



## Determination of seasonal changes of spider mite (Acari: Tetranychidae) densities and species composition on kudzu vine and soybean (Fabaceae) in Japan with the use of phosphoglucomutase zymograms\*

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### Abstract

Identification of spider mites based on morphological characteristics is difficult because morphological differences between species may be subtle and in some groups, including the *Tetranychus* Dufour species, detectable only in adult males, which usually correspond to a small proportion of a population. The utility of an alternative method, phosphoglucomutase (PGM) zymogram, is demonstrated in this study. Using this method, we were able to discriminate females of each of 13 known Japanese *Tetranychus* species. We examined the species composition and seasonal density changes on kudzu vine [*Pueraria montana* var. *lobata* (Willd.) Sanjappa and Pradeep], a fabaceous weed, between 1997 and 1999, and on soybean [*Glycine max* (L.)] between 1999 and 2001. On kudzu vine, spider mite populations showed two types of seasonal fluctuation, one characterized by a single peak in September or October and the other by two peaks, in June and September. Five spider mite species were found on this plant species, with *T. pueraricola* Ehara & Gotoh being dominant throughout the 3-year period and accounting for 75.6–96.9% of all females. On soybean, spider mite populations showed three types of seasonal fluctuation, characterized by one peak (August), two peaks (August, November), and three peaks (June, August, October), respectively. On this plant, eight species were found, *T. pueraricola* being dominant in 1999 (54.7%), *T. parakanzawai* Ehara in 2000 (72.6%) and *T. kanzawai* Kishida in 2001 (69.2%). Such annual variation in dominance was probably determined by the order of invasion of soybean fields.

**Key words:** Species composition, population dynamics, *Pueraria montana* var. *lobata*, soybean, Tetranychidae.

### Introduction

Species identification of spider mites has important implications for accurate control, population dynamics studies and resolving international trade barriers related to plant quarantine (Kitashima & Gotoh, 1997; Osakabe *et al.*, 2002). A number of methods has been used for species identification, based mainly on the morphological characteristics of adults (Ehara, 1999; Ehara & Gotoh, 2009), ribosomal DNA (rDNA) polymorphisms (Navajas *et al.*, 1997, 2001) and restriction fragment-length polymorphism following PCR (PCR-RFLP) (Gotoh *et al.*, 1998; Osakabe *et al.*, 2002). However, each of these methods has some disadvantages. Species identification based on morphological characteristics observed under phase-contrast microscopy is difficult because the mites are very small, differences are often subtle and the collected individuals may not be of the sex or developmental stage that has the known relevant morphological characteristics. In some groups, including the *Tetranychus* Dufour species, differences are usually only known in adult males, which may be hard to find. DNA sequencing is expensive and labor intensive and, as a result, may not allow the comparison of a large number of individuals (Hance *et al.*, 1998).