Longevity and age specific fecundity of Adoxophyes orana F.v.R

MITTEILUNGEN DER SCHWEIZERISCHEN ENTOMOLOGISCHEN GESELLSCHAFT
BULLETIN DE LA SOCIÉTÉ ENTOMOLOGIQUE SUISSE
57, 75-77, 1984

Longevity and age specific fecundity of Adoxophyes orana F. v. R

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The longevity and the age specific fecundity of the summer fruit tortrix *Adoxophyes orana* F. v. R. were studied in an insectary and at 25 °C. The highest fecundity rate was observed less than 50 day degrees after the adults emerged, while the peak mortality occurred about 100 day degrees later.

The summer fruit tortrix (SFT) *Adoxophyes orana* F. v. R. has become a major pest in apple orchards located in Western Switzerland. Two simulation models (FLÜCKIGER & BENZ 1982, BAUMGÄRTNER & CHARMILLOT 1983) have been used to follow the SFT development through different age classes under field conditions. MEGEVAND's (1980) data on the development of immature life stages (eggs, larvae, pupae) were used by BAUMGÄRTNER & CHARMILLOT (1983) for the parametrization of MANETSCH's (1976) time-varying distributed model. This work provides the experimental basis for parameter estimates on adult survival and fecundity rates.

MATERIAL AND METHOD

Experimental procedures

The insects were obtained from a stock culture maintained at the federal agricultural research station in Nyon. Males and females were separated in the pupal stage and transferred to 25 °C. Groups of 10 couples in each were formed with emerging moths and put into 1.25 l polystirene containers whose walls were covered with blotting paper. Water was offered to the moths on a small piece of cotton wool. A piece of paper was put underneath the plastic cover to facilitate the recovery of eggs collected daily. The number of eggs laid daily was determined in measuring the surface of an egg batch under a binocular. One mm^2 of surface was estimated to have 5 eggs. The number of dead moths separated by sexes was also recorded daily. The first experiment was carried out with four insect groups at 25 °C and long day conditions (18/6). The relative humidity was about 70% in the temperature cabinet, but presumably higher in the plastic containers. In the second experiment, 9 groups of moths were studied from June 4 to July 9 1982 in an insectary. The temperature was recorded at a weather station located nearby. During this experiment the day length was about 17 hours.

Statistical analysis

Age specific survival and fecundity was recalculated on a physiological scale above the 11.1 °C developmental threshold for pupae (BAUMGÄRTNER & CHARMIL-

LOT 1983). Thereby the average number of moths and the average number of eggs laid per day degree was computed for a period of 10 day degrees and plotted against physiological time.

A modified version of BIERI *et al.* (1983) model was used to describe the age (x) specific fecundity rate (FEK, [1], while the age specific survival of all adults (SURV, [2]) was represented by GOMPERTZ's function (BATSCHELET 1980, VON ARX *et al.* 1983).

$$0 \leqq FEK = a \cdot (x - b)/c^{(x-b)} \qquad [1]$$

$$1 \geqq SURV = \{1/EXP(-d)\} \cdot EXP\{-d \cdot EXP(e \cdot x)\} \qquad [2]$$

The parameters a, b (preoviposition period), c, d, e were estimated with JENNRICH's *et al.* (1981) program. The total fecundity was obtained by integrating numerically the age dependent fecundity rate with ANONYM (1980) DCADRE-function.

RESULTS AND DISCUSSION

Environmental factors have a profound influence on the biology of SFT adults (fig. 1). The fecundity rate was lower in the 25 °C temperature cabinet and the moths produced only 271.1 eggs as opposed to 328.6 in the insectary. JANSSEN (1958) obtained similar numbers from her experiments and from the literature available to her, while DE JONG & VAN DIEREN (1974) recorded 160 to 320 eggs per female. The variability in the fecundity rate (Fig. 1) observed in the insectary may be due to the fact that ambient temperatures were sometimes close to the threshold for oviposition. This value is approximated by the developmental

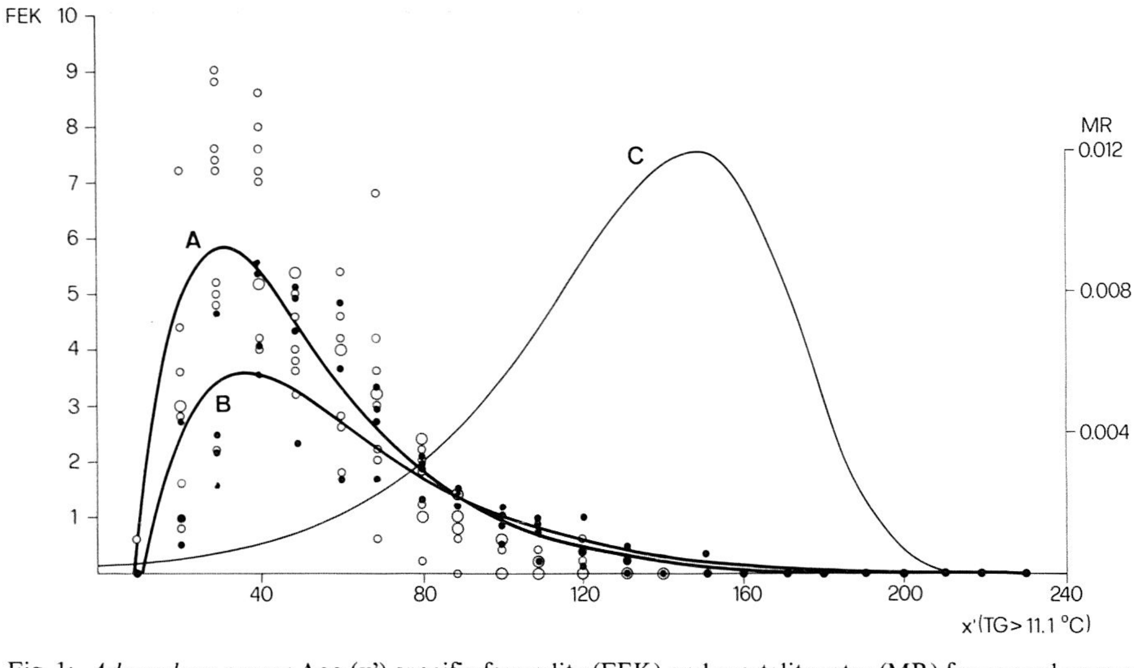

Fig. 1: *Adoxophyes orana:* Age (x') specific fecundity (FEK) and mortality rates (MR) for several groups of insects, kept either in an insectary (○, A) or at 25 °C (●, B). Each dot represents a calculated value for a 10 day degree period. (A : $0 \leqq FEK = (0.7558 \cdot (x' - 10.54))/(1.0488^{(x'-10.54)})$; B : $0 \leqq FEK = (0.3752 \cdot (x' - 11.48))/1.0375^{(x'-11.48)}$); C : $MR = 1 - d\ (SURV)/dx' = 0.00024 \cdot EXP\ (-0.0073 \cdot EXP\ (0.0335 \cdot x')) \cdot EXP\ (0.0335 \cdot x')$; x = age in day degrees above a 11.1 °C threshold; x' = x - 5).

threshold for pupae (BAUMGÄRTNER & CHARMILLOT 1983) and may be a rather low estimate for a threshold of adult activities. BÖHM (1957, cit. by JANSSEN 1958) estimated an oviposition threshold of 12 °C, while DE JONG (1951, cit. by JANSSEN 1958) observed the oviposition in the temperature range of 15-32 °C. The mortality rate was highest after the end of the reproductive phase (fig. 1). The preoviposition period (insectary: 5.5 day degrees) was shorter than assumed by FLÜCKIGER & BENZ (1982) or observed by JANSSEN (1958).

ACKNOWLEDGEMENTS

The authors wish to thank Prof. Dr. V. DELUCCHI, Institute de Phytiatrie, EPF Zurich, and Dr. J. DERRON, Station fédérale de recherches agronomiques, Nyon, for reviewing the manuscript. Mr. G. BIANCHI and Dr. D. RUBLI, Institute de Phytiatrie, EPF Zurich were preparing the data and making the graphs.

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(received October 29, 1983)