SHORT COMMUNICATIONS

Collapse of the Outbreak of the Sugi Tussock Moth, *Dasychira argentata* BUTLER (Lepidoptera : Lymantridae)¹

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(Received November 14, 1980)

The Sugi tussock moth, *Dasychira argentata* BUTLER, is a serious pest of man-made forests in Japan. It defoliates Sugi cedar, *Cryptomeria japonica* D. DON, and Hinoki cypress, *Chamaecyparis obtusa* S. & Z., which are most widely planted in the warm and cool temperature zones. Severe defoliation is occasionally caused by its outbreak, resulting in tree mortality and growth loss (SHIBATA et. al., 1978). Since 1895, four outbreaks were recorded locally in Nara Prefecture; 1895-1896, 1902-1903, 1915 and 1964-1965. In each outbreak, the tussock moth population remained at a high level causing heavy defoliation for only one or two generations, after that the population declined abruptly.

In July, 1978, an outbreak of the tussock moth on Sugi cedar and Hinoki cypress stands was detected over approximately 200 ha in Sakurai City, Nara Prefecture (SHIBATA and NISHIGUCHI, 1980). This outbreak was characterized by it, having one clear infestation center and spreading to the neighboring stands in the next generation. However, in the summer of 1979, no larvae were observed in the outbreak area.

In this paper, population data are presented which document the natural decline in this outbreak.

The Sugi tussock moth has two generations in a year; the summer generation is from late May to early August and the overwinter generation is from mid-August to mid-May of the next year. The overwintering stage is the third or fourth instar.

Six study plots, described as follows, were set out in the Sugi cedar forests in 1978 and 1979. No chemicals were applied there in the course of the study.

IWASAKA (21 years old): the infestation center of the heaviest defoliation in the summer of 1978.

OHBARA A (21 years old), B (10 years old) and C (5 years old): the surrounding stands of less defoliation, in which the larval densities were low in the summer of 1978 but relatively high in winter. They are about 3 km out from IWASAKA.

OHBARA D (4 years old): the stand outside OHBARA A, B and C, in which the no visible defoliation was recognized.

TAKATORI (12 years old): the stand with the low larval density about 13 km from the outbreak area.

In order to estimate the larval density, the following three methods were adopted. When trees were too high and larvae were too many to count, the frass drop method (SHIBATA and NISHIGUCHI, 1980) was used. When the number of larvae was low, trees were cut down and the larvae on the crowns were counted (cut-down method). When trees were not high, larvae were counted directly (direct count method). However, at TAKATORI the larval density was not estimated.

Full-grown larvae were collected in late July, 1978 in IWASAKA and the fourth and fifth instar larvae were collected in late April, 1979 in the other study plots. Collected larvae were reared singly in glass tubes (diameter: 3 cm, length: 20 cm) under aseptic conditions in the laboratory of the Nara Forest Experiment Station. The cause of larval death was determined individually.

Seasonal fluctuations of larval densities and survival curves of the reared populations from each study plot are shown in Fig. 1.

In IWASAKA which was the outbreak center in the summer of 1978, the estimated number of full-grown larvae was 5,843,000 per hectare in late July (SHIBATA and NISHIGUCHI, 1980), but no young larvae of the next generation were found. The population decline seems to be due to the following two facts. Firstly, 40 percent of the reared larvae were infected by Nuclear Polyhedrosis Virus (NPV) and the survival rate from full-grown larvae to adults was only 20 percent (Table 1). Secondly, it was observed that the newly hatched larvae dispersed from this stand to the surrounding stands probably

¹ Appl. Ent. Zool. **16** (4) : 487-489 (1981)

Fig. 1. Seasonal fluctuations of larval density (thick lines) and survival curves or reared populations (thin lines) of the Sugi tussock moth in each study plot.

○: Frass drop method ●: Cut-down method •: Direct count method

because of a food shortage (SHIBATA and NISHIGUCHI, 1980).

In OHBARA A, B and C, though some larvae were observed in the summer of 1978, the greater part of them originated from IWASAKA through dispersal. Overwintering larvae were extinct by early July, showing the same mortality process in all three plots (Fig. 1). On the other hand, in early summer it was observed that there were many larvae infested by NPV on the twigs and the ground in these plots. Just as in the natural populations, reared larvae from the three plots all died from NPV (Table 1).

In OHBARA D, located outside of OHBARA A, B and C, the larval population was not extinct and adults appeared. Here 73.8 percent of the reared larvae from this plot matured but 4.8 percent were infected by NPV (Table 1). Thus, one of the reasons no larvae were observed in the summer of 1979 was probably this disease.

In TAKATORI, where the larval density was very low, the survival rate from larvae to adults in rearing was 81.4 percent and no larvae were infected by the disease (Table 1).

It is well known that outbreaks of forest defoliators, e.g., the Douglas-fir tussock moth,

Table 1. LIFE TABLES OF THE REARING POPULATIONS OF THE SUGI TUSsock MoTH FROM EACH STUDY PLOT

x	dF_x	IWASAKA			OHBARA A			OHBARA B		
		l_x	d_x	q_x	l_x	d_x	q_x	l_x	d_x	q_x
Larvae		50			101			61		
	NPV		20	40.0		101	100.0		61	100.0
	Other diseases		9	18.0		0	0.0		0	0.0
	Unknown		8	16.0		0	0.0		0	0.0
Pupae		13			0			0		
	Parasites		3	23.1		0	0.0		0	0.0
	Unknown		0	0.0		0	0.0		0	0.0
Adults		10			0			0		

x	dF_x	OHBARA C			OHBARA D			TAKATORI		
		l_x	d_x	q_x	l_x	d_x	q_x	l_x	d_x	q_x
Larvae		39			42			43		
	NPV		39	100.0		2	4.8		0	0.0
	Other diseases		0	0.0		0	0.0		0	0.0
	Unknown		0	0.0		7	16.7		1	2.3
Pupae		0			33			42		
	Parasites		0	0.0		2	6.1		6	14.3
	Unknown		0	0.0		0	0.0		1	2.4
Adults		0			31			35		

Orgyia pseudotsugata MCDUNNOUGH (MASON and THOMPSON, 1971), the gypsy moth, *Lymantria dispar* LINNÉ (LEONARD, 1974; HIGASHIURA and KAMIJO, 1978) and the red-belly tussock moth, *Lymantria fumida* BUTLER (KATAGIRI, 1977) are often exterminated by the natural prevalence of NPV or other diseases. In the same manner, the major cause of collapse in the outbreak population of the Sugi tussock moth appeared to be a natural epizootic of NPV in the larval stage.

I wish to express my sincere thanks to Dr. K. KATAGIRI, For. & For. Prod. Res. Inst. for the identification of the diseased larvae and Mr. K. KOBAYASHI, Kansai Branch, For. & For. Prod. Res. Inst. for his critical reading of the manuscript.

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