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Host Plant Suitability to the Potato-Feeder Lady Beetle, *Epilachna vigintioctomaculata* (Coleoptera : Coccinellidae) on Some Cultivated and Wild Solanaceous Plants

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Synopsis

The host plant suitability to the phytophagous lady beetle, *Epilachna vigintioctomaculata* was examined on twelve solanaceous plants (three cultivated and nine wild species). Special effort was made to search for plants which were able to reduce only the egg production of female adults without deterring larval development, in order to develop a genetic plant resource for breeding of varieties resistant to *E. vigintioctomaculata*. Three of the twelve species tested, *Scopolia japonica, Solanum villosum* and *S. carolinense*, were selected as promising plants. In *Scopolia japonica* and *S. villosum*, egg production was reduced largely by nonvolatile secondary metabolites present in the leaves. In *S. carolinense*, reduction of egg production seemed to be due to both secondary metabolites in the leaves and spine-like projections on the foliage.

Key words: *Epilachna vigintioctomaculata*, host plant suitability, *Scopolia japonica, Solanum villosum, S. carolinense*.

I. Introduction

The phytophagous lady beetle, *Epilachna vigintioctomaculata* (henceforth abbreviated to Evm) and the related species, *E. vigintioctopunctata*, are major pests of solanaceous crops such as potato, *Solanum tuberosum*, egg-plant, *S. melongena*, and tomato, *Lycopersicon esculentum*, in Japan. Although some studies have been conducted on the host preference and food habit of Evm (KOYAMA, 1950 ; KUROSAWA, 1954 ; HOSHIKAWA, 1983), the host plant suitability for *Epilachna* beetles has never been examined in detail on solanaceous plants including wild ones. One possible reason may be that these beetles have not developed severe insecticide resistance, and can be easily controlled using synthetic-organic insecticides. In recent years, a large number of measures other than chemical control have been proposed in order to minimize the environmental impact associated with pesticide use in the agro-ecosystem of Japan. Control methods

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involving plant varieties resistant to insect pests are an important approach along these lines.

In the present study, host plant suitability to Evm was examined in terms of some population parameters (for example, number of eggs laid, hatchability, longevity of adult beetles, and survival rate during the immature stages) using both cultivated and wild Solanaceae, in order to obtain a better breeding resource for producing cultivars resistant to Evm. It would be important for the excellent and sustainable varieties resistant to insect pests to have both a high productivity (yield) and moderate phytochemical defense mechanisms against herbivores. Plant with excessive defensive mechanisms would be inappropriate as a food resource for herbivores including both insects and humans, because such plants are often rich in secondary metabolic products and invest more energy in chemical defense at the expense of their vegetative growth and reproduction (KOGAN, 1986). Furthermore, plants able to deter both female adults and larval development are likely to contain more toxic substances detrimental to humans as well, making them unsuitable as a breeding resource. Therefore, in the present investigation, a special effort was made to search for plants which were able to reduce egg production (number of eggs laid per female) alone, without affecting the insect survivorship during the immature stages.

In addition, many field studies on the population ecology of *Epilachna* beetles have shown that the population density during the reproductive seasons was most important "key factor" responsible for the fluctuations or stability in population dynamics (IWAO, 1970; NAKAMURA, 1976; NAKAMURA *et al.*, 1981; HIRANO, 1985; SHIRAI, 1987b). If the population density of Evm could be successfully controlled at the initial stage, the damage to solanaceous crops by larvae and newly emerged adults could be reduced within the range of the minimum injury level, since Evm has an univoltine life history in Japan. Thus, searching for plants deterring egg production seems the most promising approach to obtaining a plant genetic resource for breeding of varieties resistant to Evm.

II. Materials and Methods

1. Insect:

Overwintered beetles of Evm were collected from potato fields in Takatoh, Nagano Prefecture (about 800 m above the sea level) in mid May, 1988 and 1989, when the potatoes had begun to sprout. After exposure to 15° C and 16L-8D for five days, these beetles were used for the examination of oviposition and longevity. The cooling treatment was applied to eliminate any influence of previous feeding on potato leaves in the field.

2. Plants tested:

Twelve species of solanaceous plants were tested (three cultivated and nine wild plants).

(1) Cultivated plants:

Potato : *Solanum tuberosum* cv. 'Danshaku' , egg-plant: *S. melongena* cv. 'Senryo-nigo', and tomato: *Lycopersicon esculentum* cv. 'Beiju' .

(2) Plants native to Japan:

Deadly nightshade: *Scopolia japonica*, a type of bittersweet: *Solanum lyratum*, Oomarubano-horoshi: *S. megacarpum*, and black nightshade: *S. nigrum* (controvertible plant, see Discussion on page 53).

Table 1 Ovipositional traits of *Epilachna vigintioctomaculata* on twelve solanaceous plants (I)

Plants	No. of females examined	Females oviposition	No. of eggs laid per females[a]	Longevity of females adult[a]
		(%)		(day)
Solanum tuberosum	20	100.0	390.8±226.7	69.1±28.2
S. melongena	20	100.0	183.8± 92.2 *	65.7±19.4
Lycopersicon esculentum	20	100.0	426.3±220.8	54.3±17.6
Scopolia japonica	20	80.0	37.3± 37.0 *	52.6±25.8
Solanum lyratum	20	85.0	16.9± 17.5 *	26.4± 8.9 *
S. megacarpum	20	100.0	277.5±115.4	45.7±19.5 *
S. nigrum	20	100.0	421.5±167.4	81.0±25.1
S. carolinense	20	85.0	84.5± 75.2 *	56.6±20.4
S. chacoense	20	100.0	317.6±211.1	50.5±19.1
S. commersonii	20	100.0	355.3±188.0	50.6±10.3 *
S. villosum	20	100.0	148.8± 74.6 *	71.0±27.1
S. torvum	12	25.0	5.1± 11.8 *	11.0± 4.7 *

[a] Average ± SD.
* Significant difference between the potato, *Solanum tuberosum* (control plant) at 5 % level (by *t*-test).

Table 2 Ovipositional traits of *E. vigintioctomaculata* on twelve solanaceous plants (II)

Plants	No. of egg-masses	Egg-mass[a] size	Hatchability[a]	Duration of egg stage[a]
			(%)	(days)
Solanum tuberosum	42	26.4±7.0	91.9±11.7	6.9±0.6
S. melongena	36	24.6±8.7	91.8±17.4	6.5±0.7
Lycopersicon esculentum	42	25.4±7.8	96.0± 7.8	6.7±0.5
Scopolia japonica	11	20.8±6.9	86.2±11.6	5.8±0.9 *
Solanum lyratum	13	14.6±5.8 *	95.6± 6.9	6.3±0.6
S. megacarpum	29	24.9±7.6	91.5± 7.6	6.3±0.9
S. nigrum	42	23.1±8.3	93.4±16.0	6.4±0.7
S. carolinense	37	23.0±8.7	91.9± 9.4	6.8±0.8
S. chacoense	13	23.2±8.1	77.0±11.7 *	7.0±1.1
S. commersonii	17	23.4±7.4	89.3±12.1	7.1±0.7
S. villosum	36	21.2±7.4 *	93.7±11.2	5.8±1.1 *
S. torvum	2	18.0±5.7	69.8± 2.2 *	6.0±0.7

[a] Average ± SD.
* Significant difference between the potato, *Solanum tuberosum* (control plant) at 5 % level (by *t*-test).

(3) Plants naturalized to Japan:

Horse nettle : *Solanum carolinense*.

(4) Plants introduced from abroad:

Solanum torvum, woolly nightshade : *S. villosum*, and wild potatoes : *S. chacoense* and *S. commersonii*.

All of the twelve species were grown in flower pots in uncontrolled greenhouses at the National Research Institute of Vegetables, Ornamental Plants and Tea (NIVOT) in 1988, and the National Institute of Agro-Environmental Sciences (NIAES) in 1989.

3. Host plant suitability :

In this study, egg production by Evm female beetles and survivorship during the immature stages were mainly examined on the twelve solanaceous plants. The examinations for three plants (*S. carolinense*, *S. villosum* and *S. torvum*) were conducted at NIAES in 1989, and those for the other nine species were done at NIVOT in 1988. The experimental data for 1988 and 1989 were pooled, because the results of a preliminary trial on potato in 1989 showed no significant differences from those obtained in 1988 :

Year	n	No. of eggs laid	Longevity of female
1988	20	390.8±226.7	69.1±28.2
1989	10	349.2±168.4	54.0±24.6

Table 3 Survival and development of larvae of *E. vigintioctomaculata* on twelve solanaceous plants

Plants	No. of replication	Immature stages[a]		Pronotal width of newly emerged female[ab]
		Survival rate (%)	Period (days)	(mm)
Solanum tuberosum	14	80.5±10.8	24.8±0.9	3.29±0.16
S. melongena	11	56.8±21.6 *	24.6±1.4	3.27±0.03
Lycopersicon esculentum	11	86.7±14.4	26.8±1.0 *	3.28±0.11
Scopolia japonica	12	66.0±14.3	25.5±2.8	3.06±0.28
Solanum lyratum	12	59.4±21.5 *	25.4±1.3	3.21±0.12
S. megacarpum	8	69.2±12.7	25.3±2.5	3.25±0.12
S. nigrum	9	83.7±14.5	24.8±0.7	3.18±0.13
S. carolinense	11	80.2±12.7	26.3±1.4 *	3.12±0.16
S. chacoense	9	79.0±19.9	23.1±1.2 *	3.10±0.11 *
S. commersonii	10	76.7±14.1	25.4±1.6	3.27±0.11
S. villosum	9	77.3± 8.1	28.2±1.0 *	3.21±0.14
S. torvum[c]	11	2.3± 7.5 *	42.5 *	−

[a] Average ± SD.

[b] No. of females measured are 15 for every plants.

[c] The first instar larvae obtained from adult parents feeding on potato leaves were used only for the set of *S. torvum*

* Significant difference between the potato, *Solanum tuberosum* (control plant) at 5 % level (by *t*-test).

For the oviposition examination, pairs of female and male overwintered adults, collected from a potato field, were each transferred to a plastic dish (9cm diameter, 5 cm deep, covered with polyester gauze) and supplied with a fresh plant leaf. These dishes were checked every day for the number of eggs laid and survivorship of adults. Leaves were replaced with fresh ones at intervals of one or two days, and each experiment was terminated when the female adult died. The number of eggs per egg-mass (expressed as egg-mass size), hatchability and duration of egg stage were examined using the egg-masses which had been laid on the gauze or leaf and saved from cannibalism by adult beetles. The rate of oviposition by females was defined as : (no. of females laying more than one egg-mass) ÷ (no. of females tested) ×100.

For the experiments during the immature stages, 8 to 10 hatched larvae were transferred to a plastic dish (9cm diameter, 5cm deep, covered with polyester gauze) and supplied with the same plant leaf on which their adult parents had been reared, except for of *S. torvum* (see Table 3). A fresh leaf was added to the dish at intervals of one or two days until the third instar stage and every day during the 4th instar stage. After emergence, fifteen new female adults were selected randomly for the pronotal width measurement.

4. Egg production during simultaneous rearing with wild plant and potato leaves :

For the four wild plants, *Scopolia japonica, Solanum carolinense, S. villosum* and *S. lyratum*, which had shown a conspicuous reduction of oviposition in the above experiment, the number of eggs laid was checked for 50 days to determine whether these wild plants released any volatile substances from their leaves that would be detrimental to egg production. Each pair of female and male adults was transferred to a plastic dish (15 cm diameter, 9 cm deep, plugged with absorbent cotton) and supplied simultaneously with potato and wild plant leaves. The leaves of the two plants were replaced with fresh ones at intervals of one or two days. These experiments were conducted at NIAES in 1989, and all of the experimental sets (3, 4) were carried out under constant conditions of 23° C, 16L-8D and about 60% RH.

Table 4 The egg production by female of *E. vigintioctomaculata* upon simultaneous rearing with wild plant and cultivated potato leaves

Combination of food plants	No. of replication	Females oviposition	No. of eggs laid per females[a]
		(%)	
Scopolia japonica + potato	12	100	327.0±149.2
Solanum carolinense + potato	12	100	242.7± 78.5
S. villosum + potato	7	100	349.5±103.6
S. lyratum + potato	12	100	165.7± 90.9 *
Potato (*S. tuberosum*)	20	100	383.8±222.8

a Average ± SD. (Total number of egg laid for 50 days).
* Significant difference between the setup of potapo only at 5 % level (by *t*-test).

5. Statistical analysis :

Differences in all the population parameters obtained from the experiments were tested statistically between the control plant, *S. tuberosum*, and other plants using *t*-test ($p<0.05$).

Ⅲ. Results

1. Host plant suitability during the ovipositional stage :

Table 1 shows the number of eggs laid per female, rate of female oviposition and longevity of females among the twelve plants tested. In comparison with the control plant, *S. tuberosum*, significant reductions in egg production were found when Evm was reared on six plants ; *S. melongena, S. lyratum, S. carolinense, S. torvum, S. villosum* and *Scopolia japonica.*

2. Host plant suitability during the egg stage :

Table 2 shows the egg-mass size, hatchability and duration of egg stage. Significant decreases in hatchability were recognized on *S. chacoense* and *S. torvum.*

3. Host plant suitability during the immature stages :

Table 3 shows the survival rates, developmental periods during immature stages from first instar larvae to emergence and the pronotal width of newly emerged females reared on each of the twelve plants. In comparison with the control plant, significant decreases in the survival rate were found on *S. melongena, S. lyratum* and *S. torvum.* Body size of the newly emerged females was significantly smaller only on *S. chacoense.*

4. Egg production during simultaneous rearing on both wild plant and potato leaves :

Table 4 shows the number of eggs laid per female when Evm was reared on both wild plant and potato leaves for 50 days. The "*S. lyratum* plus potato" experimental set showed a significant reduction in egg production in comparison with potato leaf only. However, the other three "wild plant plus potato leaf" combinations showed no significant reduction in egg production. According to the leaf area fed by adult beetles, it was observed that Evm beetles preferred potato leaf to a wild plant leaf in any combination including the "*S. lyratum* plus potato" set.

IV. Discussion

1. Selection of plant resources resistant to Evm :

In this study, two important parameters for the determination of the reproductive rate in Evm population, the number of eggs laid per female and the survival rate during the immature stages, were evaluated in order to select promising plants for further breeding of varieties resistant to Evm. Hatchability was not evaluated because of the high rates of more than 70% recorded on all of the plants tested, and its low variance among the plants tested.

From the relationship between the survival rates during the immature stages and the number of eggs per female (Fig. 1), three wild plants, *Solanum carolinense, S. villosum* and *Scopolia japonica,* were selected as the plants which could significantly reduce egg production without affecting the survival rates at the immature stages. The results for *Scopolia japonica* were almost the same as the previous report (SHIRAI, 1987a). *S. torvum* severely deterred both egg production and survival rate at the immature stages, suggesting that this plant contained a substance in the leaf which affected the egg production and survivorship of Evm, as in the case of the melon aphid, *Aphis gossypii* (SHINODA *et al.*, 1990). Therefore, *S. torvum* was not acceptable as an appropriate plant resource because of its very severe inhibitory effect. *S. melongena* and

S. lyratum were also rejected for the same reason. Unfortunately, two wild potato species, *Solanum chacoense* and *S. commersonii*, introduced from Latin America, showed no resistance to Evm (Fig. 1).

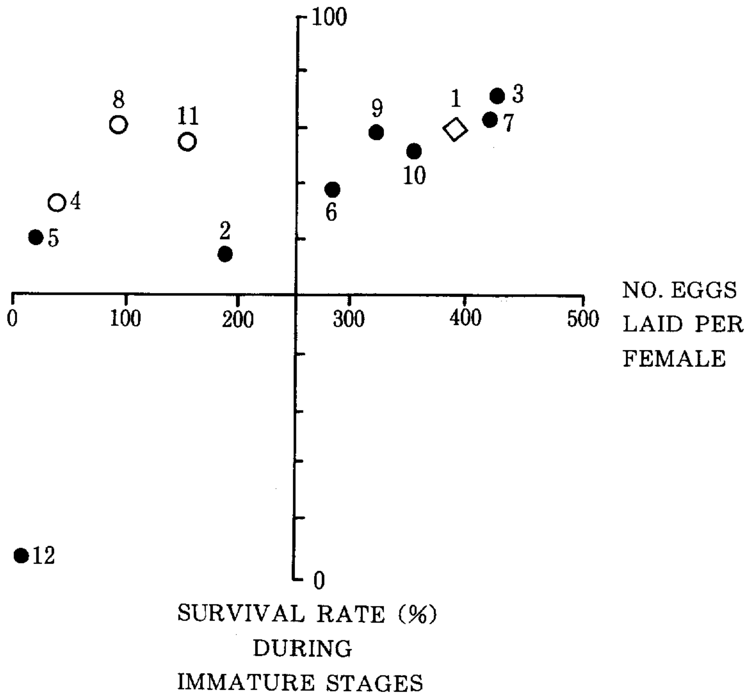

Fig. 1 Relationship between the number of eggs laid per female (horizontal axis) and the survival rate during immature stage (vertical axis) in *Epilachna vigintioctomaculata* reared on twelve solanaceous plants.

◇ 1.*Solanum tuberosum*(control plant)
● 2.*S. melongena* ● 3.*L. esculentum*
● 5.*S. lyratum* ● 6.*S. megacarpum*
● 7.*S. nigrum* ● 9.*S. chacoense*
● 10.*S. commersonii* ● 12.*S. torvum*
○ 4.*Scopolia japonica*
○ 8.*Solanum carolinense*
○ 11.*S. villosum*

2. Mechanisms of reduction in egg production :

A large number of studies on host suitability of Solanaceae plants for phytophagous insects have been conducted using the Colorado potato beetle, *Leptinotarsa decemlineata* (abbreviated to CPB) (HSIAO *et al.*, 1968 : BONGERS, 1970 : HARRISON *et al.*, 1988 : HARE, 1990). CASAGRANDE (1982) pointed out that two factors, secondary metabolic compounds in the leaf and trichomelike projections on the foliage, should be separately examined regarding the mechanism of solanaceous plant resistance to CPB, because the wild potato species, *S. berthaultii* was revealed to inhibit egg production strongly due to the glandular hairs on the foliage, irrespective of the level of alkaloids in the leaf. After his work, the deterrent mechanism by the glandular hairs was attributed to the mechanical effect of spine-like projections on the foliage and chemical effect associated with a volatile substance released from the tips of glandular trichomes on wild potato (Gibson *et al.*, 1983) or wild tomato (Kennedy *et al.*, 1985). Accordingly, in the present study also, the mechanism of reduction in egg production of Evm on the three wild plants selected, *S. carolinense, S. villosum* and *Scopolia japonica*, was studied by separating the effect of the morphological leaf characteristics such as spine-like projections on the foliage from that due to secondary compounds present in the leaves. The level of primary nutrients in leaves, such as nitrogen, was not considered to be as important as the above two factors, because female adults produced a large number of eggs even on two wild potato species which had a lower nitrogen content than the cultivated potato (Table 1). In addition, these three wild species seemed to possess a substance essential (and sufficient) for the survival and development of Evm, because they did not affect the longevity of female adults during the reproductive period (Table 1) or the body size (pronotal width) of newly emerged females (Table 3).

S. carolinense had many sharp spine-like projections on the foliage, whereas such features were not observed on the leaves of *S. villosum* and *Scopolia japonica* by the stereoscopic microscopy at ×40 magnification. In the experiment where a female adult was supplied simultaneously with both a wild plant and cultivated potato leaves in a plastic dish, no significant reduction in egg production was observed for three leaf combinations (Table 4), suggesting that the wild plants did not contain any volatile compounds in their leaves that would be detrimental to egg production. Mechanical interference with egg production by sharp spine-like projections on the foliage of *S. carolinense* could be confirmed by an experiment in which Evm females are supplied with leaves depleted of surface spines.

Table 5 The secondary metabolites of the Solanaceous plants

Plants	Alkaloids and other secondary compounds
Solanum tuberosum	solanine, solanidine
S. chacoense	chaconine, leptine, quercetin-3
S. commersonii	commersonine, sitosterin
S. lyratum	solanine, solanidine
S. nigrum	solanine, solasonine, solasondine, solamargine, atropine, saponine, tigogenine
S. carolinense	solanine
S. torvum	solasonine, sisalagenon, 3-amnospirostane, torvogenine
L. esculentum	solanine, tomatine, tomatidine, saponine, furanocoumarin
Scopolia japonica	hyoscyamine, scopolamine, atropine, scopolin

Sources : Hawkes *et al.* (1979), Hegnauer (1973 ; 1990), and Mitsuhashi (1988).

Although this study did not include a phytochemical investigation, the secondary compounds of solanaceous plants are summarized from the literature in Table 5. It can be seen that *Scopolia japonica* contains some specific tropane alkaloids such as atropine, hyoscyamine and scopolamine. HARRISON et al., (1988) reported that the substance deterring the feeding of CPB was not a steroidal glycoalkaloid such as solanine, tomatine and chaconine, but a tropane alkaloid. Tropane alkaloids may therefore be also important secondary compounds related to the reduction in egg production of Evm. Future investigations should determine the content of tropane alkaloids in the three wild solanaceous plants selected for this study, since phytochemical data on Solanaceae are very scanty, especially in the cases of *S. carolinense* and *S. villosum*.

The present study also provided an important information on the taxonomy of the genus *Solanum*. Host plant suitability for egg production by Evm varied significantly between *S. nigrum* and *S. villosum* (Table 1), even though these two *Solanum* species are closely related, belonging to the *nigrum* complex (EDMONDS, 1979). Thus, specific phytochemical differences in leaf secondary compounds may occur between the two *nigrum* plants.

On the basis of the present results, the mechanism of the reduction in egg production of Evm was interpreted as follows : In the case of *S. carolinense*, the reduction in egg production was due to secondary compounds in the leaf, and presumably to the sharp spine-like projections on the foliage. On the other hand, in *S. villosum* and *Scopolia japonica*, egg production was reduced solely by nonvolatile secondary compounds. As a next step, the phytochemical compounds in these wild solanaceous plants should be identified in order to elucidate the mechanism underlying the reduction of egg production without deterring insect development during the immature stages.

3. Native host plants of Evm in Japan :

Finally, on the basis of the host suitability on four wild plants indigenous to Japan, *Scopolia japonica, Solanum lyratum, S. megacarpum* and *S. nigrum* (Tables 1 and 4), it would be important to identify the native host plants of Evm prior to the invasion of the insect into potato fields. The potato was introduced to Japan in the 16th or 17th century, and the area used for cultivation increased rapidly between about 1900 and 1930 (UMEMURA, 1984). It is considered that Evm was already distributed throughout Japan in ancient times and became an important insect pest of potato as the cultivation became widespread (KATAKURA, 1975). Which plant was the native wild host of Evm prior to potato cultivation?

Solanum megacarpum and a type of bitter gourd, *Schizopepon bryoniaefolis* (Cucurbitaceae) were confirmed to be native host plants in Hokkaido (KATAKURA, 1975 : 1981), but there are no reliable reports on native plants in Honshu (KATAKURA, 1988 : SHIRAI, 1990). According to the results of the present study, the order of host plant suitability for Evm was *S. nigrum* 〉 *S. megacarpum* 〉 *Scopolia japonica* 〉 *S. lyratum* and the suitability of *S. nigrum* was higher than that of the cultivated potato, *S. tuberosum*. However, *S. nigrum* is a controvertible native plant, because this species was probably naturalized to Japan in prehistoric times (OSADA, 1981: KATAKURA, 1988). *S. megacarpum* seems to be the most likely candidate because of its high host suitability. In some field surveys, Evm was detected on *Scopolia japonica* (HARA *et al.*, 1979 : SHIRAI, 1987a), and on *S. lyratum* (SAKABE *et al.*, 1990) as host plants in mountainous areas of central Honshu. However it is doubtful whether Evm is able to complete its life cycle and maintain its population on *S. lyratum* alone, because of the very low reproductive rate and short longevity of female adults (Table 1). In addition, it is assumed that the Evm population exhibits a relatively low reproductive rate even on *Scopolia japonica*. According to the present information, wild plants such as *S. megacarpum* and its related species (*S. maximowiczii* and *S. japonense*), together with the deadly nightshade, *Scopolia japonica*, are considered to be reliable native host plants of Evm in the Honshu area.

Furthermore, the suitability of two wild potatoes, *S. chacoense* and *S. commersonii*, was not inferior to that of the cultivated potato 'Danshaku'. This fact seems to indicate that Evm already had a relatively high reproductive rate on the potato varieties, 'early rose' or 'snow flake', used about 100 years ago when the insect invaded potato fields for the first time from its wild native host plants.

V. Acknowledgements

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VI. Summary

The host plant suitability to the phytophagous lady beetle, *Epilachna vigintioctomaculata*, was examined on twelve Solanaceae plants (three cultivated and nine wild species). Special effort was made to search for plants which were able to reduce solely the egg production of female adults without deterring development of the insect during the immature stages as a genetic plant resource for future breeding of varieties resistant to *E. vigintioctomaculata*. All the plants tested were grown in uncontrolled greenhouses and the examinations were conducted under constant conditions of 23° C and 16L-8D.

(1) Adult beetles and larvae of *E. vigintioctomaculata* were able to feed on all the leaves of twelve plants tested, but fed little on *S. torvum* alone.

(2) In comparison with the control plant, *Solanum tuberosum*, significant reduction in egg production was found on *S. melongena*, *S. lyratum*, *S. carolinense*, *S. torvum*, *S. villosum* and *Scopolia japonica*.

(3) In comparison with *S. tuberosum*, there was a significant decrease in the survival rate during the immature stages on *S. melongena*, *S. lyratum* and *S. torvum*.

(4) Three wild plants, *S. carolinense*, *S. villosum* and *Scopolia japonica*, were selected as plants which were able to reduce only egg production without affecting the survival rate during the immature stages.

(5) In the cases of *S. villosum* and *Scopolia japonica*, egg production was reduced largely by nonvolatile secondary metabolites present in the leaves.

(6) In *S. carolinense*, the reduction in egg production was considered to be due to both secondary metabolites in the leaves and sharp spine-like projections on the foliage.

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* in Japanese ** in Japanese with an English summary *** in German

Explanation of Plate I

A : Female adult, Egg-mass and 4th instar larva of *Epilachna vigintioctomaculata.*

B : Deadly nightshade, *Scopolia japonica.*

C : Horse nettle, *Solanum carolinense.*

Plate I

A

B

C

Explanation of Plate II

D: Black nightshade, *Solanum nigrum* (Left) and woolly nightshade, *S. villosum* (Right).

E: *Solanum torvum.*

F: A type of bittersweet, *Solanum lyratum.*

Plate II

D

E

F

ナス科植物に対するオオニジュウヤホシテントウ（鞘翅目：テントウムシ科）の寄主適合性

白井洋一

和文摘要

12種のナス科植物（3種の栽培植物と9種の野生植物）を用いて，オオニジュウヤホシテントウに対する寄主植物適合性を調査した．優れた耐虫性品種の育種素材の選択を目標として，この研究では，特に幼虫期の生存を阻害せず，雌成虫の産卵量だけを抑制する植物の探索に注目した．供試植物は無加温の温室で栽培され，実験はすべて23℃，16L-8Dの一定条件で行った．

(1) オオニジュウヤホシテントウの成虫と幼虫は，供試した12種の植物の葉をすべて摂食したが，*Solanum torvum*（トルバム）では著しく摂食量が少なかった．

(2) 栽培ジャガイモ（*Solanum tuberosum*：対照区）に比べて，ナス（*S. melongena*），ハシリドコロ（*Scopolia japonica*），ヒヨドリジョウゴ（*S. lyratum*），ワルナスビ（*S. carolinense*），*Solanum villosum*，および*S. torvum*の6種で，産卵数の有意な低下が認められた．

(3) 栽培ジャガイモに比べて，ナス，ヒヨドリジョウゴ，および*S.torvum*の3種で，未成熟期生存率の有意な低下が認められた．

(4) 幼虫の生存を阻害せず，産卵数だけを抑制する植物として，ハシリドコロ，ワルナスビ，および*S. villosum*が選択された．

(5) ハシリドコロと*S. villosum*では，産卵数抑制の原因は，主に植物中の2次代謝物質によると考えられた．

(6) ワルナスビでは，産卵数抑制は，植物中の2次代謝物質と，葉表面の刺状物質による物理的阻害によって生じていると推定された．

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