

Concentration of neonicotinoid insecticides and their metabolites in Japanese bottled green-tea beverages and their safety evaluation

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Abstract

In this study, we determined the concentration of seven neonicotinoid insecticides and 13 of their metabolites in 46 bottled green-tea beverages, and estimated the daily intake of neonicotinoids in adults and children from these drinks. Liquid chromatography coupled with electrospray ionization tandem mass spectrometry (LC-ESI/MS/MS) analysis revealed that six neonicotinoids and two metabolites were detected in bottled green-tea beverages, and the 50th percentile concentration indicated dinotefuran > thiacloprid > clothianidin > imidacloprid > thiamethoxam > acetamiprid > *N*-desmethyl-acetamiprid > thiacloprid-amide. The concentration and composition profile of neonicotinoids in bottled green-tea beverages were different between brands; however, no significant differences were observed among manufacturing sites. The concentration of acetamiprid in bottled green-tea beverages was significantly correlated with that of *N*-desmethyl-acetamiprid. A significant relationship between concentrations of thiamethoxam and clothianidin in bottled green-tea beverages was also observed, suggesting those neonicotinoids are metabolized during the tea leaves cultivation period. The daily intake for neonicotinoids in both adults and children from consumption of bottled green-tea beverages was <2.1% when compared with the acceptable daily intake (ADI) of neonicotinoids.

Keywords : neonicotinoid insecticide, bottled green-tea beverages, dinotefuran, *N*-desmethyl-acetamiprid, acceptable daily intake

I Introduction

Neonicotinoid insecticides are widely used as an alternative to organic phosphorus- and carbamate-type agricultural chemicals. These neonicotinoids currently account for approximately one-third of the world insecticide market¹⁾. In Japan, tons of neonicotinoid insecticides have entered the market since 1993²⁾. The first one to be registered was imidacloprid, followed by acetamiprid³⁾. Other neonicotinoids,

such as nitenpyram, thiacloprid, clothianidin, thiamethoxam, and dinotefuran, are also commercially available in Japan, and their domestic sales are increasing³⁾. In 2016, dinotefuran, a non-chlorinated neonicotinoid, was the most sold insecticide in Japan, followed by clothianidin, imidacloprid, and acetamiprid⁴⁾.

Neonicotinoids have widely been used in agriculture and home gardening, and because of their systemic nature as insecticides, they are absorbed by the root system, leaves, and