

Title Using new tools to track the larger grain borer, *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae).

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Abstract

We used natural markers to investigate dispersal by *P. truncatus* between rural stores and natural environments. Insects were collected in Mexico and Ghana using pheromone-baited flight traps, and from infested maize in Mexico. We applied three techniques to track the insects remotely: stable isotope analysis (SIA), to detect food use; molecular genetics, to reveal population mixing and relatedness; and trace-element profiling, to identify geographic origin. The delta 13C signatures of candidate and known foods of *P. truncatus* were also determined. Foods were isotopically distinct, with delta 13C signatures typical of either C4 or C3 plants (maize grains -11.6 per mil, *Spondias purpurea* -26.1 per mil), while delta 13C and delta 15N varied with region and habitat for *P. truncatus*. Rural stores in central western Mexico (Michuacan) were heavily infested, and *P. truncatus* delta 13C signatures were consistent with maize consumption (mean delta 13C -11.3 per mil) with one intermediate value, suggesting that natural areas were not reservoirs for infestations. Beetles from natural environments in Michuacan had a predominantly C4 delta 13C signature (mean delta 13C -11.5 per mil). This may indicate dispersal out of stores, or the use of field maize or other C4 foods. Ghanaian beetles from a teak forest were the most 13C-enriched (mean delta 13C -9.3 per mil), indicating dependence on a C4 plant, though not necessarily maize. In northwestern Mexico (Sonora), beetles were highly 13C-depleted and had not consumed maize even when captured close to stores and field maize. In northern Mexico, the only beetle captured had a delta 13C of -10.7 per mil (C4 plant) and the highest delta 15N (-17.5 per mil). The delta 15N was highly variable and will be discussed elsewhere. Genetic fingerprinting using amplified fragment length polymorphism suggested a high level of polymorphism in *P. truncatus* at local, regional, and national scales. Preliminary trace element profiling suggested that sulfur, chromium, and manganese were possible elements for tracking *P. truncatus*. We discussed future work and further development of the techniques for tracing dispersal.