월동 먹노린재 성충의 초기 비행 예측

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Forecasting early seasonal flight activity of overwintered adult *S. lurida* (Hemiptera: Pentatomidae) in rice

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1. Introduction

S. lurida is a insect pest on rice in many rice growing countries. Since 1997, in addition to the increasing frequency, occurrence of *S. lurida* has also been spreading, causing frequent damages in several provinces in Korea. However, there are very limited information available on its biology and management techniques because of its newly changed status. This study was conducted to develop a model to predict the early immigration flight activity of adult *S. lurida* from overwintering site to paddy field and to provide efficient control timing which can be used in management programs for *S. lurida* in rice.

2. Model development

2.1 Degree-days calculations

A computer program (Degree-Day Utility, University of California) was used to calculate degree-days by a sine wave function (Allen, 1976). Daily maximum and minimum air temperature data were obtained from nearest automated weather station to the experimental fields which were located about 5 to 9 km away from the experimental fields. Since the base temperature for the flight of overwintered *S. lurida* had not been available, total 15 sets of degree-days from January 1 to July 31 were calculated using 15 estimates for base temperature from 0 to 15°C.

2.2 Base temperature for overwintered adult flight.

To find out the base temperature for early seasonal flight of overwintered *S. lurida*, the coefficient of variations (CV) between years were calculated at two degree-day points (degree-days at first catch and at 50% cumulative capture) for 15 temperatures. The degree-days at 50% of total cumulative capture were estimated by linear interpolation from nearest two sample days. The temperatures which yielded the lowest CV for the first catch and also for the 50% cumulative capture were chosen as best (Arnold 1960).

Two temperatures 7 and 9℃ yielded lowest CV at the degree-day points of first and 50% cumulative capture, respectively. These temperatures were selected for the model development and parameter estimation.

2.3 Forecasting models.

Two prediction models were developed based on the base temperatures predicted based on two degree-day points (first catch and 50% cumulative capture). The relationship between cumulative percentage of adults caught in trap and the degree-days calculated using the chosen base temperature was modelled with a two-parameter Weibull function. The function is:

$$F(x) = 100 \{1 - \exp [(-x / a)^b] \}$$

where $f(x)$ is the cumulative percentage of adults caught in the trap at degree-day x, and a and b are fitted constants. Data from 1999 to 2001 were all pooled together for the model fitting and parameter estimations. The values of parameters were estimated using PROC NLIN (SAS institute 1999).

The estimate of parameter *a* was 882.70 with asymptotic 95% CI between 874.8 and 890.6 for base temperature 7℃ and it was 708.7 with asymptotic 95% CI between 701.9 and 715.6 for base temperature 9℃. The estimate of *b* was 9.08 with asymptotic 95% CI between 8.18 and 9.98 for base temperature 7℃ and it was 8.23 with asymptotic 95% CI between 7.43 and 9.03 for base temperature 9℃.

3. Model validation

The developed models were evaluated with data from experimental rice field in Yesan, Chung-cheong-Nam-Do, Korea in 2002. The light trap was arranged at the experimental site and monitored as previously described. Daily maximum and minimum air temperature data were obtained from nearest automated weather station to the experimental fields which were located about 7 km from the experimental field.

References

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Arnold, C. Y. 1960. Maximum-minimum temperature as a basis for computing heat units. *Proc. Am. Soc. Sci.* 76: 682-692.