Study on the population dynamics of the angoumois grain moth *Sitotroga cerealla* (Olivier)

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Abstract

The population dynamics of the angoumois grain moth *Sitotroga cerealla* (Olivier) was studied at 28℃ and 75% r h The results showed that the growth of adult population started increasing in 30 days after inoculation, and reached a peak in 150 days The growth of adultoid population (larva and pupa) had a small peak in 30 days after inoculation, and peak in 120 days The population growth under the limited condition (space and food) accorded with the Logistics Growth Model

$$N_t = \frac{1142\ 33}{1 + e^{6\ 549 - 0\ 0549t}}$$

The instantaneous rate of population increase (r) was 0 0549 Under the condition of limited space and food, the density of insect restricted the further growth of population

Introduction

Sitotroga cerealella (Olivier, 1819) is an important pest damaging the storage grain worldwide It is mainly distributed over Britain, France, German, Russian, Holand, Indian, Pakistan, Japan, all countries of the westeastern Asia, China, countries in Norht-South America, Egypt, Sudan, Kenya and Australia, etc Besides quantity, the harm caused the decrease of grain quality The starch and protein, gluten and ash content of wheat, the germination percentage and so on reduced The insect brought about 5 – 60 75% of loss of grain (Harukawa 1938, Moore 1966, Shahjahan 1974, El-Desstuki 1976)

Due to the serious harmfulness, many scholars worldwide studied on its biology, ecology and control (G A Dean, N Sachorov, A Gibson, G Storey, P K Note, F S Bedenheimer, G M Lis, L B Daniels, J Davidson, JI Byha-cobuur, A C Crombie, L O Waren, V R Adler, A Savescu, G Chippendeha, P E Boldt, Budmir, E N Corry, R C Smit, A I Balze, E H Eloyd, F Beccaar, S A Mostafa, L B Daniels, J Laing, V A Tyumeneva, B Cornwell, Z A Qureshi, L L Sower, W H Me-Gauyhey) Reported researches were focused on the population dynamics of the insect, but this study established the population growth model based on the research of population dynamics under the experimental condition

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Material and Method

The trial insect came from the last wheat harvested in the Meihuashan Mountains, Beibei, Chongqing City, and was fed 3 generations with the wheat containing water of 16% at 28℃ and 80% r h (Relative humidity) The trial wheat was disinfected for 6 hours at 60℃ after being washed with water The trial bottle (diameter of 7cm, volume of 525cm^2), desicator (diameter of 40cm) and gauze were disinfected for 2 hours at 100℃ A bottle was filled 150g of wheat All of the trial wheat was kept for 2 weeks at 24℃ and 75% r h before test, and thus the containing water of 13%

The treatments were set up in the test One was ck The other was inoculated the insect A bottle was inoculated a pair of adults (female + male) All treatment was repeated 3 times The insect was fed in desiccator at 24℃ and 75% r h

Results and Analysis

The population dynamics of adult

The result showed that the population quantity of living adult started increasing in 45 days after inoculation, and had a peak in 129 days Then it began to decrease (see Fig 1) The total quantity of adult (including living and dead) began to increase in 30 days, and had a peak 150 days(See Fig 2)

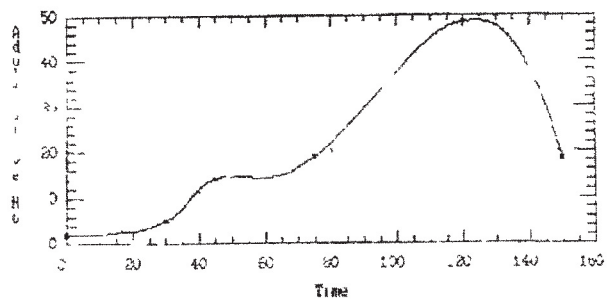

Fig. 1. The population dynamics of adult

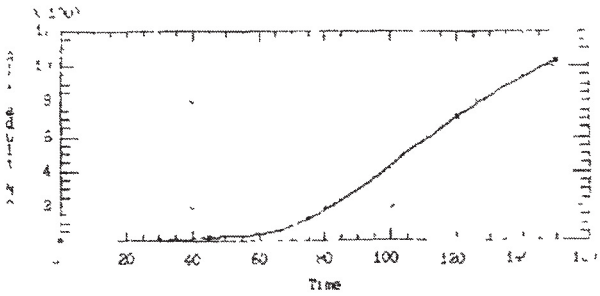

Fig. 2. The population dynamics of the total adults(live + dead)

The population dynamics of larva + pupa

The population quantity of larva and pupa had a small peak in 30 days, and a peak in 120 days Then it decreased (See Fig 3)

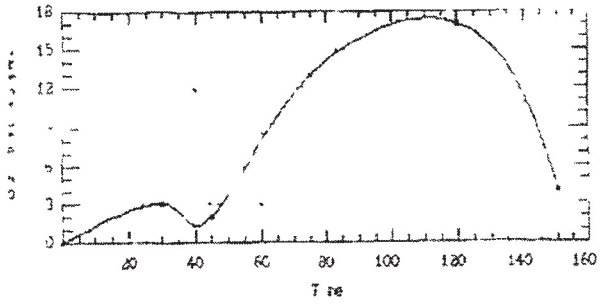

Fig. 3. The population dynamics of the adultoid (larva + pupa)

The population growth model

Fig 1 showed that the population growth of adult under the limited condition (space and food) basically accorded with the Logistics Growth Model

$$N_t = \frac{1142\ 23}{1 + e^{6\ 549 - 0\ 0549t}}$$

In the formula, N_t was the population quantity of adult changed with the time t, t was the time (day)

According to the Logistics Growth Model, the instantaneous rate of population increase(r) was 0 0549

Discussion

The rapid increase of population quantity in initial stage showed that the innate capacity increase (r_m) was greater under the fittest condition The decrease of population quantity after the peak showed that the space and food were relatively short The rapid reproduction during the initial stage was the cause that the favorable existence condition was turned into an unfavorable one, and thus the decrease of the population quantity

The regularity of the population dynamics showed that the density of insect restricted the further growth of population under the condition of limited space and food

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