

EMERGENCE ACTIVITY OF POWDER POST BEETLE, *LYCTUS BRUNNEUS* (STEPHENS), FROM INFESTED WOODEN BOARDS STORED FOR DEFINITE PERIOD

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ABSTRACT: *The results of the current work showed that Lyctus brunneus Steph. beetles (Coleoptera : Bostrichidae) emerge from storage wood in closed places during different occurrence periods and consider as renewal source for infestation.*

Three occurrence periods were observed during storage period of about 24months. The 1st occurrence periods recoded 6 months of beetles emergence and appeared the highest percentage of emerged beetles (74.8%), followed by the 2nd occurrence which its duration 4 months and detected 17.48% emergence then 3rd occurrence which recorded the least percentage of emergence (7.72% emergence) through four successive months. The effect of temperature showed positive significant correlation with number of emerged beetles during 1st occurrence period, and the correlation was positive and highly significant during 3rd occurrence period. Whereas, the both of relative humidity and moisture content of wood gave highly negative significant correlation during the 1st and the 3rd occurrence periods, while the correlation was highly positive significant during the 2nd occurrence period for both relative humidity and wood of moister content.

Key words: *Powder-post beetle, Coleoptera: Bostrichidae, Lyctus brunneus, stored wood*

INTRODUCTION

Lyctus brunneus Steph. beetle is considered one of most of serious powder post beetles attacking either raw or working wood. Infestation may occur anywhere in the structure where susceptible timber has been used (for example, in sub-floor, areas living space, roof space or in furniture and artefacts).

Lyctid powder post beetles cause severe damage to seasonal hardwood, wooden floors and furniture. The damage is usually not evident until the emergence holes of adults were observed. Reinfestation of timber is common and may continue until the food resource is completely used up. To the point, Thakur (1999) found that *Lyctus africanus* Lesne caused significant timber losses by their larval activities.

Lyctus brunneus beetles attack the sapwood of several host plants, Bain 1978 found that *Lyctus brunneus* bore sapwood of seasoned wood and partly seasoned hardwood timber, also Peters *et al* (2002) stated that the powder post beetles attack sapwood of certain hardwood and no attack softwoods. In this respect, Kvamma (1982) recorded that *Lyctus brunneus* beetle on *Quercus* spp., while Shi and Tan 1987 found that *Lyctus brunneus* is one of eight species of Lyctidae attack Chinese hardwood. Suzuki (1983) reared *Lyctus brunneus* beetle on buckwheat cake.

In Iran Niloufari 1985 and Modarres Awal 1997 found that *Lyctus brunneus* infest dry wood of *Alnus*, *Carpinus* (Betulaceae), *Ulmus* (Ulmaceae) , *Acer* (Aceraceae), *Fagus* (Fagaceae), *Populus*

(Salicaceae), and furniture and also construction timbers.

In Egypt, *Lyctus brunneus* was recorded by El-Zoheiry and Mohamed (1949) also, Nour (1963a) found that *Lyctus brunneus* is one of Lyctid beetles which recorded on some wood species as bamboo, oak, beech, sisso and acacia, the same author (1963b) remember that adult Lyctid beetles were attracted to light and found that the time of adult emergence varied according to the time of wood infestation. While, Alfieri (1976) recorded *Lyctus brunneus* from Cairo vicinity and found that this beetle emerged all year round from dry bamboo, *Alibizzia lebbek* Benth., dry timber and oak floors. Hamad and Aly 1985 stated that the *Lyctus brunneus* attracted to light trap of the Robinson type during months from September until November in 1974 and during months from March until August in 1975 at Quena governorate.

As well, some researchers, such as Helal (1986) and Batt (1989), surveyed *Lyctus africanus* Lesne from fig, mango, acacia, mulberry, sisso, poinciana, willow and sesbane trees as well as bamboo and cotton stalks, while Ali (2013) reared *Lyctus africanus* on some previous hosts, as well as, lebbek, casuarina, kaya, palm fronds, poplar and eucalyptus trees, also Shalaby (1958) reported *Lyctus impressus* Lom. from oak floors, whereas Haggag and Batt (2000) found that *Lyctus impressus* beetle infest citrus branches.

The length of emergence period of wood boring beetles from infested wood (in their different shape and uses) under suitable circumstances give the chance to replicate the infestation in same host or new suitable wood.

The aim of this work is to determine the emergence period, number of emerged *Lyctus brunneus* beetle during

the occurrence periods and the effect of temperature, relative humidity and wood moisture content on population of beetles.

MATERIALS AND METHODS

Infested wood boards with *Lyctus brunneus* Steph. beetles (Coleoptera: Bostrichidae) were collected from wooden floors which have evident signs of infestation (small circular emergence holes or fine boring dust on external surface wood) at Giza governorate during late December 2015. These boards were made from bamboo Parquet wood (the measures of wood board were 22.5cm x12.5cm x 1.5 cm). The boards were kept in plastic boxes (27cm X17cm X14 cm), each box contain 5 pieces of wood boards and covered with muslin cloth (replicated 10 times). Closed observation was made to record the number of emerged beetles during different months of 2016 and 2017 under laboratory conditions of temperature and relative humidity.

The emergence periods of beetles during the storage period were studied, percentage of emergence and peaks of population were determined, monthly temperature and relative humidity averages were calculated. Also Monthly percentages of wood moisture content were determined by measurement apparatus of wood moisture content.

The effect of temperature, relative humidity and percentage of wood moisture content on number of emerged beetles during occurrence periods was studied by simple correlation and regression, according to SAS (2001).

RESULTS AND DISCUSSION

1-Monthly numbers and percentage of emerged beetles under laboratory conditions:

Data on the emergence activity of *Lyctus brunneus* beetles estimated by

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monthly number and percentages of *L. brunneus* beetles emerged from infested floor boards storage for two years are illustrated in Tables (1 and 2).

The recoded data detected that the total cumulative number of emerged beetles was 492 during the storage period which its duration was 24 months, extending from early January 2016 to late December 2017.

During the first year of storage (2016), the monthly population for emerged beetles showed that the highest number of emerged beetles was 130 beetles (30.95% from seasonal emergence) recorded in May 2016, at Temp. 28.3°C and 36.2% RH. The emergence of beetles stopped during August, September and October, and then it started again during November recorded 12 beetles (2.86% emergence) at Temp. 21.4°C & 57.6% RH.

and December 2016 40 beetles (9.53% emergence) at Temp.18.9°C and 59.2%RH. The cumulative number of emerged beetles reached 420 beetles at the end of the first year of emergence, Table (1)

During the second year of storage (2017), the beetles emergence continued through January recorded 28 beetles (38.89% from seasonal emergence) at 14.5°C and 53.9%RH.), and February recorded 6 beetles (8.33%emergence) at 17.2 °C and 49.1%RH., afterwards the emergence of beetles ceased during the period from March to June 2017, whereas the emergence continued through July recoded 20 beetles (27.78% emergence) at Temp. 30.7°C and 43.9%RH., until October recorded one beetle (1.39% emergence) at Temp. 26.2°C and 54.7% RH., Table (2).

Table (1): Monthly number and percentages of *Lyctus brunneus* beetles emerged from infested wood storage under laboratory conditions during 2016 year.

| Months | No. of emerged beetles | | Emergence % | Lab. conditions | | Moisture content of wood % |
|--------|------------------------|------------|-------------|-----------------|------|----------------------------|
| | monthly | cumulative | | Temp.°C | RH.% | |
| Jan. | 0 | 0 | 0 | 15.3 | 55.6 | 10.2 |
| Feb. | 14 | 14 | 3.33 | 16.9 | 52.5 | 9.6 |
| Mar. | 42 | 56 | 10 | 19.1 | 47.8 | 8.7 |
| April | 98 | 154 | 23.33 | 24.8 | 41.6 | 7.6 |
| May | 130 | 284 | 30.95 | 28.3 | 36.2 | 6.7 |
| Jun. | 57 | 341 | 13.57 | 29.7 | 39.4 | 7.4 |
| Jul. | 27 | 368 | 6.43 | 27.9 | 43.6 | 7.9 |
| Aug. | 0 | 368 | 0 | 31.8 | 48.8 | 8.8 |
| Sep. | 0 | 368 | 0 | 28.8 | 50.4 | 9 |
| Oct. | 0 | 368 | 0 | 25.9 | 49.6 | 9.1 |
| Nov. | 12 | 380 | 2.86 | 21.4 | 57.6 | 10.4 |
| Dec. | 40 | 420 | 9.53 | 18.9 | 59.2 | 11 |
| Total | 420 | ----- | 100% | ----- | | |

Table (2): Monthly number and percentages of *Lyctus brunneus* beetles emerged from infested wood storage under laboratory conditions during 2017 year.

| Months | No. of emerged beetles | | Emergence % | Lab. conditions | | Moisture content of wood % |
|--------|------------------------|------------|-------------|-----------------|-------|----------------------------|
| | monthly | cumulative | | Temp.°C | RH. % | |
| Jan. | 28 | 448 | 38.89 | 14.5 | 53.9 | 10 |
| Feb. | 6 | 454 | 8.33 | 17.2 | 49.1 | 9.2 |
| Mar. | 0 | 454 | 0 | 24.2 | 42.6 | 7.9 |
| April | 0 | 454 | 0 | 29.3 | 41.8 | 7.7 |
| May | 0 | 454 | 0 | 27.8 | 36.8 | 7.1 |
| Jun. | 0 | 454 | 0 | 29.1 | 38.6 | 7.4 |
| Jul. | 20 | 474 | 27.78 | 30.7 | 43.9 | 8 |
| Aug. | 13 | 487 | 18.05 | 32.3 | 45.9 | 8.3 |
| Sep. | 4 | 491 | 5.56 | 29.9 | 48.9 | 8.9 |
| Oct. | 1 | 492 | 1.39 | 26.2 | 54.7 | 9.7 |
| Nov. | 0 | 492 | 0 | 20.8 | 56.9 | 10.3 |
| Dec. | 0 | 492 | 0 | 19.2 | 58.2 | 10.8 |
| Total | 72 | ----- | 100% | ----- | | |

The cumulative number of emerged beetles until the emergence end of the Second year recorded 492 beetles, while it was only 72 beetles during the 2nd year.

2- Occurrence periods, emergence percentage and population peaks of *Lyctus brunneus* beetles:

Obtained data on the occurrence periods and percentages of beetles emergence with peaks of *L. brunneus* beetles population emerging from storage wooden boards are recorded in Table (3).

Three occurrence periods of beetles are clearly apparent:

The first occurrence period recorded 6 months, during the period from February 2016 to July 2016. The percentage of

emergence was 74.80 % from the total population of emerged beetles during two years of storage. The peak population of the first occurrence periods recorded during May 2016 when the percentage of emergence was 35.33% from population of first occurrence period.

The second occurrence period recorded 4months, during elapsed period from November 2016 until February 2017. The percentage of emergence during the second period was 17.48% from population of emerged beetles during the total storage periods (January 2016 to late 2017). The emergence peak of population during the 2nd occurrence showed 46.51% from beetles population of 2nd occurrence recorded during December 2016.

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Table (3): Occurrence periods, emergence percentages and population peaks of *Lyctus brunneus* beetles emerged from storage wood under laboratory conditions.

| occurrence periods | Data of occurrence | | | | | Peaks of emergence | |
|-----------------------|--------------------|-----------|-------------------|------------------------|-------------|--------------------|--------------------|
| | from | to | Duration in month | No. of emerged beetles | Emergence % | Month | Emergence % |
| 1st | Feb. 2016 | Jul. 2016 | 6 | 368 | 74.80% | May 2016 | (130/368) = 35.33% |
| 2nd | Nov. 2016 | Feb. 2017 | 4 | 86 | 17.48% | Dec. 2016 | (40/86) = 46.51% |
| 3rd | Jul. 2017 | Oct. 2017 | 4 | 38 | 7.72% | Jul. 2017 | (20/38) = 52.63% |
| Total | | | 14 | 492 | 100% | ----- | |

The third occurrence period also recorded 4 months of beetle's emergence, during the period from July 2017 until October 2017. The percentage of emergence through this period was 7.72% from total beetles population emerging during the storage period. The peak of emergence for the third occurrence observed during July 2017 when the percentage of population was 52.63% from the number of emerged beetles during the third occurrence.

3- Effect of temperature, relative humidity and moisture content of wood on population of beetles emerging during different occurrence periods from storage infested wood:

The effect of temperature, relative humidity and moisture content of wood on population of emerged beetles was studied by determination of simple correlation and simple regression values, Table (4) .

a- Effect of temperature:

The correlation between laboratory

temperature and number of emerged beetles from storage wood showed differences in the significance of values through the three occurrence periods, the correlation was positive during the first occurrence period ($r = 0.508$ & $b = 4.262$) and highly positive during the third occurrence ($r = 0.719$ & $b = 2.409$), while the correlation was insignificant during the second occurrence ($r = - 0.193$ & $b = - 1.029$), Table(4). Nour (1963b) found that the number of emerging *Lyctus africanus* beetles correlated positively with temperature.

b- Effect of relative humidity:

The correlation between the relative humidity and number of emerged beetles during the different occurrence periods showed highly negative significant correlation through the 1st occurrence period ($r = - 0.815$ & $b = - 6.153$) and the 3rd occurrence period ($r = - 0.919$ & $b = - 1.691$), while the correlation was high significant and positive through the 2nd occurrence period ($r = 0.661$ & $b = 2.273$), Table (4).

Table (4): Simple correlation (r) and simple regression (b) between factors affecting on population (Temp. °C , RH% and Moisture content of wood %) and number of emerged beetles of *Lyctus brunneus* during occurrence periods.

| occurrence periods | Factors affecting on population | | | | | |
|--------------------|---------------------------------|---------|---------------------|---------|---------------------------|----------|
| | Temperature °C | | Relative humidity % | | Moisture content of wood% | |
| | r | b | r | b | r | b |
| <u>1st</u> | 0.508 | 4.262 | - 0.815 | - 6.153 | - 0.821 | - 35.527 |
| <u>2nd</u> | - 0.193 | - 1.029 | 0.661 | 2.273 | 0.775 | 15.848 |
| <u>3rd</u> | 0.719 | 2.409 | -0.919 | - 1.691 | - 0.942 | - 10.879 |

Ali (2013) found that there is no correlation between the number of emerged *Lyctus africanus* beetles and mean conditions. The occurrence period was not correlated with total number of emerged beetles.

c- Effect of moisture content of wood:

During the different occurrence periods, the correlation between the percentages of wood moisture content and number of emerged beetles indicated highly negative significant correlation through the 1st occurrence period (r = - 0.821 & b = - 35.527) and the 3rd occurrence period (r = - 0.942 & b = - 10.879), while the correlation was high significant and positive through the 2nd occurrence period (r = 0.775 & b = 15.848), Table (4) .

Okil (1982) found that the infestation of *Sinoxylon sudanicum* Lesne correlate with a range of moisture content from 13.6 to 35.6% for *Poinciana regia* wood branches preserved under laboratory condition. Also, El-Sebay (1984) mentioned that the highest number of emerged beetles and lowest one were produced from infested wood bamboo with *Dinoderus bifoveolatus* as an effect

of corresponding percentage of moisture content 39.4% and 9.4%, respectively

The previously mentioned results indicated that the wooden structures and floor boards infested with lyctid beetles special in closed places are considered as renewal for source of infestation.

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نشاط خروج الخنافس الساحقة *Lyctus brunneus* (Stephens) من الخشب المصاب المخزن لفترة محددة

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المخلص العربى

أجرى هذا البحث لمعرفة نشاط خروج خنافس *Lyctus brunneus* من أخشاب الباركية المصابة بهذه الحشرة والمخزنة لفترة محددة (عامى 2016 ، 2017) وتأثيرها بالحرارة والرطوبة فى مكان التخزين وكذلك تأثرها بالمحتوى الرطوبى للخشب خلال تلك الفترة.

و تشير نتائج البحث الى أن خنافس *Lyctus brunneus* الخارجة من الخشب المصاب المخزن لفترة محددة فى أماكن مغلقة تعتبر مصدر مجدد للإصابة لتكرار فترات خروج الخنافس واستمرارها لفترة طويلة وقد أسفر البحث عن الآتى:
- تم تسجيل تواجد ثلاث فترات خروج للخنافس من الخشب المخزن لمدة سنتين واستمرت فترة الحدوث الأولى مدة 6 أشهر وأعطت أعلى نسبة لخروج الخنافس (74.8%) من التعداد الكلى لفترة التخزين وتناقصت نسبة الخروج الى 17.48% خلال الفترة الثانية للخروج وكانت مدتها 4 أشهر أما الفترة الثالثة للخروج فكانت مدتها أيضا 4 أشهر ولكنها أظهرت أقل نسبة لخروج الخنافس (7.72%).

- تأثر خروج الخنافس بدرجات الحرارة والرطوبة النسبية المسجلة فى مكان التخزين حيث وجد ارتباط معنوى موجب بين الحرارة وتعداد الخنافس الخارجة خلال فترة الحدوث الأولى وكان الأرتباط على المعنوية خلال فترة الحدوث الثالثة ، بينما أظهرت قيم الأرتباط لكل من الرطوبة النسبية ومحتوى رطوبة الخشب مع تعداد الخنافس الخارجة وجود ارتباطات معنوية عالية سالبة خلال فترات الخروج الأولى والثالثة فى حين كان هناك ارتباط معنوي عالي موجب خلال فترة الخروج الثانية .