Population Dynamics of the Chestnut Gall Wasp, 
*Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae)

V. Estimation of the Effect of Predation by Spiders on the Mortality of Imaginal Wasps Based on the Precipitin Test

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**Summary.** During the course of a 10-year investigation on the population dynamics of *Dryocosmus kuriphilus*, a rapid decrease in the number of individuals was noticed in the adult stage. To detect the role of predation by spiders in causing this high adult mortality, spiders collected from the survey station were tested for their reaction to *Dryocosmus* antiserum. About 20 ~ 50% of the spiders collected during the emergence period of *D. kuriphilus* reacted positively, showing that the species of Thomisidae, Argiopidae, Agelegenidae and Salticidae were the important predators. The predation ratio for the total adult wasp population was estimated at 8.1% in 1968, 20.2% in 1969 and much higher in 1970, increasing with decreasing population density of the wasps. However, the predation by spiders could not account for all of the adult mortality of *D. kuriphilus*.

**Introduction**

We have studied the population dynamics of the chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu, for ten years. The life history of this important pest to the Japanese chestnut, *Castanea crenata* Sieb. et Zucc., was described in detail in Nakamura et al. (1964). The wasps generally emerge from late June to early July, although the emergence is generally concentrated in a short period of about one week. Adult wasps are always females and immediately lay eggs on the buds of chestnut tree. Miyashita et al. (1965) found that a high mortality of the adult wasp was probably due to predation. In fact, the adult wasps were often observed in the field to be trapped on spider’s web.

In this paper, we have tried to identify the predator of *D. kuriphilus*, using the precipitin test, and to evaluate the relative importance of predation as a factor responsible for the adult wasp’s mortality. The test was based upon the interaction between the *Dryocosmus* material in the gut of a predator and

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the antibody in the blood serum of a rabbit inoculated with the wasp’s extract. Such precipitin tests have been used by many workers to determine the range of predator species feeding on a certain insect (e.g., Dempster, 1960; Rothschild, 1966). Since the precipitin test reveals only whether the predator has fed on the prey or not, it is generally difficult to evaluate the effect of predation on prey species quantitatively by the result of this test. We tried to overcome this difficulty by estimating the number of prey consumed by the predator on the assumption of random eating.

Material and Methods

1. Preparation of Antigen

A lot of galls (more than 1000) of *D. kuriphilus* were collected in the field in the middle of June. Adult wasps emerging from the galls were collected every day and stored in a deep freezer. The live weight of wasps was about 7.5 mg/10 individuals and the mean dry weight ratio was 0.438. Wasp bodies of 4.678 g (live weight) were crushed with a pestle in a mortar with 90 ml of normal saline solution (0.9% NaCl), and kept for 24 h at 3°C, passed through doubled gauzes,