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LONGEVITY AND REPRODUCTIVE RATE OF *PATASSON LAMEEREI* [*HYM.* : *MYMARIDAE*], A PARASITOID OF *SITONA* SPP. [*COL.* : *CURCULIONIDAE*] EGGS (1)

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Patasson lameerei DEBAUCHE produced an average of 28.5 offspring under 2 temperature regimes using *Sitona hispidulus* (FABRICIUS) eggs as hosts. Although its fecundity was not affected by the temperature regimes, *P. lameerei* lived significantly longer at 6.7/18.3°C than at 21.1°C. When ample hosts were available, *P. lameerei* produced more offspring during the 1st few hours of its adult life than during any other comparable period. When the parasitoids were denied access to host eggs for 1, 2, or 3 days after emergence, they still produced similar numbers of offspring during their 1st 24 h exposure to hosts.

Patasson lameerei DEBAUCHE was reported by AESCHLIMANN (1975, 1977) to be the predominant parasitoid occurring in the eggs of several species of *Sitona* weevils in the Mediterranean region of Europe. This parasitoid has been imported into the United States as part of a biological control effort directed at the clover root curculio, *Sitona hispidulus* (FABRICIUS). Although *P. lameerei* has been released at several locations in the United States, it apparently has not become established in this country.

AESCHLIMANN (1977) briefly described aspects of the life history and behavior of *P. lameerei*. LEIBEE *et al.* (1979) reported the effects of temperature and host egg age on the development of *P. lameerei*. We report herein the reproductive rate as a function of parasitoid age, as well as fecundity and longevity. The effects on these biological characteristics of constant and fluctuating temperature regimes are compared.

MATERIALS AND METHODS

REPRODUCTIVE RATE, FECUNDITY AND LONGEVITY

The original source of *P. lameerei* used in this study was from several localities in France (see LEIBEE *et al.*, 1979). Host eggs were obtained from *S. hispidulus* adults which were collected near Lexington, Ky., and maintained in the laboratory on alfalfa.

Twenty-five 1-day-old *S. hispidulus* eggs were placed on moist filter paper in each

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11 cm diam. plastic Petri dish. Individual male-female pairs of newly emerged *P. lameerei* were introduced into each dish containing host eggs. The parasitoids were transferred to similarly prepared dishes containing unparasitized host eggs every 24 h until each ♀ parasitoid died. Male parasitoids were replaced as necessary to maintain pairs.

Two temperature regimes were used: constant 21.1°C and fluctuating 6.7/18.3°C. Temperatures were maintained within ± 1°C of those desired. The cooler, fluctuating temperatures were selected to mimic average minimal and maximal April temperatures in Central Kentucky because *S. hispidulus* eggs are abundant in the field at that time (Ng *et al.*, 1977). A photoperiod of 12 h light and 12 h dark was maintained; temperatures in the fluctuating regime changed abruptly, with the cooler temperature corresponding with the scotophase. Forty-two and 29 ♀ parasitoids were studied under the constant and fluctuating temperature regimes, respectively.

Eggs which had been exposed to *P. lameerei* were then held at 21.1°C until emergence of parasitoid offspring. Numbers of offspring were recorded according to their sex. Therefore, reproductive rates are based on the number of offspring which successfully completed development. Due to the small size of the organisms involved, it was not feasible to dissect parasitized host eggs to determine *P. lameerei* ovipositional rate directly.

Supplementary experiments

After determining the reproductive rate as a function of age, we wished to ascertain how soon after adult emergence that oviposition was occurring. Procedures were as described above, except that new, unparasitized eggs were provided after 12 h rather than 24 h. Five ♀ parasitoids were tested. This provided data on reproduction during the initial 12 h following emergence (under photophase) and during the following 12 h (under scotophase). This, as well as the 2 experiments described below, were conducted at 21.1°C.

In a similar experiment the initial 12 h period following parasitoid emergence was divided into 3 equal periods, all under photophase. Five newly emerged ♀ parasitoids were provided with unparasitized host eggs immediately, again at 4 h, and again at 8 h following emergence.

The last set of tests was designed to determine the effect on reproductive rate of denying the ♀ parasitoids access to host eggs for varied periods. Parasitoids were handled as described for the basic experiments on reproductive rate, except that randomly selected ♀ were not provided with host eggs until 24, 48, or 72 h following their emergence. Control ♀ were initially provided with host eggs immediately upon their emergence. Six ♀ parasitoids were studied under each of these described conditions.

RESULTS AND DISCUSSION

The majority of the oviposition occurred early in the adult life of the parasitoid, particularly during the 1st day at 21.1°C and during the 1st 2 days at 6.7/18.3°C. The daily reproductive rate was slightly lower under the cooler, fluctuating temperature regime, but the parasitoids lived longer under this regime (fig. 1). The maximum longevity of ♀ *P. lameerei* was 7 days at 21.1°C and 10days at 6.7/18.3°C.

The daily production of ♂ and ♀ offspring as a function of maternal age is shown in figure 2. Under both temperature regimes, approximately equal numbers of each sex were produced throughout the adult life of the parasitoid.

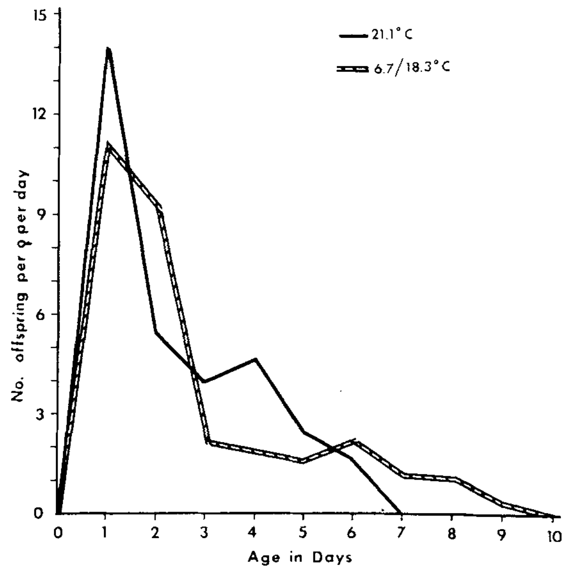

FIG. 1. The average daily reproductive rate of *P. lameerei* with *S. hispidulus* eggs as hosts.

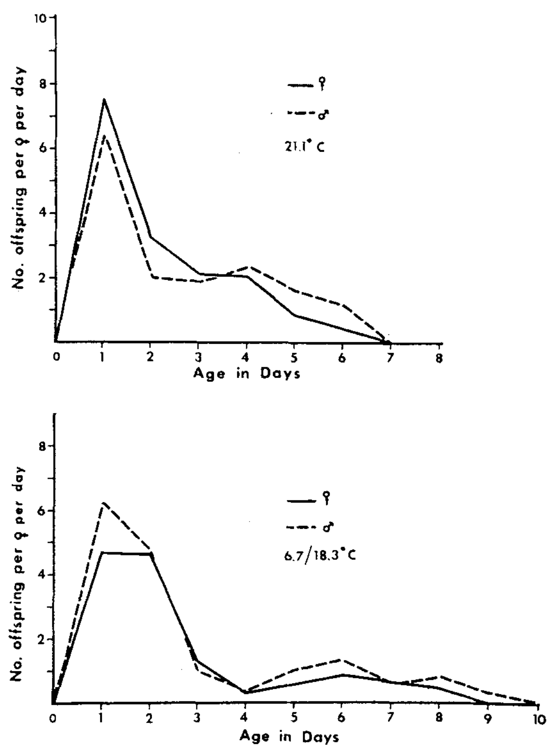

FIG. 2. Production of ♂ and ♀ offspring by *P. lameerei* as a function of age. *Sitona hispidulus* eggs were used as hosts.

The average longevity and fecundity of *P. lameerei* is presented in table 1. Adult ♀ lived significantly longer under the 6.7/18.3°C regime than under the 21.1°C regime. This increased longevity offset the lower daily reproductive rate, and resulted in similar fecundity under both regimes (table 1). Females of *P. lameerei* are capable of producing an average of 28 to 29 offspring each. This estimate is slightly higher than that of AESCHLIMANN (1977), who reported that each ♀ parasitized a maximum of 25 to 30 host eggs. In our study, 1 ♀ produced 52 offspring, and several others produced more than 40 offspring. Because *P. lameerei* is a solitary parasitoid, the number of offspring produced is equivalent to the number of host eggs parasitized. Our results also indicate greater longevity for adult ♀ *P. lameerei* than that reported by AESCHLIMANN (1977).

TABLE 1

Longevity and fecundity of adult female P. lameerei *under a 12 : 12 h photophase : scotophase and 2 temperature regimes*

	Constant 21.1°C (n = 42)	Fluctuating 6.7/18.3°C (n = 29)
$\bar{x}$ longevity ± S.E. (days)	4.7 ± 0.2y ([a])	7.2 ± 0.3z
$\bar{x}$ fecundity ± S.E.	28.7 ± 1.8z	28.2 ± 2.1z

(a) Means within a row followed by the same letter are not significantly different (P > 0.05) as determined by STUDENT's t-test.

As AESCHLIMANN (1977) reported, we have observed that adult *P. lameerei* generally emerge early in the day. During the 1st 24 h following emergence, most of the oviposition occurred during the initial 12 h period, which would correspond with the photophase in the field. Five ♀ produced an average of 19.8 ± 1.0 (S.E.) offspring during the 1st 12 h (photophase) and 2.4 ± 0.9 offspring during the next 12 h (scotophase). When the initial 12-h period was subdivided, significantly (P < 0.05) more offspring were produced during the 1st 4 h following emergence than during either of the 2 following 4-h periods. During the 1st, 2nd, and 3rd 4-h periods, 13.0 ± 1.9, 7.0 ± 2.2, and 1.6 ± 1.3 offspring were produced, respectively.

While it is clear that *P. lameerei* can parasitize *S. hispidulus* eggs shortly after adult emergence, we also wished to determine the effects on reproduction of delaying the parasitoid's access to host eggs. As shown in figure 3, *P. lameerei* produced similar numbers of offspring during the initial 24-h exposure to host eggs regardless of whether this initial access to hosts was 0, 24, 48, or 72 h following the parasitoid's emergence. The longevity of adult ♀ was not appreciably affected by delayed access to host eggs, but average fecundity was reduced by delayed access to hosts. Control ♀ produced ca. 36 offspring while ca. 31, 24, and 22 offspring were produced by ♀ which were denied initial access to hosts for 24, 48, and 72 h, respectively.

P. lameerei can develop from egg to adult emergence in ca. 1.5 to 3 weeks at constant temperatures ranging from 27 to 16°C; however, such development requires several months at 7°C (LEIBEE *et al.*, 1979). Under moderate temperatures of ca. 21°C, the complete life span of *P. lameerei* (i. e., from egg to death of the resultant adult) would be about 3 weeks. Thus, a continuous supply of *Sitona* spp. eggs throughout the growing season seems requisite to successful establishment of *P. lameerei* in the United States.

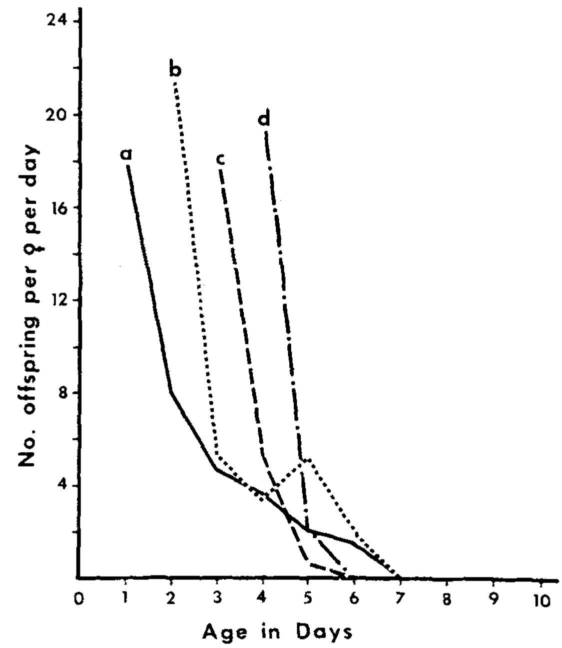

FIG. 3. The average daily reproductive rate of *P. lameerei* at 21.1°C when access to host eggs was denied for (a) 0, (b) 1, (c) 2, (d) 3 days following adult parasitoid emergence. *Sitona hispidulus* eggs were used as hosts.

Because *S. hispidulus* is univoltine, with eggs present in the field from late fall until early spring, it alone may not be a sufficient host for year round survival and reproduction of *P. lameerei* in the field. AESCHLIMANN (1977) noted that *P. lameerei* parasitizes a wide range of *Sitona* species. Other *Sitona* spp. besides *S. hispidulus* occur in North America, but their distribution and biology are poorly known. Their potential roles as alternate hosts for *P. lameerei* should be investigated.

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RÉSUMÉ

Longévité et taux de reproduction de *Patasson lameerei* [*Hym.* : *Mymaridae*]
parasite des œufs des *Sitona* spp. [*Col.* : *Curculionidae*]

Patasson lameerei DEBAUCHE a produit une moyenne de 28,5 descendants sous 2 régimes de température, utilisant les œufs de *Sitona hispidulus* (FABRICIUS) comme hôtes. Bien que sa fécondité n'ait pas été affectée par les régimes de température, la durée de vie de *P. lameerei* s'est avérée être notablement plus longue à 6,7/18,3°C qu'à 21,1°C. Lorsqu'un grand nombre d'hôtes était accessible, *P. lameerei* produisait plus de descendants lors des quelques premières heures de sa vie adulte que lors de toute autre période comparable. Lorsque l'accès des parasites aux œufs hôtes était empêché pour une période de 1, 2 ou 3 jours après l'émergence, ceux-ci continuaient à produire des nombres similaires de descendants lors de leurs premières 24 h d'exposition aux hôtes.

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