

Further Notes On The Rush Saw-Fly,
Tomostethus Juncivorus Rohwer.*

By

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I. The Rush Saw-Fly in Hyôgo Prefecture.

In a previous paper¹⁾ on the rush saw-fly the writer stated that a species of saw-fly which is presumably the same as *Tomostethus juncivorus* ROHWER is found also in Hôygo Prefecture. Later one of the writer's assistants, S. KONDO, secured, in Kasai-gun, Hyôgo Prefecture, the specimens of the saw-fly in question as well as its larvae.

Examination of the specimens of this saw-fly has shown that it could not be distinguished morphologically from *Tomostethus juncivorus* ROHWER which is found in Okayama Prefecture.

However, it is interesting to note that the seasonal life-cycle of the Hyôgo race (if such a usage of the term "race" be allowed) seems to differ from that of the Okayama race if we judge from the description made by WATANABÉ²⁾ as well as from the results of observation made by the writer's assistant.

The species described by WATANABÉ as "*kuromuné-ihabachi*" seems to be identical with *Tomostethus juncivorus* although there are a few differences of little importance between the description made by WATANABÉ and *Tomostethus juncivorus* in Okayama Prefecture.

The chief features of the seasonal life-cycle of the Hy go race as described by WATANABÉ is briefly as follows:

Kuromuné-ihabachi appears three times a year. The adult insects from the pupae which overwintered in the larval stage begin to emerge towards the middle of April, the number of adults that emerge reaches its maximum about the end of that month and the appearance generally comes to its end towards the middle of May. The majority of the larvae of the first generation are full-grown about the middle of June and crawl into the soil. These larvae pupate and emerge as adults from the middle of June to the middle of July, the end of June being the time of maximum abundance. Most of the second

* A slightly modified translation of the writer's paper published in "Nôgyô oyobi Yengei", vol. III, pp. 1131—1136, Oct., 1929.

generation larvae go into the soil towards the middle of July and the adults appear from the middle of August to the middle of September. The period of the maximum emergence of adults covers about one month from the end of August to the end of September. The larvae of the third generation are seen from the beginning of September till about the tenth of November.

KONDO observed in Kasai-Gun, Hyôgo Prefecture, many full-grown larvae on the first ten days of June and even adults were already seen towards the middle of June. The number of the adults increased markedly by the twenty-fifth of that month.

Judging from the result of observation made by KONDO as well as from the report by WATANABÉ, these saw-flies appearing towards the middle of June are without doubt the adults that emerged from the pupae of the first generation in this year.

The writer reported that in Okayama Prefecture the rush saw-fly usually begins to appear in the beginning of May, reaching the maximum abundance about the middle of that month. It is very rare that the rush saw-fly appears earlier than the beginning of May in Okayama Prefecture. It is evident, therefore, that in Hyôgo Prefecture the appearance of the rush saw-fly in the spring occurs from ten to fourteen days earlier than in Okayama Prefecture.

II. The Behavior of the Hyôgo Race When reared in Okayama Prefecture.

As has been stated in the previous chapter the rush saw-fly of Hyôgo Prefecture emerges in the spring about fourteen days earlier than the race found in Okayama Prefecture. There is another important difference in the behavior of these two races of saw-fly. In Okayama the rush saw-fly appears only twice in a year, namely, in May and September. The warmest part of the summer is past in a dormant state. In Hyôgo Prefecture the majority seem to appear three times a year, although a small portion seem to appear only twice in a year.

To what cause may these differences in behavior be due? Searching for the explanation of this problem, the writer's attention was first attracted to the climates in these two prefectures. The writer, therefore, desired to rear in Okayama Prefecture the Hyôgo race of the rush saw-fly.

In the spring of four years from 1924 to 1927 the writer's assistant collected the larvae of the first generation of the rush saw-fly in Kasai-Gun, Hyôgo Prefecture, brought them back to Kurashiki and reared in the insectary. The results of rearing were briefly as follows:

I. Larvae captured in June, 1924.

Number of larvae that span cocoons	104	}	A. Number of adults emerged in June of the same year	31
			B. Number of larvae that overwintered and transformed to adults in the spring of 1925	6+ α

II. Larvae captured in June, 1925.

Number of larvae that span cocoons.....	221+ α	}	A. Number of adults emerged in September of the same year.....	11
			B. Number of larvae that overwintered and emerged as adults in April, 1926.....	210+ α

III. Larvae captured in June, 1926.

Number of larvae that span cocoons	178	}	A. Number of adults emerged in June of the same year	66
			B. Number of adults emerged in September of the same year	13+ α
			C. Number of larvae that overwintered and emerged as adults in April, 1927	73+ α

IV. Larvae captured in June, 1927.

Number of larvae that span cocoons	375	}	A. Number of adults emerged in June of the same year.....	308
			B. Number of adults emerged in September of the same year.....	46
			C. Number of larvae that overwintered and emerged as adults in April, 1928	3

Remark: α shows the cocoons which were used for the other experiments and the exact number of which was unknown.

As will be apparent from the above table, the Hyôgo race split up into three groups when the spring brood was brought to Kurashiki and reared in the insectary, viz.:

The first group. The larvae of this group transformed to pupae without intervention of estivation and emerged as adults in June of the same year.

The second group. The larvae of this group entered estivation and transformed to pupae in September and emerged as adults in September of the same year.

The third group. The larvae which belong to this group entered estivation and remained in the dormant state until the spring of the next year.

The exact relative number of the larvae of these three groups could not be determined from the results of these rearing experiments. However, it may be stated that the number of individuals which appear as adults in September is rather small and that the majority of the spring brood either emerge as adults in June of the same year or pass the summer, autumn and winter in a dormant state and appear as adults in the next spring. Just what cause or causes induce the spring brood to enter dormancy or to pupate without estivation and to emerge in June of the same year is not yet known.

In connection with this, it is interesting to note that the second brood of the Hyôgo race which hatch out from the eggs laid in June are very difficult to rear, the majority dying away while in the young larval stage. This is not the case with the larvae which hatch out in September. These are rather easy to rear to maturity.

It has already been stated that the rush saw-fly appears three times in a year in Hyôgo Prefecture. However, it may be doubted if all the individuals are three-brooded in Hyôgo since it is a rather common occurrence among saw-flies that a part of the individuals of a generation remain in the larval stage, pass a period of another generation or even overwinter and emerge in the next spring while others pupate without entering dormancy and emerge in the same year.

The spring brood of the Hyôgo race in most cases emerged as adults in June when it was reared in Kurashiki. However, it sometimes entered dormant state (estivation) and emerged in September of the same year. The time of the appearance of the Hyôgo race in the spring was usually ten to fourteen days earlier than the Okayama race as has been already stated. Thus, the Hyôgo race is a little different in its seasonal life-cycle from the Okayama race. Whether this difference in behavior can be accounted for by the difference in climate in these two localities will be considered below.

Of several towns in Hyôgo Prefecture where the meteorological records could be obtained, Hôjô was the nearest to the place where the collection of the saw-fly in question was made. Therefore, the meteorological records in Hôjô will be compared with those of Okayama^{3), 4)}.

The figures in the following tables are the averages of the results of observations extending over a period of more than thirty years. According to the records in these tables there is very little difference between Okayama and Hyogo in regard to the mean monthly air temperature. However, in four months from March to June the mean of the daily maximum temperatures in Hojo is from 0.6° to 0.7° higher than the corresponding mean in Okayama.

Air Temperature

Month	Mean of The Daily Maximum		Mean of The Daily Minimum		Mean Monthly Air Temperature	
	Okayama	Hôjô	Okayama	Hôjô	Okayama	Hôjô
Jan.	8.5	8.5	- 0.5	- 1.2	3.6	3.7
Feb.	8.8	9.2	- 0.3	- 1.0	4.9	4.1
Mar.	12.1	12.7	2.3	1.7	7.1	7.2
April	18.2	18.8	7.7	7.2	12.9	13.2
May	22.6	23.2	12.1	11.4	27.3	17.3
June	26.0	26.7	17.4	16.9	21.5	21.8
July	29.9	30.4	22.0	22.1	25.7	26.3
Aug.	31.4	31.4	23.0	22.7	26.9	27.1
Sept.	27.3	27.8	19.1	18.8	22.9	23.3
Oct.	21.9	22.1	11.8	11.2	16.5	16.7
Nov.	16.4	16.2	5.8	4.9	10.7	10.6
Dec.	10.8	10.8	1.1	0.3	5.5	5.4

Month	Precipitation (mm)		Number of Days with Precipitation	
	Okayama	Hôjô	Okayama	Hôjô
Jan.	40.7	48.3	8	7
Feb.	47.6	58.9	9	7
Mar.	83.8	101.2	13	10
April	101.5	139.5	12	11
May	100.6	120.0	12	10
June	172.0	203.7	15	13
July	138.8	139.5	12	11
Aug.	64.7	139.0	9	8
Sept.	161.6	184.2	13	12
Oct.	101.7	118.1	10	9
Nov.	52.8	67.1	8	7
Dec.	39.3	46.3	8	6

The amount of precipitation in five months from February to June in Hôjô is about 10 to 30 mm larger than that in Okayama, while the number of days with precipitation is slightly more numerous in Okayama than in Hôjô.

That the mean of the daily maximum temperature in March to June in Hôjô is from 0.6° to 0.7° higher than in Okayama must be conducive to the breaking-up of the hibernation in the spring and also to the development of the rush saw-fly in Hyôgo, since the temperature which is important for the development of insect is not the daily mean temperature, but the hourly temperature, especially in the case where the air temperature for several hours during the day is high enough to induce the development of insect although the daily mean temperature may be so low as to be insignificant for insect development.

Experience has shown that the larvae of saw-flies would not pupate when the soil is very dry, but remain in the dormant state. It has been maintained by certain investigators that contact moisture is necessary for breaking up the dormant state^{5), 6)}. The writer has pointed out that in Hyôgo Prefecture the amount of precipitation in the spring and early summer is larger than that in Okayama Prefecture. On the contrary, the number of days with precipitation is more numerous in Okayama than in Hyôgo.

Okayama and Hyôgo are known as two of dry localities in Japan. In a dry locality small amount of precipitation would not be sufficient to moisten the lower layers of the soil when it is distributed on many days. Since in Hyôgo the amount of precipitation is larger and the number of days with precipitation is less than in Okayama, the soil in the former would contain more moisture than that in the latter.

Considering these circumstances the conditions in Hyôgo Prefecture would be more favorable for breaking up the hibernation in the early spring and also for the development of the rush saw-fly. Therefore, the fact that in Hyôgo the rush sawfly appears earlier than in Okayama seems to be accounted for, at least to some extent, by the difference in the environment. However, the influence of the environment alone is not sufficient to explain the differences in the behavior of the rush saw-fly in these two localities, for the Hyôgo race retains its habit of emerging early in the spring and a large proportion of its spring brood emerge in June of the same year even when it is reared in Okayama Prefecture.

Shall we, then, consider the rush saw-fly in Hyôgo Prefecture as a biologically different race from the one found in the Prefecture Okayama? In regard to this question the writer hopes to publish his opinion on another occasion.

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