Seasonal Abundance of the Bamboo Bug, *Notobitus meleagris* FABRICIUS (Heteroptera: Coreidae) in Okinawa Island[1]

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The bamboo bug, *Notobitus meleagris* FABRICIUS, is a pest of the bamboo because injection of its toxic saliva into the bamboo shoot at feeding causes the death of plant cells and necrosis (HILL, 1983). The distribution of the bamboo bug used to be limited to India, Taiwan (ESAKI, 1932), and the southern part of China (HILL, 1983). The species invaded the Yaeyama Islands in the 1970's (TOMOKUNI, 1989) and Okinawa Island in 1982 (AZUMA, 1986) from Taiwan. In 1988, it was reported on Tokunoshima Island and Amami-Oshima Island (TOMOKUNI, 1989). If the bug invades the mainland of Japan, it may become a serious pest of the growing bamboo shoot. However, little information is available on the ecology of *N. meleagris* except for HILL (1983) and ZHEN-YAO (1989). In this study, the seasonal abundance of *N. meleagris* on bamboos on Okinawa Island and its overwintering habits were described.

MATERIALS AND METHODS

The numbers of adults, mating pairs, nymphs and egg masses of the bamboo bug on 70 stumps (about 165 m^2) of a bamboo species, *Bambusa oldhamii*, were observed every 2 weeks from April 1990 to January 1991, except for the first half of January, in Kadena town in the central part of Okinawa Island. The shoots of bamboo were divided into lateral shoots that mainly appeared before summer and bamboo shoots that appeared during fall. The former is the branch which grows from a bamboo stem, and the latter grows into a bamboo stem. The numbers of bugs on the bamboo shoots, the lateral shoots and the other parts, including the leaves and the stem internodes, were recorded separately.

The overwintering bugs, aggregated on the wall under the eaves of a building, were observed from September 1984 to May 1985 in Naha city in the southern part of Okinawa Island. The numbers of aggregations and adults in each aggregation were counted monthly except for December and January. Nine bugs in an aggregation were marked with white color paints (Sakura Poster Color Deluxe® White 003) on February 9 to track their movement from the overwintering site.

RESULTS

Figure 1 shows the seasonal abundance of the lateral and bamboo shoots of *B. oldhamii*, one of the host plants of the insect. The lateral shoots occurred from May to December and were most abundant in July. The bamboo shoots appeared from May to January with the peak observed in September.

Figure 2A shows the seasonal abundance of nymphs of *N. meleagris*. Almost all the nymphs were observed on the lateral and bamboo shoots where they fed. The number of nymphs had a peak in July on lateral shoots, and two peaks (June and September) on bamboo shoots. These peaks synchronized with those of the numbers of lateral and bamboo shoots. The seasonal abundance of adults was shown in Fig. 2B. The number of adults had two peaks (May and July) on lateral shoots, and two peaks (July and October) on bamboo shoots. The peak in July on lateral shoots followed the peak of the number of nymphs on lateral shoots. The peaks in July and October on bamboo shoots followed the peaks of the number of nymphs on

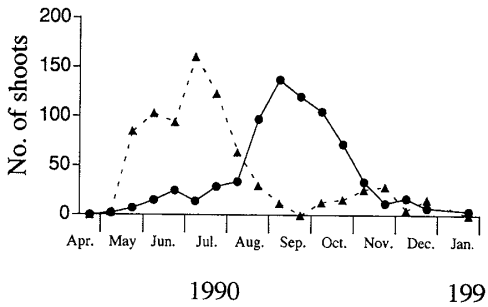

Fig. 1. Seasonal abundance of the lateral and bamboo shoots. Triangles show the number of lateral shoots and circles show the bamboo shoots.

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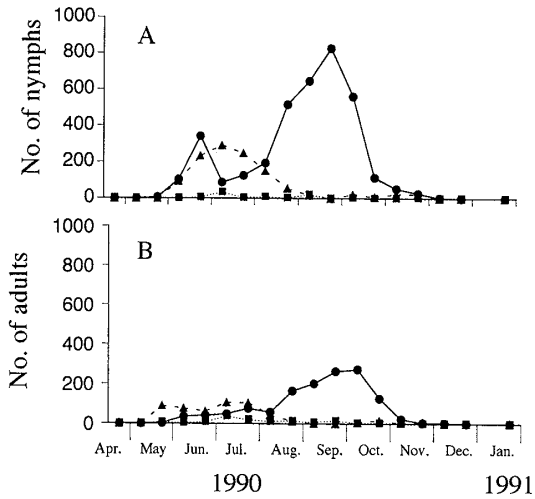

Fig. 2. Seasonal abundance of nymphs (A) and adults (B) of *Notobitus meleagris* on bamboos. Triangles show the number of insects on lateral shoots, circles show the number of insects on bamboo shoots and squares show the number of insects on the other parts of the bamboos.

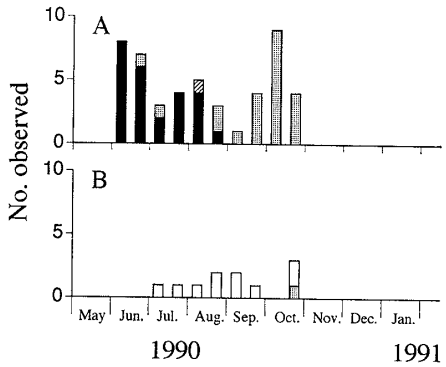

Fig. 3. Number of mating pairs (A) and egg masses (B) of *Notobitus meleagris*. Solid, dotted, slanted-line and hollow bars show the number observed on the lateral shoots, the bamboo shoots, the stem internodes and the back of leaves, respectively.

bamboo shoots in June and September, respectively. There was no peak of nymphs preceding the peak of adults which appeared on lateral shoots in May.

Among 15 observations from April to November, the sex ratios of adults (female/(male+female)) were not biased from 1 : 1 in 11 cases. However, in 4 cases, they were significantly female-biased, that is 0.59 (n=99, p<0.05) on May 19, 0.57 (n=201, p<0.05) on July 15, 0.57 (n=279, p<0.05) on September 23, and 0.58 (n=283, p<0.01) on October 10 (by Binomial test).

Table 1. Number of the overwintering aggregations and the aggregated bugs

Date	No. of aggregations	No. of bugs in each aggregation	
		Average	Range
Sep. 20, 1984	0	—	—
Oct. 31	1	16	—
Nov. 3	1	24	—
Feb. 9, 1985	18	19	5–42
Mar. 17	18	20	2–58
Apr. 20	7	7	2–33
Apr. 24	3	5	2– 7
Apr. 30	1	2	—
May 1	0	—	—

Figure 3A shows the seasonal occurrence of the matings on the bamboo. The mating pairs were found from June to October. On lateral and bamboo shoots, 52.1% and 45.8% of the total number of mating pairs (n=48) were observed respectively, and only one mating pair was detected on the stem internode. The egg masses were found from July to October (n=11, Fig. 3B). Ten egg masses were observed on the back of bamboo leaves and only one was on a bamboo shoot. The bug apparently preferred the backs of leaves as an oviposition site.

Adult bugs wintered on the wall under the eaves of the building, which had never gotten wet in the rain, from October to April. Table 1 shows the number of the overwintering aggregations and the aggregated bugs. One aggregation consisting of 16 bugs was found on October 31. From February to March, 18 aggregations were found. The number of bugs in an aggregation varied from 2 to 58. The number of aggregations decreased gradually after March, and on April 20 seven aggregations existed. On April 21, one mating pair was observed in an aggregation. In the last ten days of April, some of the bugs flew a short distance of about 1 to 2 m. Such flight behaviors indicate the enhanced activity of adults. No aggregation was found on May 1.

The nine bugs marked on February 9 decreased to 6 on March 17, and to 2 on April 20. Marked bugs were not found after April 24, while two marked bugs were found in May in a clump of

bamboos about 5 m from the wall where bugs had aggregated.

DISCUSSION

The seasonal abundance of *N. meleagris* on bamboos corresponded with that of the shoots of *B. oldhamii* on Okinawa Island. The bugs reproduced on lateral and bamboo shoots before summer and on bamboo shoots during fall. Similar phenomena were reported in the southern parts of China by ZHEN-YAO (1989). Host plants other than bamboos have never been reported (HILL, 1983; SCHAEFER and MITCHELL, 1983; ZHEN-YAO, 1989; TOMOKUNI et al., 1993; ZHENG, 1994). On Okinawa Island, *N. meleagris* was found on two other bamboo species, *B. vulgaris* and *Dendrocalamus latifflorsu* (MIYATAKE, unpubl.), while in China, 11 bamboo species were reported as hosts of *N. meleagris*, i.e. *Sinocalamus latiflorus*, *S. beecheyana*, *Bambusa rigida*, *B. ventricosa*, *B. vulgaris*, *B. gibboides*, *B. pervariabilis*, *B. textilis*, *B. gibba*, *B. fecunda* and *Phyllostachys viridis* (ZHEN-YAO, 1989; ZHENG, 1994).

Although almost all the egg masses were found on the back of bamboo leaves on lateral branches on Okinawa Island, egg masses were observed on bamboo shoots in the southern part of China (ZHEN-YAO, 1989). The factors leading to the difference in oviposition sites between Okinawa and China were not known.

All mating pairs except one were observed on lateral or bamboo shoots on Okinawa Island. In the southern part of China, the matings occurred on bamboo shoots and mating pairs on lateral shoots were never observed by ZHEN-YAO (1989).

ZHEN-YAO (1989) reported the overwintering adults aggregated in a crack in the ground or in a house from October to April in the southern part of China. The overwintering period on Okinawa Island was the same as that in the southern part of China. The number of aggregated bugs decreased from March to April as the bugs moved to the bamboos. Thus the adults which appeared on lateral shoots in May (Fig. 2B) might derive from overwintering populations.

In 1988, *N. meleagris* invaded Amami-Oshima Island, which is the northern limit of its distribution at the present (TOMOKUNI, 1989). There's a possibility that *N. meleagris* can survive during winter on the mainland of Japan. Therefore, possible invasion should be monitored in Kyushu to prevent the bug from becoming a serious pest of the bamboo shoots growing on the mainland of Japan.

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