# OUTLINE OF THE LIFE-HISTORY OF A SAWFLY, *PAMPHILIUS VIRIDITIBIALIS* TAKEUCHI

## (Studies on Symphyta V)

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Previously we described a short note of the sawfly, *Pamphilius viriditibialis* TAKEUCHI (1930), in the paper as to the life-history of *P. lucidus* ROHWER. Though this species is belonging to the same subgenus *Onycholyda* as *P. lucidus*, it has many different habits in oviposition and nest-building. This paper deals with the results of the observations on the sawfly during 1954-1956 at Sasayama. The observations were done mainly by the junior author under the direction of the senior author.

Before going further we wish to express our heartiest thanks to Dr. K. IWATA for his kind advice.

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### The Adult

PARTHENOGENESIS—The sawfly is a facultative prthenogenetic species and unfertilized eggs develop only to males as mentioned below.

Early in July, 1954, several larvae were collected, from which the adults emerged on May 14~16, 1955. Those females laid their eggs on the leaves of the food-plant in the cage without mating. Ten males emerged on May 11~26, 1956, from ten of those eggs.

APPEARANCE—The sawfly has a generation a year. The adults appear early in June to early in July at Sasayama in the field, while the emergence occures in middle of May in captivity. The most abundunt period of the adult may be late in June. Sex ratio may be 1:1, judging from 6 males and 5 females collected on July 7, 1956.

LONGEVITY—The adults were kept in the cage after their emergence without food in 1955 and 1956, and the female was able to live about 2 weeks while the male about 6 days as shown in Table 1.

**Table 1.** Longevity of adult

a) The adults emerged on May 14~16, 1955.

| | Longevity (days) | | Longevity (days) |
|---|---|---|---|
| Male | 7<br>5<br>6<br>5 | Female | 14<br>16<br>10<br>12<br>18 |
| Mean | 5.8 | Mean | 14 |

b) Ten males emerged on May 11~26, 1956.

| | Longevity (days) |
|---|---|
| Min. | 3 |
| Max. | 8 |
| Mean | 5.8 |

HABITS—

**General habits:** General habits of this sawfly is quite similar to *P. lucidus*. The most active hours are from 11 to 14 o'clock, although they are active from 9 to 16. When it is past 15, the females stop their flights, but the males are still active.

**Oviposition habits:** The plant on which the females laid their eggs was only one species, *Rubus crataegifolius* BUNGE in the field.

Usually oviposition takes place at 10~14. The females select the young leaves of the current year's shoots for oviposition, which *P. lucidus* has never chosen. As soon as the female alights on the young leaf, she goes round to the under side of the leaf with her antennae vibrating continually, and begins to seek for the suitable portion for oviposition by moving towards the tip along the vein. When the female gets the suitable portion, she lays her first egg on the vein in several second and moves ahead in a short distance and lays her second egg attaching to the first one. In this way the female makes an egg-group consisted of several eggs, but sometimes she stops oviposition after laying only one egg or lays her eggs with some distance (Photo. 1). Eighteen eggs out of 1189 eggs were abnormally deposited as shown in Table 2.

The egg-location on the leaves seems to be related to the widths of the veins, which are about 0.4~0.5 mm as shown in Table 3.

The heights of oviposited leaves, though varying with the heights of the shrubs, are usually about 100 cm above the ground. In Table 4, the numbers of oviposited leaves of various heights and the numbers of eggs per leaf and per egg-group are shown as for 14 stubs and 1171 eggs, and in Table 5 the same data in laboratory are shown.

The new virgin females were made to lay their eggs on the host-plant in the cage for the purpose of observation of egg-laying capacity. The results are recorded in Table 6. From this table it will be seen that the total number of eggs in ovary are about 40 and oviposition period is about 4 days.

**Table 2.** Abnormal egg location on the plant afield, 1956.

| Part | Under side of inter-veinal part | Upper side of leaf | Stem | In a pile | Leaf-edge | Total |
|---|---|---|---|---|---|---|
| No. eggs | 16 | 4 | 3 | 4 | 1 | 18 |

**Table 3.** Number of eggs on various widths of veins.

| Width of vein | Field(1956) | Laboratory (1955) | Total |
|---|---|---|---|
| 0.20 mm | 0 | 2 | 2 |
| 0.24 | 5 | 1 | 6 |
| 0.28 | 5 | 4 | 9 |
| 0.32 | 14 | 3 | 17 |
| 0.36 | 26 | 6 | 32 |
| 0.40 | 47 | 18 | 65 |
| 0.44 | 53 | 15 | 68 |
| 0.48 | 53 | 16 | 69 |
| 0.52 | 26 | 5 | 31 |
| 0.56 | 23 | 7 | 30 |
| 0.60 | 18 | 4 | 22 |
| 0.64 | 11 | 2 | 13 |
| 0.68 | 6 | 3 | 9 |
| 0.72 | 5 | 2 | 7 |
| 0.76 | 4 | 1 | 5 |
| 0.80 | 5 | 0 | 5 |
| 0.84 | 2 | 1 | 3 |
| 0.88 | 1 | 0 | 1 |
| 0.92 | 1 | 0 | 1 |
| 1.20 | 1 | 0 | 1 |
| 1.32 | 1 | 0 | 1 |
| Total | 307 | 90 | 397 |

**Table 5.** Numbers of eggs per leaf and per egg-group in captivity observed in 1955.

A) Number of eggs per leaf

| No. eggs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 26 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. leaves | 2 | 0 | 1 | 5 | 3 | 1 | 0 | 2 | 1 | 2 | 1 | 1 | 19 |

B) Number of eggs per egg-group.

| No. eggs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total |
|---|---|---|---|---|---|---|---|---|---|
| No. egg-groups | 4 | 4 | 8 | 6 | 4 | 1 | 2 | 2 | 117 |

## The Egg

COLOR and SIZE—The shape of egg is cylindroid as that of *P. lucidus*. The color is milky white with glass-lustre just after oviposition, but becomes slightly paler one day after oviposition and to have a tinge of pale yellow 3 days after, and comes to the extreme point of fading 2 or 3 days before hatching.

The eggs increase in size as mentioned in the following chapter. Table 7 shows the size of eggs. Judging from this table, the eggs in the field larger than those of captivity and the sexal differentiation may be recognizable even in egg-period, i. e. the male eggs seems to be smaller than female.

DEVELOPMENT—In 1955 the development of the eggs was observed in the same way to the case of *P. lucidus*. Twenty-three eggs were kept on observation and 4 out of them did not hatch.

The average incubation period was 10.23 days in May, 1955, as shown in Table 8, but it may be shorten by higher temperature.

**Tabel 6.** Egg-laying period and the number of deposited eggs, 1955.

| | Date | Temp. at 17 (°C) | Rearing examples 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|---|---|
| Number of deposited eggs | V 14 | 19 | e | e | | | | |
| | 15 | 18 | 0 | 0 | e | e | | |
| | 16 | 19 | 5 | 13 | 0 | 0 | e | |
| | 17 | 20 | 0 | 8 | 0 | 10 | 0 | |
| | 18 | 20 | 9 | 0 | 10 | 0 | 0 | |
| | 19 | 17 | 5 | 0 | 4 | 5 | 16 | |
| | 20 | 18 | 8 | 5 | 0 | 4 | 10 | |
| | 21 | 21 | 0 | 0 | 0 | 0 | 8 | |
| | 22 | 24 | 0 | 0 | 0 | 0 | 0 | |
| | 23 | 21 | 0 | 0 | 0 | 0 | 0 | |
| | 24 | 23 | 0 | 0 | 0 | 0 | 0 | |
| | 25 | 21 | 0 | 0 | 0 | 0 | 0 | |
| | 26 | 19 | 0 | 0 | 0 | 0 | 0 | |
| | 27 | 20 | 0 | 0 | d | 0 | 0 | |
| | 28 | 19 | d | 0 | | 0 | 0 | |
| | 29 | 21 | | 0 | | d | 0 | |
| | 30 | 20 | | 0 | | | 0 | |
| | 31 | 21 | | 0 | | | 0 | |
| | VI 1 | 21 | | d | | | d | |
| Oviposition period (days) | | | 5 | 5 | 2 | 4 | 3 | 3.5 |
| No. deposited eggs | | | 27 | 26 | 14 | 19 | 34 | 24 |
| No. eggs in ovary | Mat. | | 12 | 3 | 24 | 19 | 9 | |
| | Inm. | | 2 | 1 | 6 | 0 | 3 | |
| Total number of eggs | | | 41 | 30 | 44 | 38 | 46 | 39.8 |

e: date of emergence, d: date of death.

**Table 4.** Oviposited leaves of various heights with numbers of eggs per leaf and per egg-group.
(Field observation in 1956, 14 stubs convined)

| Height (cm) | No. oviposited leaves | Number of eggs per leaf | | | | | | | | | | | | | | | | | | | | | | | | No. total eggs | Number of eggs per egg-group | | | | | | | | | | No. total egg-grous |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 26 | 36 | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 30 | 4 | | 1 | | | 1 | | | 1 | | | | | | | | | | | 1 | | | | | | | 34 | | 2 | 2 | 3 | 1 | | 1 | | | | 9 |
| 40 | 3 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | 6 | 2 | 2 | | | | | | | | | 4 |
| 50 | 7 | | 1 | 1 | 1 | | | | 2 | 1 | 1 | | | | | | | | | | | | | | | | 44 | 9 | 2 | 2 | 2 | 2 | | 1 | | | | 18 |
| 60 | 8 | | | 2 | | | 1 | 2 | | | 1 | | | | | 1 | | | | | | | | | | | 51 | | 3 | 5 | 3 | | 3 | | | | | | 14 |
| 70 | 10 | | | 4 | 1 | 1 | 3 | | | | | | | | | | | | 1 | | | | | | | | 57 | 2 | 4 | 3 | 5 | 2 | | | 1 | | | 17 |
| 80 | 5 | | | 1 | 2 | | 1 | | | | | | | | | | | | 1 | | | | | | 1 | | 61 | 1 | 2 | 2 | 5 | 2 | 2 | | 1 | | | 15 |
| 90 | 10 | | 2 | 1 | 3 | 2 | | 2 | | | 1 | | | | | | | | | | | 1 | | | | | 74 | 8 | 8 | 7 | 2 | 1 | | 1 | | 1 | | 28 |
| 100 | 15 | 3 | 2 | 1 | 1 | | 1 | | | 2 | | | | 1 | 1 | | 1 | | 1 | | | | | | | | 99 | 14 | 5 | 2 | 3 | 4 | 1 | 2 | 1 | 1 | | 33 |
| 110 | 17 | 2 | 3 | 3 | 1 | 1 | 1 | | | 2 | | 1 | | | | 1 | 1 | 1 | | | | | | | | | 109 | 14 | 7 | 6 | 3 | 3 | 2 | 2 | | | 1 | 38 |
| 120 | 15 | | | 6 | | | 1 | | | | 1 | 1 | 2 | | 1 | | | | | | 1 | 1 | | | | | 124 | 10 | 11 | 3 | 3 | 2 | 4 | 3 | 2 | | | 38 |
| 130 | 12 | 1 | 1 | 2 | | 2 | | 2 | 2 | 1 | 1 | | | | | | | | | | 1 | | | | | | 68 | 4 | 1 | 4 | 3 | 3 | | 3 | | | | 18 |
| 140 | 10 | | 1 | | 1 | 1 | 2 | | 1 | 1 | | 1 | | | | 1 | | | | | 1 | | | | | | 86 | 8 | 4 | 4 | 6 | 2 | 4 | | | | | 28 |
| 150 | 9 | | | | | 2 | 2 | 1 | | 2 | 1 | | 1 | | | | | | | 1 | | | | | | | 88 | 3 | 8 | 5 | 5 | 1 | 2 | 1 | | | 1 | 26 |
| 160 | 3 | | | | 1 | | | | | | | | | | | | 1 | | | | | | 1 | | | | 42 | | 1 | 3 | 2 | 2 | 1 | 1 | | | | 10 |
| 170 | 6 | 1 | | | 1 | | | 1 | | | | 1 | | | | 1 | | | | | | 1 | | | | | 59 | 6 | 3 | 4 | 1 | 5 | 1 | | | | | 20 |
| 180 | 5 | | | | 1 | | 1 | 1 | | | | | 1 | | | | | | | | | | | 1 | | 1 | 88 | 7 | 3 | 3 | 4 | 3 | 1 | 3 | 1 | | | 25 |
| 190 | 5 | | | | 1 | | 1 | | | 1 | | | | | | | 1 | | | | | | | | 1 | | 61 | 5 | 2 | 4 | 2 | 3 | | | 1 | 1 | | 18 |
| 200 | 2 | | | | | | 1 | | | | | | | | 1 | | | | | | | | | | | | 20 | 4 | 1 | | 1 | 2 | | | | | | 8 |
| Total | 146 | 8 | 12 | 21 | 14 | 10 | 15 | 9 | 6 | 10 | 6 | 4 | 4 | 1 | 3 | 4 | 4 | 1 | 3 | 2 | 2 | 3 | 1 | 6 | 2 | 1 | 1171 | 97 | 69 | 59 | 53 | 38 | 21 | 18 | 7 | 3 | 2 | 367 |

The average increase ratio of the egg per about 24 hours is shown in Table 9, though the difference of the incubation period causes a little disagreement in the ratio as shown in Fig. 1. From this table it will be seen that the largest increase ratio occures 4~5 days after oviposition as that of *P. lucidus*. The difference between the widths of caudal and cephalic portion was measured as about 0.03 mm one day before hatching.

The formulae of increase ratio are as follows:

Length $\cdots Y = 0.3390 \log X + 0.8988$

Width $\cdots Y = 0.6279 \log X + 0.8311$

$Y$—increase ratio, $X$—days after ovipcsition.

HATCHING—About 20 hours before hatching the eyes of embryo becomes visible through the egg shell. The movement of the embryo and hatching is quite similar to *P. lucidus*, but the total amount of the time for hatching is longer, i. e. it is about 2.5 hours. The death of hatching larva was observed occasionally.

### The Larva

DESCRIPTION (Fig. 2)—The details of each instar will be described the other day. The brief description of the last instar larva is as follows:

About 25 mm long, male larva smaller than female.

Head black with preclypeus pale brown, body greenish with following parts black: margins of cervical sclerites, a large dorsal patch and a pair of pleural patches of prothorax, a pair of small patches on subdorsal parts of 1st annulet of mesothorax, margins of each thoracic surpedal lobe, proximal parts of each coxa, 3 patches on epiproct and 10 th abdominal sternite.

Head almost polished, slightly reticulate, setigerous; setae on gena long, but on vertex short. Relative lengths of the antennal segments about 8:10 :10:6:9:5:8. Frons pentagonal in outline, with few setae, and about 9/10 as high as broad. Clypeus with 3 setae on each side. Labrum with 8 setae on each side, slightly depressed longitudinally, and apical margin slightly emarginate at middle. Frons: clypeus: labrum about 5:2:2. Prothorax with 2, mesothorax~8 th abdominal segment each with 4, 9 th abdominal segment with 3 annulets on dorsal and ventral aspects. Body almost without setae; prothoracic patches and caudal segment setigerous. Fleshy protuberance of 8 th abdominal segment distinct. Epiproct with V-shaped carina, which divides the colored patch into 3 parts. Relative lengths of the segments of subanal appendage about 8:3:5; basal segment with several setae and others without

**Table 7.** Measurement of eggs. (mm)

| | Just after oviposition | | One day before hatching | | | |
|---|---|---|---|---|---|---|
| | | | Unfertilized (Lab., 1955) | | Wild (1956) | |
| | Width | Length | Width | Length | Width | Length |
| Min. | 0.50 | 1.28 | 0.66 | 1.56 | 0.72 | 1.69 |
| Max. | 0.56 | 1.41 | 0.75 | 1.78 | 0.89 | 2.11 |
| S.D. | 0.016 | 0.039 | 0.095 | 0.039 | — | — |
| $r_{(W.L)}$ | −0.20 | | +0.17 | | — | — |

**Table 8.** Incubation period, 1955.

| Incubation period (days) | 10 | 11 | Total | Mean |
|---|---|---|---|---|
| No. eggs | 13 | 6 | 19 | 10.23 |

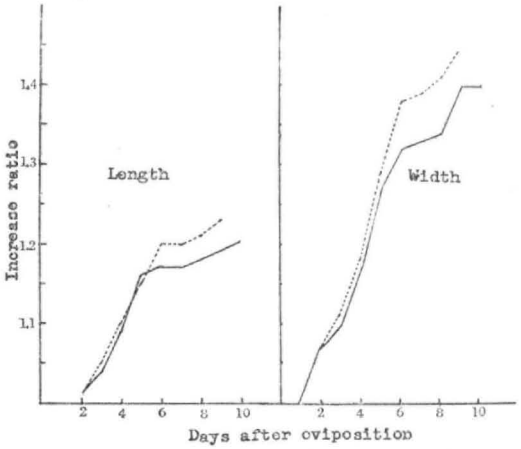


**Fig. 1** Growth curves of eggs, showing differences between different incubation periods.
Dotted line: 10 days incubation period,
Soild line: 11 days.

**Table 9.** Increase ratio of eggs, 1955.

| No. measured eggs | | 1 3 | | | | | | | | | | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days after oviposition | | Just after | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Increase ratio | Length | 1.00 | 1.00 | 1.01 | 1.04 | 1.10 | 1.15 | 1.19 | 1.19 | 1.20 | 1.22 | 1.20 |
| | Width | 1.00 | 1.00 | 1.07 | 1.11 | 1.18 | 1.28 | 1.36 | 1.37 | 1.39 | 1.44 | 1.40 |
| Length/Width | | 2.70 | 2.70 | 2.54 | 2.52 | 2.51 | 2.33 | 2.33 | 2.33 | 2.33 | 2.29 | 2.28 |

**Table 10.** Duration of larval stadia.

| Date of observation | May, 1955 | | | | | July, 1956 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex | Male | | | | | Male | | | | | Female | | | | | |
| Instar / Duration | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th | 1st | 2nd | 3rd | 4th | 5th | 6th |
| 5 days | | | | | | | | | | 2 | | | | | | 1 |
| 4 | 11 | 10 | 2 | | 1 | | | 1 | | | | | | | | 1 |
| 3 | 5 | 6 | 10 | 6 | 7 | 4 | | 3 | 1 | 2 | 5 | | 1 | | 5 | 4 |
| 2 | | | 4 | 10 | 8 | 3 | 5 | 4 | 7 | 4 | 7 | 6 | 7 | 8 | 3 | 5 |
| 1 | | | | | | 1 | 3 | | | | | 6 | 4 | 4 | 2 | 1 |
| Average of duration | 3.7 | 3.6 | 2.9 | 2.4 | 2.5 | 2.4 | 1.6 | 2.6 | 2.1 | 3.0 | 2.4 | 1.5 | 1.8 | 1.7 | 2.6 | 2.7 |
| No. examined specimens | 16 | | | | | 8 | | | | | 12 | | | | | |

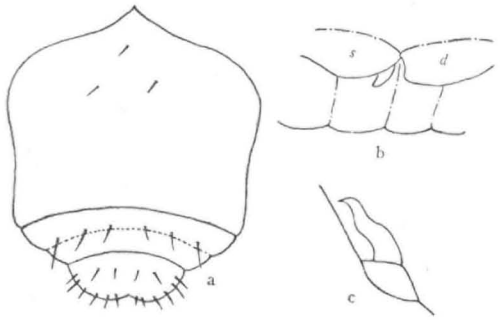


**Fig. 2** a: frons with clypeus and labrum, b: 8 th abdominal segment in ventro-lateral aspect, *s*: subspiracular lobe, *d*: surpedal lobe, c: median subanal precess of caudal segment in lateral aspect. (Last instar larva)

seta. Median subanal process in Fig. 2.

DEVELOPMENT—The development of the larvae was observed during May 26~June 23, 1955, and July 9~24, 1956, in laboratory. The temperatures at 10 a. m. were 25°C in max., 19°C in min. and 21.5°C in average in 1955, and 29°C in max., 22°C in min. and 26.6°C in average in 1956.

The larvae have usually 4 moults in male and 5 moults in female, but only one example with 6 moults was observed in 1956. The duration of each instar and the total larval period are shown in Table 10 and 11 respectively. From these tables it will be seen that the temperature and sexuality have influence on the duration of larval stadia.

The head widths of the alcoholic specimens of each instar larvae were measured with ocular micrometer. The results are recorded in Table 12 and Fig. 3, from which it will be seen that the standerd deviations of the older instars are larger than those of the younger.

HABITS—The movement of the hatching larva is quite similar to *P. lucidus*,but the larva of this species seems to have a gregarious habit. (Photo. 2~6)

As the eggs are attached to each other,the small

**Table 11.** Larval period.

| Larval period (days) | 16 | 15 | 14 | 13 | 12 | 11 | Total no. examined | Average |
|---|---|---|---|---|---|---|---|---|
| May, 1955 | 5 | 8 | 3 | | | | 16 | 15.1 |
| July, 1956 ♂ | | | | 3 | 2 | 3 | 8 | 12.0 |
| July, 1956 ♀ | | 1 | 1 | 4 | 1 | 12 | 20 | 12.6 |

leaf-rolls of the first instar larvae, made of only some serrations of the leaf, are situated very close by. The rolls become to be united together, as each larva enlarges its nest, and all the larvae become to live in a single large leaf-roll. Sometimes when the leaf has already been rolled by a larva, the new hatching larva goes into the roll and becomes to live in the same nest with the former one. As the migration activity of the older larvae is larger than that of the younger, the larvae older than the 3 rd instar come often into the nest of the younger instars.

Though the nest is built with a leaf in early period, later the nests become to be consisted of same leaves and many larvae are living in a large single nest. The number of the larvae per nest are usually 2~6 as shown in Table 13. Some examples of the instars of the larvae living in a single nest are recorded in Table 14.

When the larvae grow older and the leaves decrease in number, the larvae make a thread-tannel upon the plant, by means of which they can migrate gregariously to the lower parts of the plant. On the way of migration, the full-grown larvae fall down to the ground and burrow into the soil. But sometimes a solitary larva coming down by its thread-bridge was observed.

FOOD-PLANT—The larvae and eggs were found only on *Rubus crataegifolius* BUNGE in the field.

### The Pupa

The pupal chamber and prepupa are quite similar to *P. lucidus*. The size of pupal chamber is about 1.2~1.4 cm long by about 0.6~0.8 cm broad.

Two hundred and sixty-eight full-grown larvae reared in laboratory were made to burrow in a certain limited space of the garden soil on July 20, 1956 and only 46 of them were found in prepupal form when dug out and made thorough examination on August 26. This reduction of individual number may be due to the attacking of their natural enemies, as several larvae of May-beetles and

**Table 12.** Head-widths of each instar larva.

| Date of observation | Instar | Min. | Max. | M. | S.D. | Growth ratio | No. measured specimens |
|---|---|---|---|---|---|---|---|
| July, 1956 | 1st | 0.59 | 0.83 | 0.69 | 0.062 | | 89 |
| | 2nd | 0.79 | 1.03 | 0.89 | 0.036 | 1.290 | 57 |
| | 3rd | 0.97 | 1.41 | 1.17 | 0.303 | 1.315 | 128 |
| | 4th | 1.31 | 1.76 | 1.52 | 0.381 | 1.299 | 103 |
| | 5th | 1.72 | 2.34 | 1.94 | 0.568 | 1.276 | 97 |
| | 6th | 1.93 | 2.63 | 2.22 | 0.574 | 1.144 | 83 |
| May, 1955 | 1st | 0.52 | 0.69 | 0.62 | 0.031 | | 29 |
| | 2nd | 0.72 | 0.90 | 0.79 | 0.041 | 1.276 | 23 |
| | 3rd | 0.97 | 1.28 | 1.16 | 0.079 | 1.468 | 39 |
| | 4th | 1.31 | 1.66 | 1.46 | 0.083 | 1.259 | 58 |
| | 5th | 1.66 | 2.24 | 1.88 | 0.118 | 1.281 | 53 |

**Table 13.** Number of the larvae per nest, 1956.

| Date of observation \ No. larvae per nest | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | Total no. nest | Total no. larvae |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VII 8 | 3 | 5 (1) | 1 | 1 (1) | | | | | | | | | | | 10 (2) | 20 |
| 9 | | 2 | 1 | 1 (1) | 1 (1) | 1 (1) | | | | | | | | | 6 (3) | 22 |
| 10 | 4 | | 6 (3) | 2 (2) | 5 | 1 (1) | 3 (3) | 1 (1) | | | | | | | 22 (10) | 90 |
| 12 | | 1 (1) | | | | | | 1 (1) | 1 (1) | | | | | | 3 (3) | 19 |
| 13 | 1 | 1 (1) | 1 (1) | 1 (1) | 1 (1) | | | 1 (1) | 1 (1) | 1 (1) | | | | | 8 (7) | 42 |
| 15 | 2 | 7 (2) | 6 (2) | 4 (3) | 2 (2) | 2 (2) | 2 (1) | 1 (1) | | 1 (1) | 1 (1) | 1 (1) | 1 (1) | 1 (1) | 31 (18) | 157 |
| 16 | 2 | 1 | 2 (1) | | 2 (2) | | 2 (2) | | | | | | | | 9 (5) | 34 |
| Total | 12 | 17 (5) | 17 (7) | 9 (8) | 11 (6) | 4 (4) | 7 (7) | 4 (4) | 2 (2) | 2 (2) | 1 (1) | 1 (1) | 1 (1) | 1 (1) | 89 (48) | 384 |

Parenthesized number means the number of the nest, in which different instar larvae live together, out of the total.

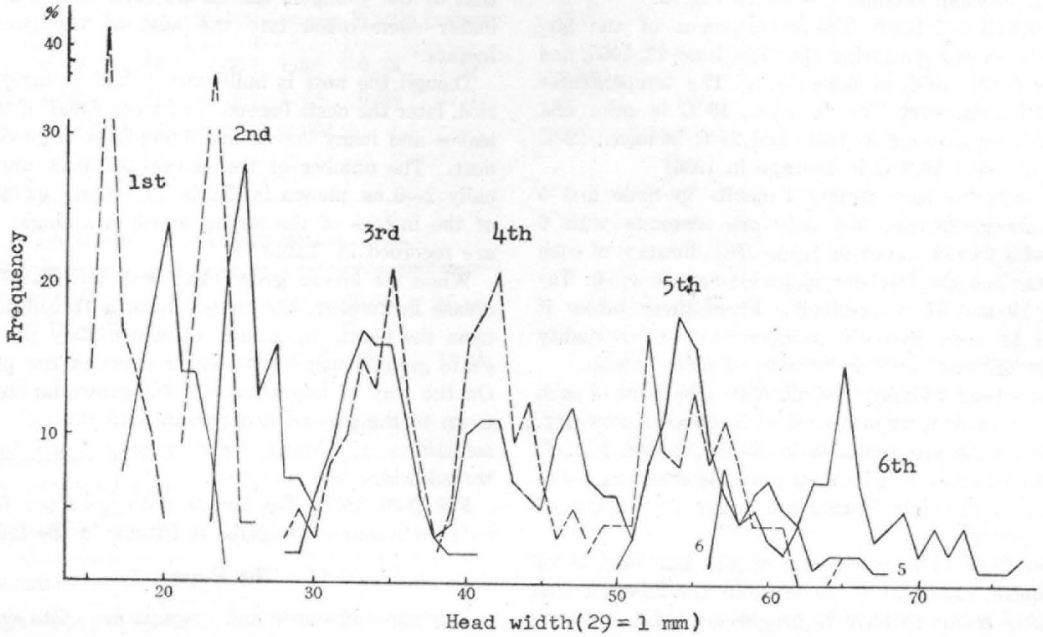


**Fig. 3** Frequency distributions of the head-width of each instar. Dotted line: Observation in 1955, Solid line: in 1956. (Number of each instar larvae similar to Table 12.)

**Table 14.** Number of each instar larvae in a nest.
(Showing 8 examples from Table 13)

| Date of observation \ Instar | 1st | 2nd | 3rd | 4th | last | Total no. larvae |
|---|---|---|---|---|---|---|
| VII 8 | 1 | 1 | | | | 2 |
| 9 | 1 | 1 | 3 | | | 5 |
| 10 | 1 | | 3 | | | 4 |
| 12 | 3 | | 1 | 4 | | 8 |
| 13 | 1 | 5 | 2 | 1 | | 9 |
| 13 | 4 | | | | 1 | 5 |
| 15 | | 2 | 5 | 4 | 2 | 13 |
| 16 | | | 1 | 3 | 3 | 7 |

**Table 15.** Location of pupal chamber in the ground, 1956.

| Depth of surface soil (cm) \ Depth (cm) | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Total no. examined | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 3 | | 4 | 6 | 2 | | | | | | | 15 | 7.3 |
| 20 | 1 | | | 1 | 3 | 1 | 2 | 4 | 8 | 6 | 5 | 31 | 12.4 |

**Table 16.** Pupal period, 1956.

| Pupal period (days) | 7 | 8 | 9 | 10 | 11 | Total | Average |
|---|---|---|---|---|---|---|---|
| No. examined | 2 | 3 | 3 | 1 | 1 | 10 | 8.6 days |

Carabid-larvae were found together with them. The locations of them were in the depth of 5~15 cm as shown in Table 15, while some larvae burrow to the depth of 30 cm in glass-cage of 35 cm depth. From this fact it is considered that the location of pupal chambers in the ground may vary with the soil conditions.

Pupal stage is very short, 8.6 days in average before emergence as shown in Table 16.

The size of the pupa is rather larger than that of adult.

The color of the pupa is greenish white just after pupation, and the eyes become to be colored 4~5 days before emergence. Continuouslly the dorsal parts of thorax become changing color to black and one day before emergence, the whole body finished to change color to black.

The adults stay for 2 or 3 days in pupal chamber after emergence.

### The Natural Enemy

The parasites have never been found in all stages. An ant (species unknown) was observed attacking the eggs and it prefered the developed eggs.

### Summary

The present paper contains the observations on the life-history and habits of *Pamphilius viriditibialis* TAKEUCHI (1930), which are very similar to *P. lucidus* but the following points are different from it.

A) The life on the earth is from June to July.
B) The eggs usually laid continuouslly on the veins of the under sides of the leaves.
C) The larvae have 5 instars in male and 6 instars in female.
D) The larvae live gregariously in a large nest of rolled leaves.
E) The food-plant is only *Rubus crataegifolius* BUNGE.

In addition to these data the general biology is described.

(Entomological Laboratory,
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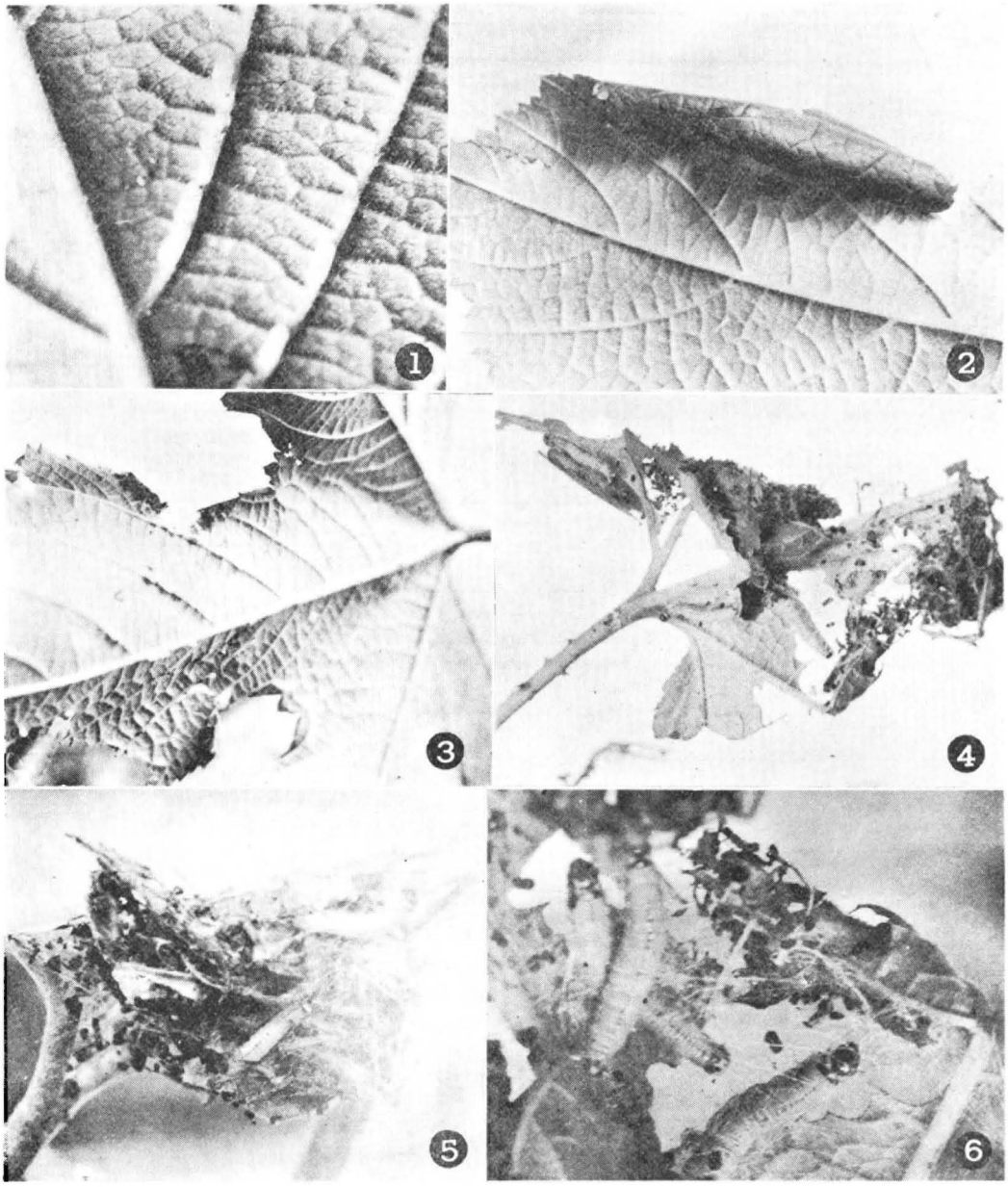


Explanations of photographs

1. Eggs on the veins of the leaf. 2. Leaf-rolls attaching to each other of 2 nd instar. 3. Leaf with eggs and early period nest. 4. Nest of a leaf, 3 rd and 4 th instars larvae. 5. Large nest almost eaten up the leaves. 6. Gregarious larvae of 5 th instar.