Considerations on the northern expansion of the summer migration range in the oleander hawk-moth *Daphnis nerii* (Linnaeus) (Lepidoptera: Sphingidae)

Michio Ohba, Naoya Wasano and Keiko Matsuda-Ohba

Institute of Biological Control, Faculty of Agriculture, Kyushu University, Fukuoka 812-8581, Japan

(Received 28 December 1998; Accepted 23 March 1999)

Abstract

Outbreaks of the oleander hawk-moth (*Daphnis nerii*), a sphingid of tropic/subtropic origins, occurred in October–December 1997 and September–December 1998 over the area of Fukuoka and Saga Prefectures. This clearly shows that the range of summer migration of *D. nerii* is expanding from southern Kyushu to the north. Our observations suggest that (1) after arrival, there were at least two generations in natural environments of northern Kyushu and (2) this lepidopteran failed to survive our winter.

Key words: Oleander hawk-moth, *Daphnis nerii*, summer migration, north-expanding distribution

INTRODUCTION

The Indian oleander, *Nerium indicum* Mill., is a popular choice in Japan as an ornamental tree for borders in gardens and public parks. Although several insect pests feed on the oleander leaf, there have been no reports on the occurrence of lepidopterans that cause serious damage to this plant in northern Kyushu.

The oleander hawk-moth, *Daphnis nerii* (L.), is a member of the family Sphingidae whose larval foodplant is the oleander. This lepidopteran is widely distributed in tropical and subtropical areas ranging from Africa to Southeast Asia and the adult is a strong flier that often migrates from Africa to Europe (Inoue et al., 1982). An outbreak of the oleander hawk-moth in the city of Fukuoka, located in northern Kyushu, was first observed in 1997 (Ohba and Ohba, 1998), and in 1998 it prevailed over wider areas of northern Kyushu. Reported herein are the results of our two-year observations on the outbreaks of this sphingid in Fukuoka and Saga Prefectures.

MATERIALS AND METHODS

During the period of October 1997–February 1998, Indian oleander trees grown in urban areas of the city of Fukuoka, Fukuoka Prefecture, were randomly examined for the occurrence of *D. nerii*. Also, urban areas of the two cities, Shimonoseki and Yamaguchi, Yamaguchi Pre-

fecture, were surveyed in February 1998.

The research areas in April–December 1998 included: (1) the entire area of the city of Fukuoka and its suburbs, (2) the cities of Saga and Karatsu, Saga Prefecture, and (3) the cities of Nogata and Iizuka, both located in the Chikuhō Region of the central part of Fukuoka Pref.

The survey involved examination of the oleander trees for the presence of (1) *D. nerii* eggs and larvae on the leaves (Fig. 1, A and B), (2) leaf damage caused by *D. nerii* larval feeding (Fig. 1C), and (3) nearby pupae and pupal shells. In particular, the results obtained in the winter seasons were mostly based on observations of larval feeding traces characteristic of this lepidopteran.

RESULTS

Observations from October 1997–February 1998

The overall results are shown in Table 1 and Fig. 2B. Larvae of the oleander hawk-moth were first found in mid October 1997, at a site in Higashi-ku, the east ward of the city of Fukuoka. In November–December 1997, the occurrence of larvae was also evident at three additional sites in a small area of Higashi-ku. In addition, our survey of February 1998 showed the existence of oleander trees with marked leaf damage caused by larval infestation at several other sites in the three wards: Higashi-ku, Hakata-ku, and Chuo-ku. Among these sites,

Fig. 1. Occurrence in 1998 of the oleander hawk-moth, *Daphnis nerii*, in the city of Fukuoka. (A) A late-stadium larva found in early November at site *b* in Nokonoshima, Nishi-ku. (B) A freshly-oviposited egg found in mid October at site *a* of Nishi-ku. (C) Indian oleander leaves damaged by larval feeding. Photographed in early October at site *a* of Nishi-ku. For the location of sites *a* and *b*, see Fig. 2B.

one site, Chuo-ku, was associated with two pupal cadavers and pupal shells accounting for three individuals in the proximity of the oleander trees.

There was no evidence for larval occurrence of the oleander hawk-moth in the cities of Yamaguchi and Shimonoseki, Yamaguchi Pref., when

explored in February 1998.

Observations from April–December 1998

From April–August 1998, our survey provided no evidence for the occurrence of *P. nerii* larvae in the three wards where the outbreaks had been observed in 1997. The occurrence of early-stadi-

Table 1. Observations in 1997–1998 of outbreaks of the oleander hawk-moth, *Daphnis nerii*, in Fukuoka and Saga Prefectures

Observation site ^a	Location	Year	Date	Occurrence of:					
				Eggs	Larvae ^b			Pupae ^c	Damaged oleander leaves
					E	M	L	C	S
1	Hakata-ku	1997	Oct. 18				○		
2	Higashi-ku		Nov. 23				○		
3	Higashi-ku		Dec. 3				○		
4	Higashi-ku		Dec. 24				○		
5	Chuo-ku	1998	Feb. 7					○	○
6	Higashi-ku		Feb. 14						
7	Higashi-ku		Feb. 14						
8	Higashi-ku		Feb. 14						
9	Hakata-ku		Feb. 21						
10	Hakata-ku		Feb. 21						
11	Hakata-ku		Feb. 21						
12	Hakata-ku		Feb. 21						
13	Hakata-ku		Feb. 21						
14	Higashi-ku		Sept. 17		○				
a	Nishi-ku		Sept. 19		○				
15	Chuo-ku		Sept. 23		○	○	○		
16	Sawara-ku		Sept. 23			○	○		
17	Sawara-ku		Sept. 23			○	○		
18	Jonan-ku		Sept. 23				○		
19	Chuo-ku		Sept. 23				○		
20	Higashi-ku		Sept. 23		○				
21	Higashi-ku		Sept. 25			○	○		
22	Karatsu		Sept. 26			○			
23	Sawara-ku		Oct. 7						
3	Higashi-ku		Oct. 13						
a	Nishi-ku		Oct. 18	○					
24	Saga		Oct. 19			○			
25	Saga		Oct. 19						
26	Higashi-ku		Oct. 22						
a	Nishi-ku		Oct. 24		○				
14	Higashi-ku		Oct. 24	○	○				
27	Tsuyazaki		Oct. 31						
b	Nishi-ku		Nov. 3				○		
28	Onojo		Nov. 4						
29	Iizuka		Nov. 7						
30	Nogata		Nov. 7			○	○		
1	Higashi-ku		Nov. 13						
31	Higashi-ku		Nov. 28			○			
32	Higashi-ku		Nov. 28					○	
33	Higashi-ku		Nov. 28						
34	Higashi-ku		Nov. 28		○				
35	Nishi-ku		Nov. 29						
36	Nishi-ku		Nov. 29						
a	Nishi-ku		Dec. 6		○		○		

^a For geographical location of the site, see Fig. 2.^b E: early-stadium. M: middle-stadium. L: late-stadium.^c C: cadavers. S: shells.

Fig. 2. Maps of (A) northern Kyushu and (B) the city of Fukuoka showing the location of the sites where the oleander hawk-moth, *Daphnis nerii*, occurred in 1997 (○) and 1998 (●).

um larvae was first observed in mid September at one site on the Hakozaki Campus, Kyushu University, located in Higashi-ku ward. As shown in Table 1 and Fig. 2, the sphingid larvae occurred throughout the city of Fukuoka and the surrounding suburbs during the period from September–December 1998. Larval occurrence was also confirmed in the two cities, Iizuka and Nogata, located in the central part of Fukuoka Pref. In Saga Pref., larvae were found in the two cities of Karatsu and Saga.

Occasionally, there were two or three sightings of early (first and second)-stadium larvae within a single site at intervals of 1–1.5 months. For instance, at one site on the Kyushu University Hakozaki Campus, early-stadium larvae were first observed on 17 September 1998, followed by

a second sighting on 24 October 1998. Also, at another site in Nishi-ku ward (site *a* in Fig. 2B), early-stadium larvae were first found on 19 September 1998, followed by sightings on 24 October and 6 December 1998.

Eggs, freshly oviposited on the leaves, were found from mid to late October 1998 at two separate sites located in Nishi-ku (the site *a* in Fig. 1B) and Higashi-ku, respectively. In addition, two adults were caught in late October in Nishi-ku and Higashi-ku, respectively (sites not shown in Fig. 2).

DISCUSSION

In Japan, the oleander hawk-moth inhabits the Ryukyus, Okinawa Prefecture, and it has been generally thought that the northern limit for summer migration of this sphingid is Kagoshima Prefecture in southern Kyushu (Inoue et al., 1982). Thus, it is clear from our observations that the range of summer migration of *D. nerii* is expanding to the north. The first record of the oleander hawk-moth from northern Kyushu was made by Ohba (1994) who caught a fresh adult in the city of Fukuoka in late November 1993. In addition, Matsuda (1998) reported the cases of several sightings of the moth in the city of Kitakyushu, Fukuoka Pref., in the summer seasons of 1993–1994. Thus, it is conceivable that the influx of *D. nerii* populations into northern Kyushu started in the early 1990s. At present, the cause of the influx is unknown. It is likely, however, that recent global warming is involved in the expanding migration of the oleander hawk-moth to the north, as documented for several Japanese butterflies (Ishii, 1998; Shirozu, 1998).

Our data suggest that after arrival there were at least two generations in northern Kyushu. This is supported by the evidence that the two sites had two and three occurrences of early-stadium larvae, respectively, at intervals of 1–1.5 months. Also, the fact, that in 1998 the larval occurrence was not evident from April–August, strongly suggests that the migrants in 1997 failed to survive our winter. The origin of *D. nerii* found in northern Kyushu is presently unknown. Also, it is uncertain whether it migrates stepwise or directly from the area of origin in the south. Interestingly, Murata et al. (1998) suggested that

typhoons induce overseas long-distance migration of the common cutworm, *Spodoptera litura*, leading to the sudden occurrence of populations of this pest in Kyushu. Miyata (1986) also offered an attractive hypothesis, suggesting that the summer migration of *Eligma narcissus* (Noctuidae: Sarrothripinae) to Japan is a direct flight from overseas under specific meteorological conditions.

It should be noted that in 1998 outbreaks of *D. nerii* were also evident in the city of Shimonoseki located in Yamaguchi Pref. (K. Ueda, personal communication) as well as in Yoshida-machi, Shizuoka Prefecture, Honshu (Urayama, 1999). Thus, questions of great interest are: (1) how far the oleander hawk-moth is migrating on Honshu, and (2) whether Shikoku is included in the range of recent summer migration of this insect.

REFERENCES

- Inoue, H., S. Sugi, H. Kuroko, S. Moriuchi and A. Kawabe (1982) *Moths of Japan. Vol. 1: Text*. Kodansha Co. Ltd., Tokyo. 966 pp. (in Japanese).
- Ishii, M. (1998) Global warming and butterflies. *The Nature and Insects* No. 435: 2-3 (in Japanese).
- Matsuda, K. (1998) Sighting of the oleander hawk-moth at Taki-no-Setuindo, Kokuramimami-ku, Kitakyushu-shi. *Kita-Kyushu no Konchu* 45: 72 (in Japanese).
- Miyata, A. (1986) *Shinjukinokawaga*. Bun-ichi Sogo Shuppan Co. Ltd., Tokyo. 166 pp. (in Japanese).
- Murata, M., T. Etoh, K. Itoyama and S. Tojo (1998) Sudden occurrence of the common cutworm, *Spodoptera litura* (Lepidoptera: Noctuidae) in southern Japan during the typhoon season. *Appl. Entomol. Zool.* 33: 419-427.
- Ohba, M. (1994) A record of the oleander hawk-moth from Fukuoka-shi. *Kita-Kyushu no Konchu* 41: 45 (in Japanese).
- Ohba, M. and K. Ohba (1998) Outbreak of the oleander hawk-moth in Fukuoka-shi. *Kita-Kyushu no Konchu* 45: 71-72 (in Japanese).
- Shirozu, T. (1998) Classification of unnative butterflies recently invaded into Japan. *The Nature and Insects* No. 433: 2-3 (in Japanese).
- Urayama, Y. (1999) An outbreak of the larvae of *Daphnis nerii* (Linnaeus) (Sphingidae) at Yoshida in Shizuoka Pref. in autumn of 1998. *Yugato* 155: 16 (in Japanese).