study the seed-borne fungi on sesame prevalent in Punjab, Pakistan [35]. *In the treatment, rhizopus stolonifera* and rhizomucor fungi are identified from the unroasted and roasted water spray sesame seed. *Beauveria bassiana* and *Verticillium lecanii* were the most dominant fungi isolated from *T. castaneum* growing in flour, followed by *Sporothrix sp*., *Hirsutella Versicolor, Granulomanus sp.,* modern *Rhizoctonia solani, Moelleriella sp., Aspergillus fumigatus* and *A. flavus* [6]. The present results indicate the presence of aspergillus, penicillium, acremonium and mucor fungi in infected *T. castaneum* pest.

The excess material of faecal matter of *T. castaneum* was carried out by fluorescent Emission Scanning electron microscope (FESEM- 6300, JEOL) by secondary electron (SE) imaging mode [24]. The *T. castaneum* faecal matter from the given result shows the amount of potassium element was high compared to carbon and oxygen. Aluminium, Potassium, silica and calcium *T. castaneum* were present in a low level of faecal matter organism.

Conclusion

The *T. castaneum* (Coleoptera: Tenebrionidae) major pest cause extensive damage to stored products, reducing their nutritional and economic value. All body measurements of *T. castaneum* pest used in this study, length and width of head, antenna, thorax, fore wing, hind wing, foreleg, mid-leg and hind leg. The complete life cycle and biology of a T. castaneum pest can be identified, allowing growers to control it at the most vulnerable phase in the process or even avoid it entirely. From these studies of *T. castaneum* stored pests in sesame seed that they can provide awareness to society. Suppose the human can consume sesame seed with excreta of *T. castaneum. In that case,* toxic or adverse health effects are neurotoxicity, central or peripheral nervous systems, nausea, diarrhoea, vomiting, diabetes, lung disease, etc.

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