

## Population fluctuations of the chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu, and its natural enemies in the vicinity of Tsukuba over the past fifteen years

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*Torymus sinensis* Kamijo is a parasitoid wasp of the chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu. *T. sinensis* was introduced from China in 1982 and was released at the National Institute of Fruit Tree Science in Tsukuba, Ibaraki Prefecture. An additional release was conducted at a chestnut orchard in Kasumigaura-shi, 20 km from the first release point, in 1985. These wasps succeeded in establishing themselves, and their offspring have spread rapidly (Shiga, 1999).

To monitor the population fluctuations of *D. kuriphilus* and its natural enemies around the *T. sinensis* release point, we have conducted three field surveys in the vicinity of Tsukuba for more than 15 years. For Survey A, we counted the number of *D. kuriphilus* galls on more than 40 chestnut trees consisting of 20 European, Japanese and Chinese varieties and on 4 trees of the native wild chestnut, "Shibaguri," at the institute. Five to twenty 2-year-old branches on each tree were randomly chosen each year, and the buds and galls on these branches were counted to estimate the infestation rate by this pest. For Survey B, we collected dried galls of *D. kuriphilus* at two locations in the Tsukuba area (1993-2004), four locations in the Dejima area (1993-) and three locations in the Iwama area (1993-), every winter. Galls were collected for a given time period at each point every year, and the numbers collected were converted into the number index per unit of time as the estimation of the population density of *D. kuriphilus*. For Survey C, the galls collected in Survey B were saved in an outside screened container after counting. Parasitoid wasps that emerged from these galls, including *T. sinensis*, *T. beneficus* Yasumatsu et Kamijo and facultative hyperparasitoids were recorded with species identification each day.

The infestation rates by *D. kuriphilus*, obtained in Survey A, were high in 2000 and low around 2003 (Fig. 1). Although the rates varied among chestnut varieties, the patterns of fluctuation were similar in all varieties. The numbers of dried galls collected for Survey B showed a peak in 2001, and a low trough in 2005 (Fig. 2). These results indicate that the population of *D. kuriphilus* was very high in 1999, and that the subpopulations in and around Tsukuba have increased and decreased synchronously over the past 15 years. After 1999, the *D. kuriphilus* population sank to low levels, but over the last few years it has increased to high levels again. These fluctuations in the *D. kuriphilus* population seem to be related to parasitism by *T. sinensis*, at least partially. The numbers of *T. sinensis* females per 100 galls, obtained in Survey C, showed wide fluctuations from

1993 to 1999, and have remained at low levels since then (Fig. 3). On the other hand, the population of *T. beneficus*, a native natural enemy of *D. kuriphilus*, rapidly decreased, and no *T. beneficus* wasps have been recorded in any area since 1998. The disappearance of *T. beneficus* is probably due to direct and/or indirect interaction with *T. sinensis*. The facultative hyperparasitoids appear to have a significant effect on the dynamics of *D. kuriphilus* and *T. sinensis*. However, further surveys are needed to clarify the interaction between them.

This work was supported in part by a Grant-in-Aid for Scientific Research (B) (No. 19380037).

## Reference

Shiga, M. (1999) Classical biological control of the chestnut gall wasp, *Dryocosmus kuriphilus*: Present status and interactions between an introduced parasitoid, *Torymus sinensis*, and native parasitoids. In *Biological Invasions of Ecosystem by Pest and Beneficial Organisms* (E. Yano, K. Matuo, M. Shiyomi and D. A. Andow, eds.). NIAES Series 3, National Institute of Agro-Environmental Sciences, Tsukuba, pp. 175-188.

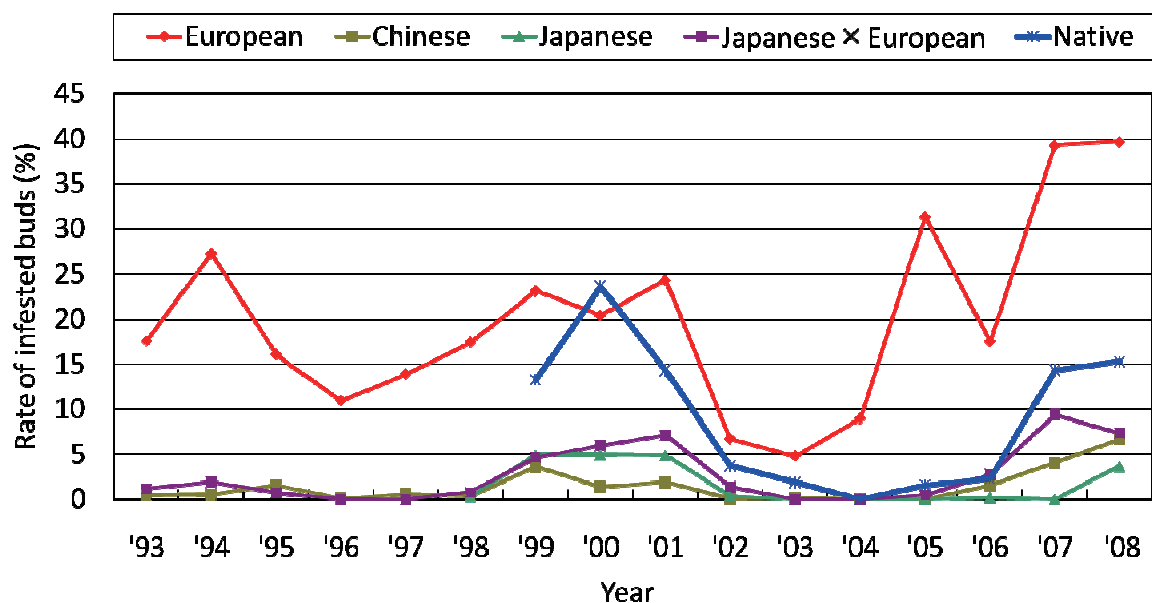


Fig. 1. Annual change in the rate of infested buds by *D. kuriphilus* (survey at NIFTS).

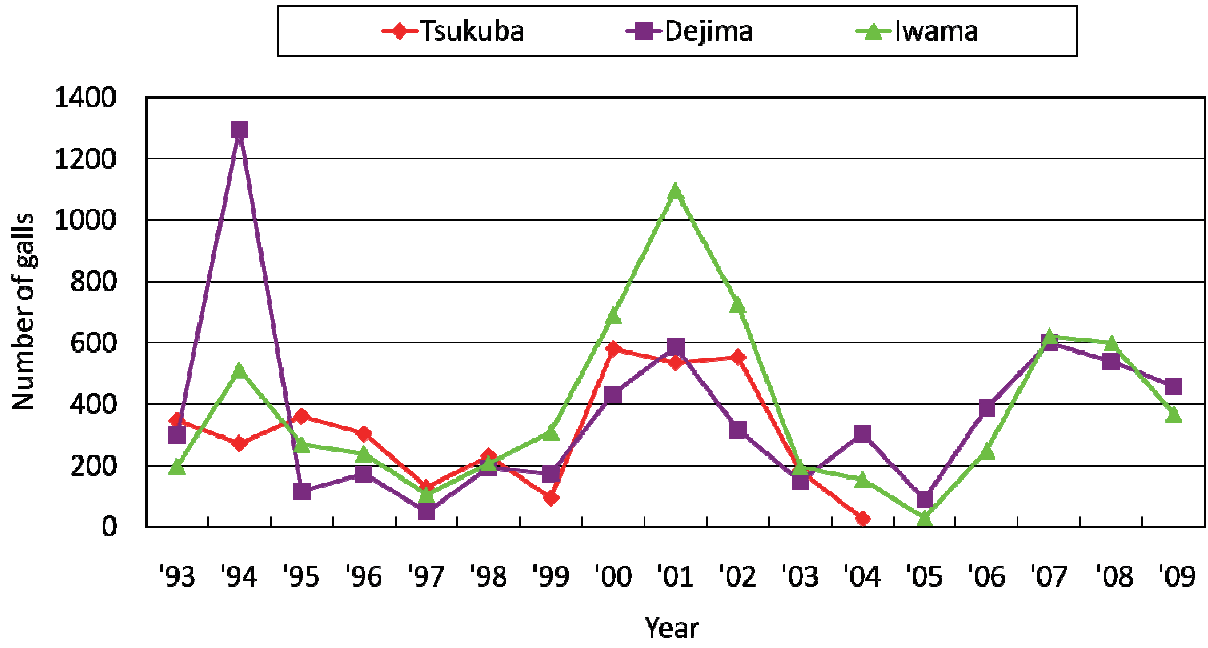


Fig. 2. Annual change in the number of collected galls in each area (mean of locations in each area).

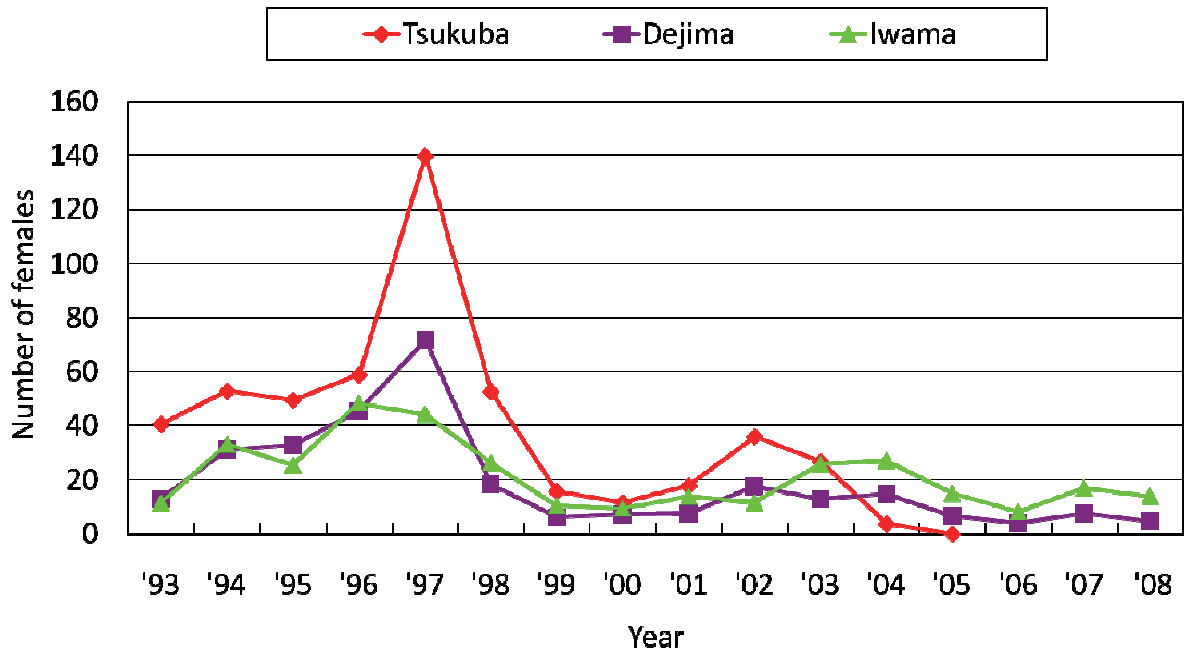


Fig.3. Annual change in the number of *T. sinensis* females per 100 galls.