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Sampling of Flying Insects with a Truck-Mounted Trap

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Abstract
Flight activity of insects was studied using a trap mounted on a truck (truck trap) in an area dominated by grasslands in the northern part of Tochigi Prefecture in Japan from April to December 1985. Many insects belonging to Coleoptera, Hemiptera, Thysanoptera and Diptera were collected and their seasonal flight activities were determined.

Discipline: Insect pest
Additional key words: Coleoptera, Diptera, Hemiptera, Thysanoptera

Introduction

A truck trap is a non-attractant trap mounted on a vehicle[4,11,15]. This collection method has been used in studies on blood-sucking insect populations[1,5,6,13] and insect fauna[8,9,14].

In 1985, flying insects were periodically collected in an area dominated by grasslands using a truck trap. The fauna of flying insects and their seasonal flight activities were determined.

Sampling area and methods

Samplings took place in the Nasunogahara plains in the northern part of Tochigi Prefecture, Japan. This area spreads to the northern limits of the Laurel Forest Zone from a height of 300 to 500 m. The main vegetation consists of grass, *Rhododendron-Pinetum densiflorae* and *Quercetum acutissimo-serratae*. The sampling vehicle was driven through this area over a circuit of 24 km.

The sampling net was made of 50 mesh saran screen, the mouth was 80 × 80 cm in size and it tapered back over 200 cm to a 15 × 15 cm end.

The net was attached to an iron frame and mounted on the roof rack of the vehicle, at a height of 150 to 250 cm above the ground (Plate 1).

Samplings were carried out on clear days, once every week from April to December in 1985. The vehicle was driven at a speed of 50 km/hr over the 24 km circuit course. Samplings were carried out twice on sampling days to analyze the effect of meteorological factors.

The first circuit began one hour after sun culmination (midday sampling) and the second circuit one hour before sunset (sunset sampling).

Plate 1. Truck trap

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Flight activity of collected insects

1) Beetles

Eleven thousand one hundred twenty individuals belonging to 39 families were collected. The Staphylinidae family accounted for the largest number of individuals, followed by the Ptiliidae. Rutanen and Muona collected 607 species of beetles belonging to 47 families with a truck trap in Finland[14], the Staphylinidae family accounting for the largest number of individuals followed by the Ptiliidae. Karg also collected 41 families in Poland, with a predominance of Staphylinidae, Nitidulidae and Ptiliidae[8]. These results were similar to those obtained in our survey. Seasonal abundance in the nine major families is shown in Fig. 1 and summarized as follows.

Staphylinidae: In total, 7,508 individuals belonging to more than 100 species were collected. The genus *Atheta* accounted for the largest number of individuals, 5,187 (69.1% of all individuals)[16]. Other well represented genera included *Capelimus* (5.8%), *Megarthrus* (2.7%) and *Oxytelus* (2.7%). The tendency of the catches was very similar in the midday and sunset samplings and there were two peaks in the changes of the number of collected individuals, the first peak, occurring in June and the second in October or November. The number of catches of Staphylinidae with a yellow pan in Canada peaked in June and was very small in August[2], as in our materials. Samples collected in sunset

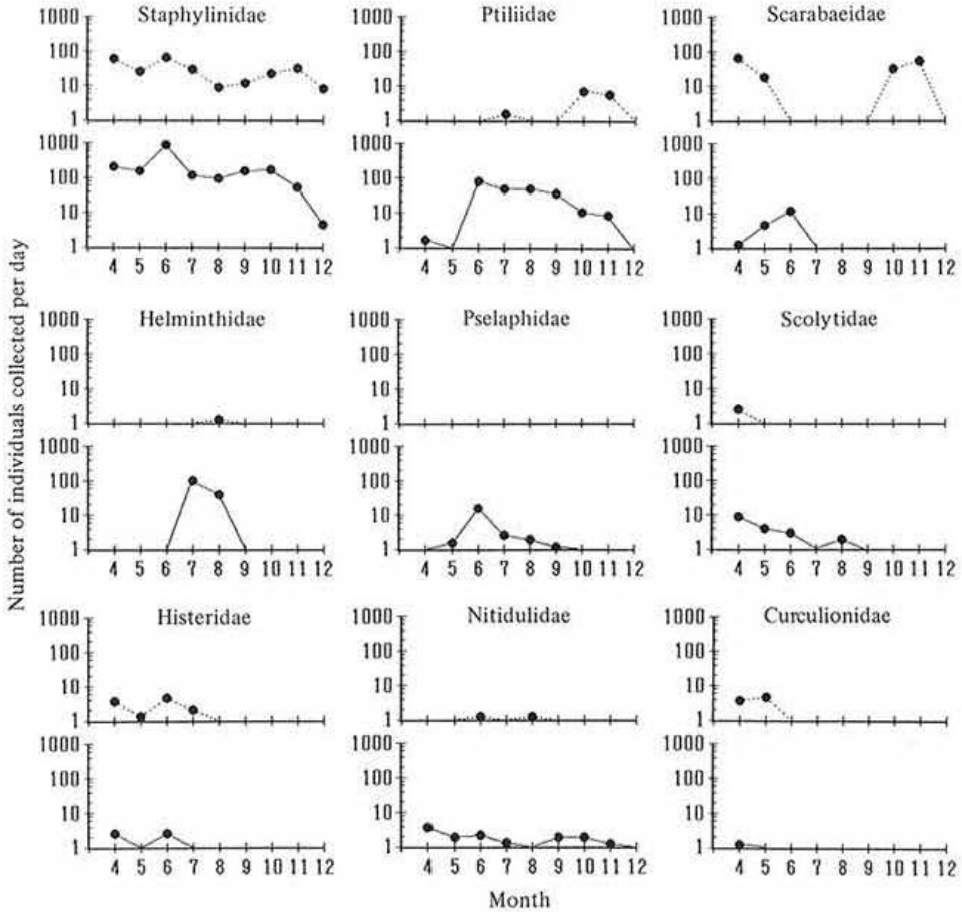

Fig. 1. Catches of beetles (1985)

● ------ ● : Midday sampling, ● —— ● : Sunset sampling

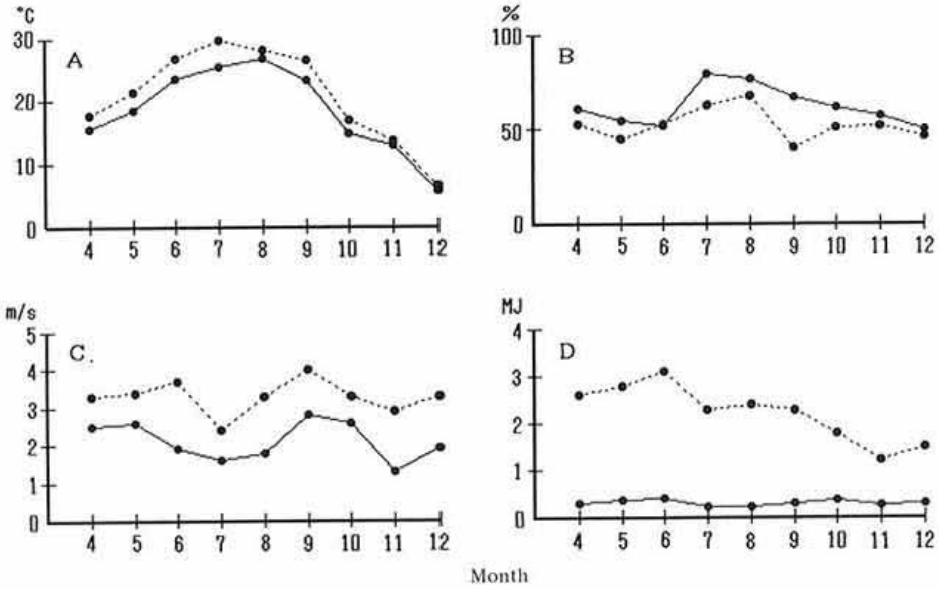

Fig. 2. Weather conditions at the sampling time (1985)
● ------ ● : Midday sampling, ● —— ● : Sunset sampling.
A: Temperature, B: Relative humidity, C: Wind velocity,
D: Luminosity ($MJ/m^2/0.5$ hr).

samplings accounted for 87.7% of the total. Fig. 2 shows the weather conditions at each sampling time. The factor differing most between the midday and sunset samplings was the luminosity, and the less intense it was, the more staphylinid individuals were active in flight. None of the samples collected at 24 km/hr were severely damaged.

Ptiliidae: One thousand four hundred thirty-eight individuals were collected, with a peak in June and thereafter the numbers decreased gradually to a zero value in December. Most of the individuals were collected in sunset samplings, while some were collected in midday samplings in October and November. The luminosity was the main factor affecting the flight activity and the temperature was also important in cold months.

Scarabaeidae: Seven hundred eleven individuals were collected. All of them were coprophagous and 93.7% of the collected Scarabaeidae consisted of *Aphodius rectus* MOTSCHULSKY. Catches of *A. rectus* showed two peaks in spring and in late autumn. Most of the *A. rectus* individuals were collected in midday samplings but some were collected in sunset samplings in spring.

Helminthidae: Six hundred fifty-nine individuals belonging to six species were collected in summer. *Zaizevia nitida* NOMURA accounted for 96.8% of the collected Helminthidae[18]. Most of the *Z. nitida* were collected in sunset samplings.

Pselaphidae: Eighty-one individuals were collected between May and September, mostly in sunset samplings.

Scolytidae: Seventy-seven individuals belonging to 16 species were collected[19], most species in sunset samplings in spring.

Histeridae: Sixty-nine individuals were collected between April and July, 70% of them in midday samplings.

Nitidulidae: Sixty-nine individuals were collected between April and November, most of them in sunset samplings.

Curculionidae: Fifty-nine individuals belonging to 14 species were collected, mainly in midday samplings in spring[19].

Other families: Other collected families (individuals) included Rhizophagidae (51), Chrysomellidae (49), Lathridiidae (38), Coccinellidae (32), Hydrophilidae (32), Psephenidae (30), Anthribidae (28),

Scydmaenidae (25), Attelabidae (24), Carabidae (24) Silvanidae (23), Leiodidae (20), Catopidae (16), Cryptophagidae (15), Anobiidae (14), Bruchidae (4), Dytiscidae (4), Helodidae (3), Byturidae (2), Heteroceridae (2), Mycetophagidae (2), Rhizophagidae (2), Cerambycidae (1), Cucujidae (1), Elacatidae (1), Elateridae (1), Hydraenidae (1), Limnichidae (1), Pyrochroidae (1), and Scaphidiidae (1).

2) Aphids

Six thousand nine hundred ninety-five individuals were collected. A small peak occurred from June to August, and a large peak from October to November (Fig. 3). There was no notable difference in the collected numbers between midday and sunset samplings, suggesting that the luminosity, from 0.2 to 3.1 MJ/m^2/0.5 hr, did not affect their flight activity.

The collected aphids were all alatae.

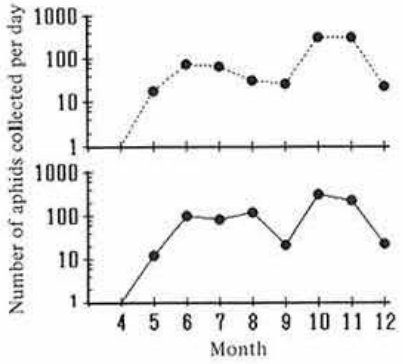

Fig. 3. Catches of aphids (1985)
● ------ ● : Midday sampling,
● —— ● : Sunset sampling.

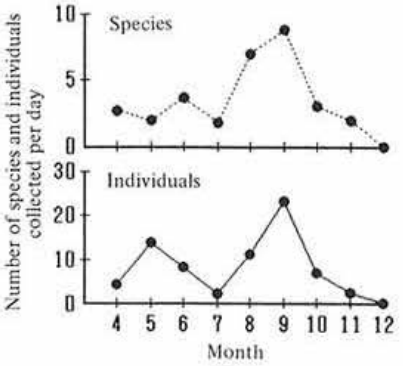

Fig. 4. Catches of thrips (1985)

3) Thrips

Three hundred four thrips belonging to 31 species were collected. The most abundant species were *Ecacanthothrips inarmatus* KUROSAWA (69 individuals) and *Thrips flavus* SCHRANK (61 individuals)[17]. A large peak in the numbers of collected individuals and species was observed in September (Fig. 4). Only a few females were present in 9 out of 31 species. The rate of collected males of *Stenothrips graminum* UZEL was higher in direct sampling from the hosts than in the sucking trap sampling[10]. Obviously the flight ability was different between males and females, and the migration ability of the females was higher than that of the males.

4) Blood-sucking insects

One thousand seven hundred five black flies, 1,376 females and 329 males, belonging to 14 species were collected from April to December (Fig. 5). The most

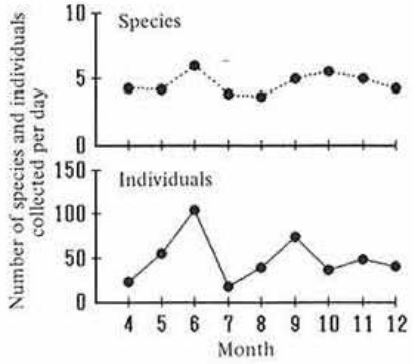

Fig. 5. Catches of black flies (1985)

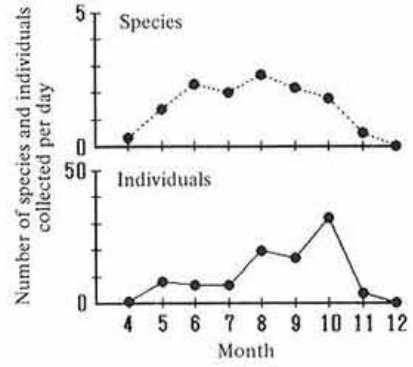

Fig. 6. Catches of *Culicoides* (1985)

abundant species were *Simulium aokii* TAKAHASHI and *S. bidentatum* SHIRAKI. The number of collected individuals was positively correlated with the temperature and negatively correlated with the relative humidity. Three hundred eighty biting midges belonging to *Culicoides*, 301 females and 79 males, were collected between April and November (Fig. 6). The species were most abundant in August and individuals in October. The predominant species was *Culicoides maculatus* of which 300 individuals were collected.

Sampling with a truck trap

Okada and Kudo[12] surveyed the thrips in tea fields for two years with suction traps. Mean diversity per individual[7] and relative diversity[3] were 4.6 and 0.22, respectively, in tea field sampling, while the corresponding values were 8.6 and 0.53 in our survey. It is suggested that a stationary trap is more suitable for the sampling of species with a narrow range living in a smaller area, while the truck trap is more suitable for sampling of species with a wide range occurring over a wider area. The truck trap can be used in either a rural or an urban area where there is a convenient road, and samples can be obtained without the inevitable biases associated with the stationary traps.

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