

# TEMPERATURE SENSITIVE EFFECTS OF THE NEONICOTINOID CLOTHIANIDIN ON BUMBLEBEE (*BOMBUS TERRESTRIS*) FORAGING BEHAVIOUR

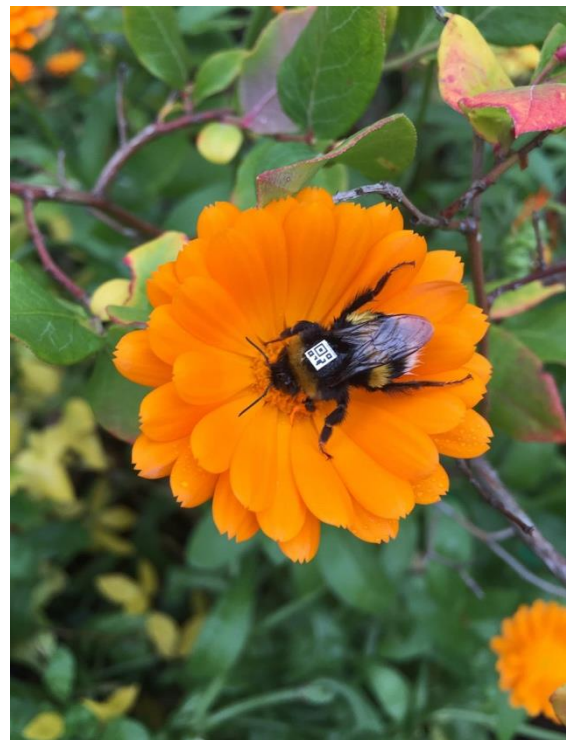
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Bumblebees and other pollinating insects provide a crucial service in most terrestrial ecosystems. However, in recent years, populations of the pollinator species are declining. One of the drivers behind the decline is the extensive use of pesticides. Insecticides used in agriculture to protect crops against parasites and herbivorous insects may negatively affect non-target insects, including bees and other pollinators.

There is still little knowledge about how insecticide toxicity is affected by environmental conditions such as ambient temperature. Therefore, the aim of this study was to assess how exposure to field-realistic sub-lethal concentrations of the neonicotinoid insecticide clothianidin affected bumblebee foraging depending on ambient temperature and precipitation. We developed an automatic monitoring system capable of recording individual bumblebee foraging bouts in natural settings and exposed 25 bumblebee (*Bombus terrestris*) colonies to 2 different concentrations of clothianidin and compared them to a non-exposed control group.

Our cost-effective test system worked very well to obtain individual bumblebee observations on the behaviour regarding foraging bouts. Neither number of foraging bouts nor the daily rhythm of foraging bout duration was affected by clothianidin exposure or temperature. Foraging bout duration was the only foraging behaviour that was affected; Exposure to clothianidin prolonged the foraging bout duration, with the longest extension at low temperature and decreasing difference to control with increasing temperature. The foraging bout

duration decreased with increasing precipitation in both exposed and non-exposed groups, suggesting that precipitation did not affect toxicity.



**Bumblebee** *Bombus terrestris* with bCode resting on *Calendula officinalis* flower. Photo Pawel J. Kolano. Date 23 May 2019.

Based on our findings, we conclude that the effect of clothianidin exposure on bumblebee foraging behaviour is temperature, but not precipitation sensitive. Thus, local climatic conditions and future climate change scenarios should be considered in risk assessments of clothianidin and other insecticides.