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Host Suitability of Two Leguminous Plants for *Matsumuraeses falcana* (Lepidoptera: Tortricidae)

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Abstract: The host suitability of *Phaseolus angularis* and *Pueraria lobata* for *Matsumuraeses falcana*, a major soybean pest, was examined under laboratory conditions. Experimental individuals completed development from the 1st instar larva to the adult stage on these two leguminous plants. There was no significant difference between *Glycine max* and these two plants with respect to survival rate or larval and pupal periods of individuals of *Matsumuraeses falcana*. However, adults emerging from *Pu. lobata* were significantly smaller than those emerging from *G. max* or *Ph. angularis*. As only a few larvae were discovered in dead stems or seed pods of soybean plants in winter, the moths probably emigrate in fall from soybean hosts to wild leguminous plants such as *Pu. lobata*, and may overwinter on these plants in the Kyoto region.

Key words: *Glycine max*, host suitability, *Pueraria lobata*, overwintering, *Matsumuraeses falcana*

The bean podworm, *Matsumuraeses falcana* (Walsingham, 1900), is widely distributed from Southeast Asia to the East Palaearctic Region, including Japan (Komai, 1999). It is one of the major pests of the soybean plant, *Glycine max* (L.) Merril, in Western Japan (Kobayashi and Oku, 1976; Oku *et al.*, 1983; Wakamura, 1987). During the early growth season, larvae tie young leaves of host plants together, feed inside the leaves, and later feed on the surface and inside of the pods. The damage caused by this insect is sometimes severe, with up to 52.5% of pods being infested by this pest in soybean fields of the Kanto district, Honshu (cultivar 'Akiyoshi') (Kobayashi and Kikuchi, 1981).

The larvae of *M. falcana* were also recorded from 6 leguminous plants in the field: *Phaseolus angularis*, *Pueraria lobata*, *Trifolium pretense*, *Robinia pseudo-acacia*, *Lupinus* sp. and *Vicia faba* (Oku *et al.*, 1983). However, the suitability or acceptance of these plants as hosts for *M. falcana* has not been investigated. Soybean is usually cultivated from June to November in Central Honshu, Japan. *Matsumuraeses falcana* is multivoltine, and is believed not to possess a definite diapause stage (Oku *et al.*, 1983). The species may therefore overwinter on other wild leguminous plants. The purpose of this study is to investigate the host suitability of legumes other than soybean, and

includes the Kudzu plant, *Pueraria lobata*, which is very common around the soybean field and which is suspected of being important for *M. falcana* as a host for overwintering.

Materials and Methods

1. Host suitability of *Phaseolus angularis* and *Pueraria lobata* for *M. falcana*

(1) Insect. The next generation of larvae collected on *Glycine max* in the experimental farm of Kyoto Prefectural University, Kyoto in August 2002 was used in this investigation. Razowski and Yasuda (1975) recorded 4 allied species of the genus from soybean plants. Correct identification of emerging adults involved the use of genitalic characters. Adult specimens used in this study are preserved in the Laboratory of Applied Entomology, Kyoto Prefectural University.

(2) Test plants. *Glycine max* (cultivar 'Shin-Tambaguro'), *Phaseolus angularis* W. F. Wight ('Dainagon') from the experimental farm, Kyoto Prefectural University, and *Pueraria lobata* (Willd.) Maesen & Almeida from the vicinity of the experimental farm were used in this investigation.

(3) Rearing. This experiment was conducted in the laboratory at 20 ± 1℃ , with a photoperiod of 15-9(L:D) h and a photophase starting at 0730 hours. Newly hatched larvae (25 individuals for each plant) originating from eggs deposited by 5 females were reared individually in a plastic cup (dia 7 cm, ht. 3 cm), and young leaves of each plant were placed on moist filter paper as a source of food. Leaves were replaced with new ones when necessary. Pupation and adult emergence were checked every day.

(4) Size of adult forewing. The forewings of adults emerging from the 3 plants were measured to within 0.01 mm under an ocular microscope as an indicator of adult size.

(5) Statistical analyses. Survival rates on the 3 test plants were compared using a χ^2 test (at the 5% level). Total developmental days from egg hatching to adult emergence and forewing lengths were compared using Scheffe's test (at the 5 % level) after analysis of variance (ANOVA). Data on males and females were pooled for statistical analyses because there was no significant difference between these groups.

2. Overwintering of *M. falcana* on soybean

The stems, leaves and pods of dead plants (10 plants per sample) collected from the experimental farm at Kyoto Pref. Univ. were examined to determine the overwintering stage and number of *M. falcana* on 13 January, 25 February and 11 March, 2003.

Results and Discussion

1. Host suitability of two leguminous plants

Table 1. Length of larval and pupal periods, in days, and survival rate of *M. falcana* reared on three legumes at 20℃, 15L-9D. Values followed by a different letter in the same row are significantly different (Scheffe's test, $P<0.05$)

Host plant	N	Larval period (mean±SD)	Pupal period (mean±SD)	Eclosion to emergence (mean±SD)	Survival rate (%)*
Glycine max	18	22.3±2.66a	15.7±1.05a	39.0±3.28a	76.7A
Phaseolus angularis	16	23.6±1.34a	15.5±2.18a	39.6±3.01a	78.9A
Pueraria lobata	16	24.5±2.07b	15.3±0.62a	39.8±2.51a	75A

*Same letters indicate no significant difference (χ^2 test, $P>0.05$)

Table 2. Adult forewing length of *M. falcana* reared on 3 legumes.

Host plant	N	Mean length (mm)	SD
G. max	14	7.65a*	0.46
Ph. angulalis	15	7.44a	0.45
Pu. lobata	15	6.93b	0.38

*Different letters indicate a significant difference (Scheffe's test, $P<0.05$)

Table 3. Overwintering larvae of *M. falcana* on *G. max* at Kyoto in 2003.

Date collected	N	Larval stage	Plant part
13 Jan.	1	4th instar	stem
25 Feb.	1	3rd instar	pod
25 Feb.	1	4th instar	stem

Survival rates of *M. falcana* on the 3 plants are shown in Table 1. Survivorship was highest on *Phaseolus angularis* (78.9 %) and lowest on *Pueraria lobata* (75.0 %), but no significant differences were observed between the 3 plants ($P>0.05$). The number of days required for development from 1st instar larva to adult emergence was as follows: *G. max*: 39.0, *Ph. angularis*: 39.6, and *Pu. lobata*: 39.8 days (Table 1); no significant differences were observed between the 3 plants ($P>0.05$). However, the mean size of the adult forewing of individuals derived from *Pu. lobata* was 6.93 mm, and was

significantly smaller than that of individuals obtained from *G. max* or *Ph. angularis* ($P<0.05$) (Table 2).

The results of this investigation confirmed that the host suitability of *Ph. angularis* for *M. falcana* is as high as that of *G. max*, and that this tortricid moth accepts as a host the wild legume *Pu. lobata*, although this host yields adults of a slightly smaller size.

2. Overwintering of *M. falcana* in Central Honshu, Japan.

Investigation of dead soybean plants during winter revealed that *M. falcana* overwinter during mid-instar larval stages (Table 3). However, it has been reported that members of the species overwinter during the pupal stage in Shikoku, South-Western Japan, and as young larvae on *Vicia faba* in the Southwestern part of Honshu (Kobayashi, 1979). On the other hand, the species was not discovered during the winter and spring in the Tohoku district, Northern Honshu, and it has been suggested that the species cannot survive during the winter in this district (Oku *et al.*, 1983). A few larvae were found on soybean plants during winter and early spring in Kyoto, Central Honshu (Table 3). It was therefore believed that most adults on soybean move to the other leguminous plants in fall, where they lay eggs on their new host plants and subsequently overwinter. Though *P. angularis* appeared to be highly suitable as a host for *M. falcana* (Table 1), this crop is also harvested in fall. *Matsumuraeses falcana* is reported as having no diapause stage, and it has been suggested that overwintering occurs during various developmental stages in Southwestern Honshu, Japan (Oku *et al.*, 1983). Adults emerging during the spring may lay eggs on wild host plants and remain there for one generation. Then in July the 2nd generation may move to soybean host plants. The population density of *M. falcana* on soybean may be affected by the number of overwintering individuals on wild legumes surrounding the soybean field.

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