BIONOMICS OF *LIPOSCELIS PAETUS* IN STORED GRAIN (PSOCOPTERA: LIPOSCELIDAE).

Vanessa PIKE, David REES and Richard HATCH.

Natural Resources Institute (NRI), Central Avenue, Chatham Maritime, Kent, ME4 4TB, United Kingdom.

Abstract

In recent years the pest status of *Liposcelis* spp. appears to have increased. Very little is known about their biology, ecology and economic status. As part of an on-going project at NRI on *Liposcelis* spp. the reproductive cycle of *L. paetus* has been studied. Mean egg and nymph development periods were 8.14 and 10.97 days respectively. The mean pre-oviposition period measured 2.1 days. Females laid a mean of 1.05 eggs per day. These data will be used to calculate the intrinsic rate of population increase under conditions found in tropical storage facilities.

Introduction

In Indonesia *Liposcelis* spp. are recognized as a major nuisance in rice storage facilities. Reports from South-East Asia (Haines, unpublished data) state that huge infestations of *L. entomophilus* and, less often, *L. bostrychophilus* can become established in a few weeks. Stored sorghum in Mali, West Africa, is also prone to infestation by *L. paetus* and *L. entomophilus* (Hodges, unpublished data). There is evidence to suggest these species are tolerant of certain insecticides (Pranata *et al.*, 1983) and fumigants (Haines, unpublished data).

At NRI work has already been carried out to assess the intrinsic rate of increase for *L. bostrychophilus* (Shires, 1982) and, more recently, to compare the effects of variation in temperature and humidity on the population growth rates of these three species (Rees and Walker, 1990).

Using a strain of *L. paetus* originating from a wheat store in Ethiopia, details of this species' reproductive cycle have been recorded. Once all the relevant information has been accumulated the intrinsic rate of population increase will be calculated. The insects used in all these experiments were maintained in culture at 27°C and 70% RH on American brown rice.

Egg development period and survivorship

Method

Fifty to one hundred adults were placed in each of 50 chambers (Fluon-lined* glass rings, 3.5cm dia. x 1cm deep, with a filter paper base). Each chamber contained 1g of ground American brown rice. After 24 hours in an incubator at 30°C and 70% RH, the adults and rice were removed. The 92 eggs that had been laid were returned to the incubator to develop. After 6 days, the eggs were examined for emergences every 24 hours for 28 days. The percentage survivorship was calculated (Table I).

Results

Table I. Egg development and survivorship

Mean development period	**8.14 ± 0.14 days**
Range	**6 - 9 days**
Total eggs laid	**92**
Total eggs hatched	**84**
% Survivorship	**91.3%**

Female nymph development period and survivorship

Method

Two hundred unsexed nymphs of known age were each placed in a Fluon-lined glass ring (1.5cm dia. x 1.8cm deep) with a filter paper base, along with 1g of ground brown rice. When each nymph was 7 days old an adult male was

* Fluon - PTFE suspension, ex ICI Ltd.

introduced. (Preliminary trials showed that the female nymphs did not mature in less than 1 week: if the males were added any sooner the small nymphs were often eaten.) Daily observations were carried out for 30 days or until the first egg was laid. The date of the initial oviposition was recorded.

Initial observations had shown that the pre-oviposition period of *L. paetus* was 2.1 ± 0.16 days. The female nymph development period was therefore calculated by subtracting 2.1 days from the total time from emergence to oviposition (Table II).

Results

Table II. Nymph development

Mean no. of days to oviposition	13.07 ± 0.07 days
Mean pre-oviposition period	2.10 ± 0.16 days
Mean nymph development period	10.97 ± 0.17 days

Of the total 200 insects used in the trial 98 died as nymphs. At the end of the 30 day experimental period 55 of the remaining insects were found to be males. Daily inspection had shown that only 15 of the 47 surviving females had laid eggs. The results presented in Table II are based on the data collected from these 15 females.

Fecundity

Method

Virgin females (3-4 week old) were paired with mature males of unknown age and placed in individual 2cm square Fluon-lined plastic containers. Their behaviour was observed. The majority of the pairs mated within 10 minutes. A total of 81 pairs copulated. A food source consisting of two brown rice grains glued to a 1cm square of filter paper was added to each container.

Following the assumptions of Howe (1953), the intrinsic rate of increase for insects with a short development period is influenced primarily by the egg output during the first few weeks of egg-laying activity. For this reason the containers were observed for only 3 weeks. The eggs were removed once their presence had been noted. Female survivorship and oviposition were recorded.

Results

Table III. Female survivorship

Total initial number of females	81
Total number of surviving females	46
Survivorship	56.8%

Table IV. Egg output

Range of egg output	0 to 46
Mean number of eggs laid over 3 weeks	21.96±3.8
Mean egg output/day/female	1.05

The females proved to be highly fecund. Only 5% of females that were known to have copulated laid no eggs.

Discussion

The development period for *L. paetus* on American brown rice at 30°C and 70% RH is 21.2 ± 0.27 days. This is comparable to the value of 21 ± 1 days calculated by Shires for *L. bostrychophilus* at 27°C and 70% RH (Shires, 1982). The patterns of the two life cycles are similar as would be anticipated for two related species.

The egg and nymph development periods have low standard deviations and are suitable for calculating the intrinsic rate of population increase (r). The high nymph and adult mortality observed may have, in part, been caused by the experimental conditions used. If the data presented here were used in r-value calculations the final figure may be inaccurate. Further studies are required to confirm the adult and nymph survivorship percentages expressed here accurately reflect the field situation. Initial observations showed that disturbance caused by handling extends the development period. Further investigations are therefore needed to reduce the effect of disturbance on experimental populations.

References

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ECOLOGIE D'ESPECES DE *LIPOSCELIS* DANS LES STOCKS DE GRAINS (PSOCOPTERA : LIPOSCELIDAE)

Vanessa PIKE, David REES et Richard HATCH

Overseas Development Natural Resources Institute
Chatham Maritime, Chatham, Kent, ME4 4TB, UK

RESUME

Depuis quelques années, les déprédations dues à *Liposcelis* sp. se sont accrues. Ce ravageur est reconnu comme étant une des principales nuisances des stocks de riz en Indonésie. Les rapports en provenance du sud et du sud-ouest asiatiques montrent que de gigantesques invasions de *L. entomophilus* et, moins souvent, de *L. bostrychophilus* peuvent survenir en l'espace de quelques semaines. Les stocks de sorgho du Mali et de l'Afrique de l'ouest sont aussi prédisposés à des attaques de *L. entomophilus* et d'une autre espèce *L. paetus*.

On sait peu de choses sur la biologie et l'écologie de ces déprédateurs ainsi que sur leur impact économique. Des recherches de l'ODNRI ont déjà défini les limites de température et d'humidité des trois espèces et ont montré que *L. paetus* s'avère remarquablement résistant aux hautes températures. Des expériences ont été entreprises pour calculer le taux d'accroissement potentiel de populations de *L. paetus*. Elles font partie d'un programme de recherche visant à établir l'importance économique de *Liposcelis* sp.

Une étude détaillée, portant sur les aspects du cycle de reproduction de *L. paetus*, a montré quelles étaient les périodes de développement des oeufs et des nymphes ainsi que les taux de mortalité, de fécondité et de survie des adultes. Ces données seront utilisées pour calculer le degré d'augmentation intrinsèque des populations dans les conditions qui sont celles des stocks tropicaux.