Effects of number of copulations on the overwintering success in *Orius species*

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A carnivorous stinkbugs of the genus Orius species (Heteroptera: Anthocoridae), an economically important natural enemy of various agricultural pests, are distributed throughout Japan's temperate zone, and are multivoltine. Both males and females overwinter in many insect species. In *Orius* species, however, only female adults overwinter successfully while male adults cannot. Female-biased survivorship in winter has been reported in another stinkbug, *Mendia scotti* (Heteroptera: Pentatomidae). In *M. scotti* males transfer nutrients to females during copulation and copulated males decreases the overwintering survivorship. Males of many insects donate nutrients in their ejaculate to females during copulation. In *Callosobruchus maculatus* (Coleoptera: Bruchidae) multiply mated females lived longer than those copulated once. If females of *Orius* species also getting nutrients from males through the copulation in autumn, the winter survival rates in copulated females are expected to be higher than uncopulated females, and also higher in once copulated females than multiply copulated females. In this study, semi-field condition experiments with *O. sauteri* and *O. nagaii* revealed that the overwinteirng survivorships of once copulated females were higher than that of uncopulated females. However, in females, the overwintering survivorship of the multiply copulated *O. sauteri* females was not higher than that of the once copulated females. In contrast, while less than 10% of once copulated *O. strigicollis* females survived until middle March as well as the uncopulated females, about 30% of the multiply copulated females survived. In all experiments males die out during winter, and copulation experiences did not affect their survivorships. These findings revealed that *Orius* females receive benefits from males through the copulations in autumn.