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Expression of the red imported fire ant foraging gene and colony-level variation in behavior

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Intraspecific behavioral variation has important consequences for ecology and evolution. In social insects, genetic variation in a behavior can allow a colony to exhibit more flexible, rapid responses to environmental changes and promote homeostasis. In addition, genetic variation in traits enables adaptive evolution. In a number of social insects, variation in foraging behaviors and division of labor has been associated with variation in expression of the foraging gene (*for*), a gene encoding cGMP-dependent protein kinase (PKG). We assayed field colonies of the red imported fire ant (*Solenopsis invicta*) in order to quantify colony-level variation in foraging-related behaviors such as activity, exploration, macronutrient preferences, and recruitment to transient and stable resources. In order to correlate behavior with gene expression, we flash froze foragers and workers from the interior of the nest and used qPCR to quantify *Solenopsis invicta* for expression (*sifor*). Behavioral assays revealed a significant effect of colony of origin on all foraging-related behaviors ($p < 0.001$, all traits). Fire ants varied in *sifor* expression levels at both the colony and regional level, and foragers exhibited increased expression compared to interior workers. In addition, colony-level variation in *sifor* expression was significantly correlated with colony-level variation in foraging-related behaviors. These results demonstrate an important role of *sifor* expression and the associated cGMP/PKG signaling pathway in fire ant foraging behavior. This intraspecific variation in behavior may provide insight into variation in the ecological effects of fire ants, their success as invaders, and methods necessary for their control.