

**Occurrence and Biology of the Celery Weevil,
Hypera adspersa var. *alternans* STEPHENS
(Col. Curculionidae) in Hokkaido, Japan***

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Introduction

On May 20, 1980, one of the authors T. Nikkuni found quite strange weevils on the coast of Okhotsk in Hokkaido, Japan, where *Legusticum scoticum* (Umbelliferae) grew wild on the rocks of the seaside. The weevils were perching on the plant leaves. By a careful examination it was found that the external characteristics and the food habit of them were consistent with those of *Hypera adspersa* FABRICIUS,¹⁾ described also earlier by Hoffmann.²⁾ Two pairs of the adult specimens were sent to Systematic Entomology Laboratory of Kyushu University for positive identification. Dr. Morimoto kindly determined the identity of the weevil as being *Hypera adspersa* var. *alternans* (STEPHENS).⁷⁾

Hypera adspersa, whose Japanese name is Madarazomushi, was first observed by Nawa⁴⁾ in Gifu Prefecture, Japan. After 50 years, the name Madarazomushi was changed into Shirosujitakozo by Morimoto³⁾ in the Science Bulletin of the Faculty of Agriculture, Kyushu University. In the present paper, the weevil of *Hypera adspersa* var. *alternans* is named "Celery Weevil" after their food plants.

Reports on this weevil apparently have not yet been published hence authors in this study investigated first the biology of the weevils. Both field discrimination of the weevils and the result of an ecological survey are presented.

Materials and Methods

The study at the College of Dairying, in year 1980-1981, was performed in a form of various rearing experiments in the incubator. In addition,

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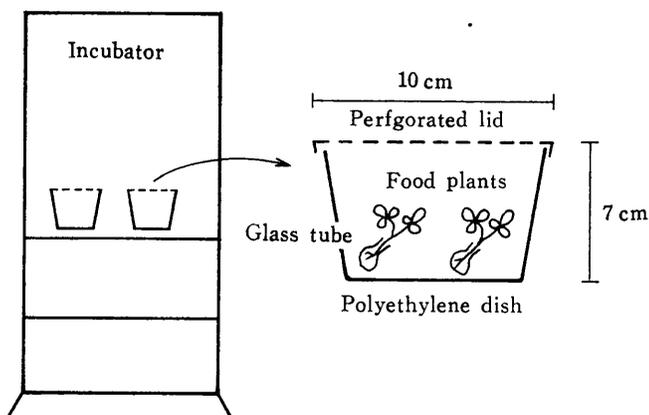


Fig. 1. Rearing dish in which various habits of weevil were examined.

field observations were carried out at Okoppe, Hokkaido (North 44°30' Lat., East 143° Long.).

Rearing experiments were carried out in polyethylene dishes placed in the incubator (Fig. 1). The plants used in experiments were placed in water filled glass tubes. The tubes were put in polyethylene dish, and then the insects were placed onto plants and the dish covered with a perforated lid. The plants were generally replaced daily with fresh new ones.

The weevils were collected in the adult stage at Okoppe, Hokkaido. They were perching on wild *Ligusticum scoticum* L. (Umbelliferae).

Field observations were carried out in the actual environment. Furthermore, the behaviour to plants was tested also in the rearing dish. In such an assay one specimen of each plant species investigated were arranged circularly. The plants selected had the closest similarity in size (5~7 cm) and stage of growth (a leaflet with an attached petiole).

On May 20th, one pair of hibernated adults, on June 1st, ten larvae of 2 mm in length were placed in the center of plants circle. Examination was made after ten days, by noting the feeding marks and counting the number of eggs on the plants.

Results and Discussion

1) Discrimination of species in Japanese Hyerinae.

In Japan six species of the weevil belonging to the genus *Hypera* were reported so far, among which four were injurious to leguminous grasses; *Hypera nigrirostris*, *H. viciae*, *H. basalis* and *H. punctata*.^{5,6,9)}

Taxonomic studies of Hyerinae were investigated in details for a long time. Accordingly, in the present study there is no need to report them in details.

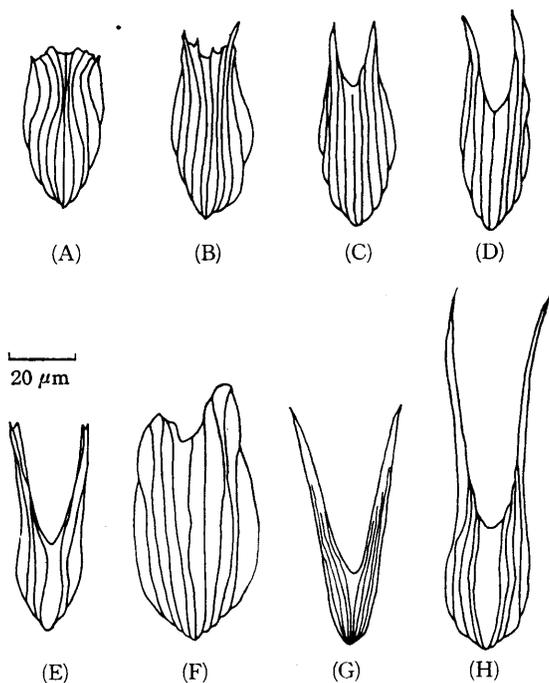


Fig. 2. Scales of erytra in Hyperinae.

(A) *Hypera rumicis* (B) *Hypera adspersa* (C) *Hypera viciae* (D) *Hypera* sp.
 (E) *Hypera basalis* (F) *Hypera punctata* (G) *Hypera nigrirostris* (H) *Hypera postica*

Generally, scales of Hyperinae have one lobation at the cusp. The species of Hyperinae in Japan is distinguished by the form of scale on elytra (especially, according to the extent of lobation), as presented and summarized in Fig. 2. Although the form of scale is barely visible by naked eye, it can be seen well under a magnifying glass and readily visible and understood by seeing scanning electron microscope (Plate).

Thus, in the case of celery weevil the extent of lobation on the scale is of the smallest degree, and in addition there are some small notches within the lobation itself.

2) Appearance (Plate)

ADULT

The adult weevil is of the middle size, about 4.6–7.3 mm in length and about half of it in width. Dorsally it is grey or brownish grey, with black stripes on its elytra.

A taxonomic description of celery weevil has been reported in details by Stephens²⁾ and Hoffmann²⁾. Accordingly, here will be omitted. However, in this study we must emphasize that the hind wings of this weevil are

very small (Fig. 3), and as a consequence of this fact nearly a total inability of weevils to fly. Therefore, they can not distribute to a wide zone.

Very little difference exists between the sexes; the female usually has a slightly larger and stockier body than the male.

EGG

The egg is a small grainy one with about 0.7×0.4 mm in diameter, and oval in shape. It is barely visible by the naked eye. When the egg is deposited in the pith cavity of the petioles, it can not be seen from the outside. When dissected out from petiole it has distinct yellowish-white color. As incubation proceeds, the color deepens until it becomes very dark.

LARVA

When newly hatched, the larva is approximately 1.9 mm long. Its body is yellow while head black in color. When larva matures, it is a legless whitish grub, and when fully grown it measures about 16 mm and its body is fusiform and brownish black in color, with the head relatively small.

PUPA

The pupa is soft, very easily crushed and brown in color. The color is changed during the earlier stage of the pupal period, and length of pupa varies from 8 mm to 12 mm. The pupa stays in the cocoon. The cocoon is delicate and has a structure like that of a lace, and it is on the average about 13 mm long and 7 mm wide. It is symmetrical oval in shape and brown in color.

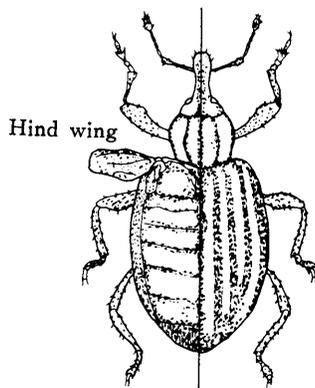


Fig. 3. Dorsal view of celery weevil (*Hypera adspersa* var. *alternans*).

MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
+++	+++	+++	+++	+++				
		○○	○○○					
			---	-				
			◎	◎◎◎				
				+	+++	+++	+++	+

+ Adult ○ Egg - Larva ◎ Pupa

Fig. 4. Annual life cycle of celery weevil (*Hypera adspersa* var. *alternans*) at Okoppe, Hokkaido, Japan.

3) Life History and Habit (Fig. 4)

The weevil, generally winters only in the adult stage. In spring, first it makes cavities in the petioles with its rostrum, and then deposits from one to as many as fifty eggs.

Each female lays a total of two to five hundred eggs during spring. The adult crawls during the day at elevated temperatures but it can not fly due to its small hind wings.

The eggs hatch in six under 20°C, or twenty days under 10°C respectively. The young larvae begin their feeding on the plant leaves. However the newlyhatched larvae feed first on the interior of the petioles for one-two days, then they emerge through a tiny hole in the petioles to the surface of leaves. The larval period extends from ten under 20°C to twenty days 10°C respectively.

Fully-grown larvae may spin their cocoons on the leaves of food plant. The insects remain in the pupal stage during six under 20°C, or fifteen days under 10°C respectively, then they emerge as adults.

Newly-emerged weevils feed on the leaves of Umbelliferous plants for about one month.

In Hokkaido, most of the weevils left in around food plants at the middle of August. There is probably only one generation of the insect in a year.

OVIPOSITION

Generally, the adult of Hyperinous weevil deposits the eggs on the proper food plants. For instance, *Hypera nigrirostris* prefers the red clover while

Table 1. Number of eggs laid in different plants in an assay to ascertain choice of the oviposition plant
(per one female in 10 days)

Plant combination	Plant tested	Eggs counts				Average
		1980		1981		
		dish 1	dish 2	dish 1	dish 2	
I	<i>Ligusticum scoticum</i>	121	160	91	120	123.0
	<i>Oenanthe javanica</i>	22	7	20	7	14.0
	<i>Cryptotaenia japonica</i>	11	2	7	22	10.5
	<i>Petrosoelinum crispum</i>	9	2	5	11	6.8
II	<i>Apium graveolens</i>	17	3	14	39	18.3
	<i>Daucus carota</i>	10	0	7	10	6.8
	<i>Trifolium pratense</i>	0	2	0	6	2.0
	<i>Medicago sativa</i>	9	6	4	10	7.3

H. rumicis the dock (*Rumex* spp.).

The adult of celery weevils begin oviposition in spring or early summer. Under natural habitat, the egg-laying period is about forty days, it begins at the middle ten days of May and ends during the last ten days of June. Most of eggs are located in the pith cavity of petioles.

The ovipositioning of celery weevil on various plants tested in the rearing dishes. Table 1 shows the number of eggs counted in each plant at the end of the assay.

FOOD PLANTS

Hyperinuous weevil demands its proper food plant to live. For instance, *Hypera nigrirostris*, *H. viciae*, *H. postica* and *H. punctata* feed on the foliage and buds of clover (*Trifolium* spp.), alfalfa (*Medicago* spp.) and veches (*Vicia* spp.). *Hypera rumicis* feed on the leaves of dock (*Rumex* spp.). These results are summarized in Table 2. In order to emphasize these results, we wish to draw an attention to the case of celery weevil. In Okoppe, Hokkaido, they feed exclusively on *Ligusticum scoticum* (Umbelliferae).

A brief survey of the literature data for the food plants of *Hypera adspersa* gives Umbelliferae, *Helosciadum nodiflorum* and *Crithmum mari-*

Table 2. Food plants and distribution of Hyperinae in Japan

Species	Distribution	Food plants	Preference
<i>Hypera nigrirostris</i>	Hokkaido	<i>Trifolium</i> spp.	##
	Honsyu	<i>Glycine</i> spp.	++
	Kyusyu	<i>Medicago</i> spp.	+
<i>Hypera viciae</i>	Hokkaido	<i>Vicia</i> spp.	##
		<i>Trifolium</i> spp.	+
<i>Hypera basaris</i>	Hok. Hon.	<i>Starwort</i> spp.	##
	Kyu. Sik.	<i>Mulachium</i> spp.	++
<i>Hypera punctata</i>	Yokohama	<i>Trifolium</i> spp.	##
<i>Hypera postica</i>	(America)	<i>Medicago</i> spp.	##
	(Europe)	<i>Trifolium</i> spp.	++
<i>Hypera rumicis</i>	Hokkaido	<i>Rumex</i> spp.	##
		<i>Fagopyrum</i> spp.	++
<i>Hypera adspersa</i>	Hokkaido	<i>Ligusticum</i> spp.	##
		<i>Oenanth</i> e spp.	++
		<i>Cryptotaenia</i> spp.	++
		<i>Trifolium</i> spp.	+

Table 3. Results of larvae feeding on various plant species obtained by an assay involving rearing dishes

Plants combination	Plants tested	Degree of feeding			
		1980		1981	
		dish 1	dish 2	dish 1	dish 2
I	<i>Ligusticum scoticum</i>	##	##	##	##
	<i>Oenanthe javanica</i>	++	+	++	++
	<i>Cryptotaenia japonica</i>	+	++	+	++
	<i>Petroselinum crispum</i>	+	++	+	++
II	<i>Apium graveolens</i>	+	+	+	+
	<i>Daucus carota</i>	-	+	+	-
	<i>Trifolium pratense</i>	+	-	+	+
	<i>Medicago sativa</i>	+	+	+	-

Legend; ## numerous feeding marks, ++ slight feeding marks, + only a few feeding marks, - no feeding marks.

timum,²⁾ and alfalfa in Europe and Russia as cited by Vassiliv.⁸⁾

Our results of feeding weevils on various plants are tabulated below (with the degree of feeding as rated in Table 3).

<i>Ligusticum scoticum</i>	##	<i>Daucus carota</i>	+
<i>Oenanthe javanica</i>	++	<i>Trifolium pratense</i>	+
<i>Cryptotaenia japonica</i>	++	<i>Medicago sativa</i>	+
<i>Petroselinum crispum</i>	++	<i>Apium graveolens</i>	+

Based on these experiments, it can be concluded that allowing the larvae a choice between Umbelliferous plants and other plants of the Leguminous grasses, they clearly prefer *Ligusticum scoticum*. However feeding on other Umbelliferous plants is not negligible. In stone parsley (*Cryptotaenia japonica*) and Japanese parsley (*Oenanthe javanica*) slight feeding marks appear. But when there is a lack of food, the larvae used these plants also to a considerable extent.

In the field, apart from being seen on *Ligusticum scoticum*, larvae can not be found on other plants. However, a fair chance exists that this weevil will attack to Leguminous grasses.

Acknowledgement

The authors wish to express their appreciation to Dr. Morimoto for weevil systematic identification and to Messrs S. Inoue and M. Kimura, College graduates, class 1980, for their co-operate in the project.

Summary

In 1980, the authors established the presence of celery weevil (*Hypera adspersa* var. *alternans*) in Hokkaido, Japan. This weevil in the past was known as a pest of celery crops in Europe and one rare example reported that it also attacked alfalfa in Russia.

The species of Hyperinuous weevil in Japan are distinguished by its scale form on elytra. In the case of celery weevil, the lobation extent on the scale is of the smallest degree, and additionally there are some small notches present within the lobation. The hind wings of these weevils are very small. Due to this fact it is almost impossible for the weevils to fly and to distribute to a wide zone.

The weevil generally winters only in the adult stage. In spring, the weevils begin to oviposit. Egg-laying period lasts about forty days, with one female laying two to five hundred eggs. Incubation period is six days at 20°C. The larvae feed on Umbelliferous plants for ten days at 20°C. The pupal stage lasts six days.

In Hokkaido, most of the weevils left food plants in the middle ten days of August. There is probably only one generation of the insects in a year.

References

- 1) Fabricius, J., 1792. *Curculio adspersus* Fabricius. Ent. Syst., 1: 413.
- 2) Hoffmann, A., 1954. Coléopterés Curculionides. Fauna de France, 59: 550-595.
- 3) Morimoto, K., 1962. Preliminary check list of the families Curculionidae (2) and Rhynchophoridae of Japan. Sci. Bull. Agri. Kyushu Univ., 19: 341-368.
- 4) Nawa, I., 1905. Notes on Madarazomushi. The Insect World, 32: 188-191.
- 5) Sakamoto, Y., 1971. Notes on Japanese Species of the Genus *Hypera* Injurious to Leguminous Pastures. Ann. Rept. Plant Prot. North Japan, 22: 1-8.
- 6) Sakamoto, Y., 1980. Ecological Studies of Clover Weevils. J. Coll. Dairying, 8: 113-246.
- 7) Stephens, C., 1831. Var. *alternans* Stephens. Brit. Ent. Mandib., 4: 95.
- 8) Vassiliev, M., 1913. List of pests of Lucerne. Ent. Exp. st. of the All-Russ. Soc. of Sugar Refiners in Smiela, 16: 8.
- 9) Watanabe, N., 1979. Occurrence of the Clover Leaf Weevil, *Hypera punctata* (F.) in Japan. Jap. J. Appl. Ent. Zool. 14: 494-495.

要 約

1980年、北海道で *Hypera adspersa* var. *alternans* が発生した。この虫はセリ科作物やアルファルファの害虫として古い記録がある。

日本における *Hypera* 属の種は鱗片の先端にある切れ込みの形状によって識別される。本種の場合、二裂の切れ込みは極めて浅く、その内側に細かい刻み目がある。また本種の後翅は極めて小さく、そのために飛翔することはない。

本種は成虫で越冬し、春から夏にかけて産卵する。幼虫成虫共にセリ科作物を食害するが実験室内ではセリ科の他にマメ科の植物をも食う。年一回発生。

Explanation of Plate

- 1 Adult of *Hypera adspersa* var. *alternans* ($\times 10$)
- 2 Variation of figured elytron ($\times 15$)
- 3 Scanning electron micrograph of scale ($\times 500$)
- 4 O-type marks made by larvae
- 5 Eggs ($\times 10$)
- 6 Larvae ($\times 2$)
- 7 Cocoon ($\times 2$)
- 8 Pupae ($\times 2$)

