



# A preliminary survey of epigeal predators in southwestern British Columbia cranberry fields



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## Introduction

The loss of broad-spectrum insecticides, in particular organophosphates (OPs), has been a recent development for the cranberry industry in Canada. The predicted impact of eliminating broad-spectrum insecticide use is the increase in natural enemy activity within the crop. Additionally, there are no soil-applied insecticides used in cranberries, in Canada. Thus the group of arthropods that might respond the most rapidly to the elimination of OP inputs in cranberries are the epigeal predators. In particular, Carabid and staphylinid beetles, commonly used bioindicators of the overall health of an ecosystem, would be expected to be active in cranberry fields. As a perennial crop with very little soil disturbance, within fields, we also predict differences in the abundance and composition of the epigeal predator community in older fields compared to younger fields. The objective of this study is to conduct an initial survey of epigeal predator activity in cranberry fields in the Fraser Valley. Carabids and staphylinids, along with epigeal spiders are often the focus of conservation biological control efforts in agriculture. Thus the results of this study could be the foundation for further work on developing conservation biological control programs for cranberries.

## Questions

- Which epigeal predators are dominant in cranberry fields?
- Are there differences in the epigeal predator community in older fields versus younger fields?

## Methods

**Field locations and descriptions:** Our survey was conducted in five cranberry fields located in Delta and Richmond, BC. All five fields received weekly pest monitoring services from a private crop consultant (E.S. Cropconsult Ltd.). The fields were maintained under standard production including insecticide applications for blackheaded fireworm (*Rhopobata naevana*) and cranberry tipworm (*Dasineura oxycoccana*). As with the majority of BC cranberry fields, insecticides were applied via fertigation. Fields were selected based on their age and ease of access for servicing traps. Two fields (Field 1 and Field 5) were > 10 years old, respectively (Fig. 1). Fields 2, 3 and 4 were < 5 years old. In addition to differences in age there were differences in land use surrounding each field, in particular proximity to trees and shrubs (see Fig. 1).



Figure 1. Aerial views of the 5 cranberry fields used for this survey. “X” marks location of the trapping transect.

**Trapping methods:** This survey was conducted using pitfall trapping. Traps consisted of a PVC-tube that was 15cm high and 10cm in diameter. Tubes were buried into the ground so that top of tube was flush with the soil surface. A plastic cup was cut to fit inside the tube. The cup was filled with plumbers anti-freeze (22% alcohol, 3% propylene glycol) to a depth of 5cm. The pitfall trap was covered with 12cm<sup>2</sup> piece of plywood that was raised with 2-cm high “legs” in each corner. Lastly, to prevent disturbance from birds and coyotes a brick was placed on top of the plywood cover. For each field, traps were located along a transect: edge of the field, 5m and 10m from the edge (Fig. 2). Between trapping sessions, the PVC-tube and plywood cover were left in the field, and the trap was “closed” by inverting the plastic cup.

**Survey timing and duration:** The survey was conducted from July to September, 2018 in four intervals: early July, late July, mid August, and mid September. For July and August sessions, pitfall traps were left open for 7-days and for the September session, traps were left open for 14 days. Thus the total number of trapping days was 35.

**Specimen processing:** All pitfall trap contents were stored in at 4°C until processing in late September. Trap contents were sorted into morphogroups that included the following commonly occurring groups: Formicidae, carabid adults, staphylinid adults, Coleoptera larvae, opiliones, lycosids, linyphiids, Isopods, Collembola, and Diptera adults. For the carabid and staphylinid adults we further separated into morphospecies. Representatives for each morphogroup or morphospecies have been prepared for identification, which is still pending.



Figure 2. Pitfall trap transect in a cranberry field (Field 1).

## Results – Identifying common predators

A total of 8,350 individuals were caught during our pitfall trap survey. Of these 12% or 1074 individuals were predatory arthropods, represented entirely by six dominant groups: carabids, staphylinids, Coleoptera larvae, lycosids, linyphiids, and opiliones (Fig. 3).

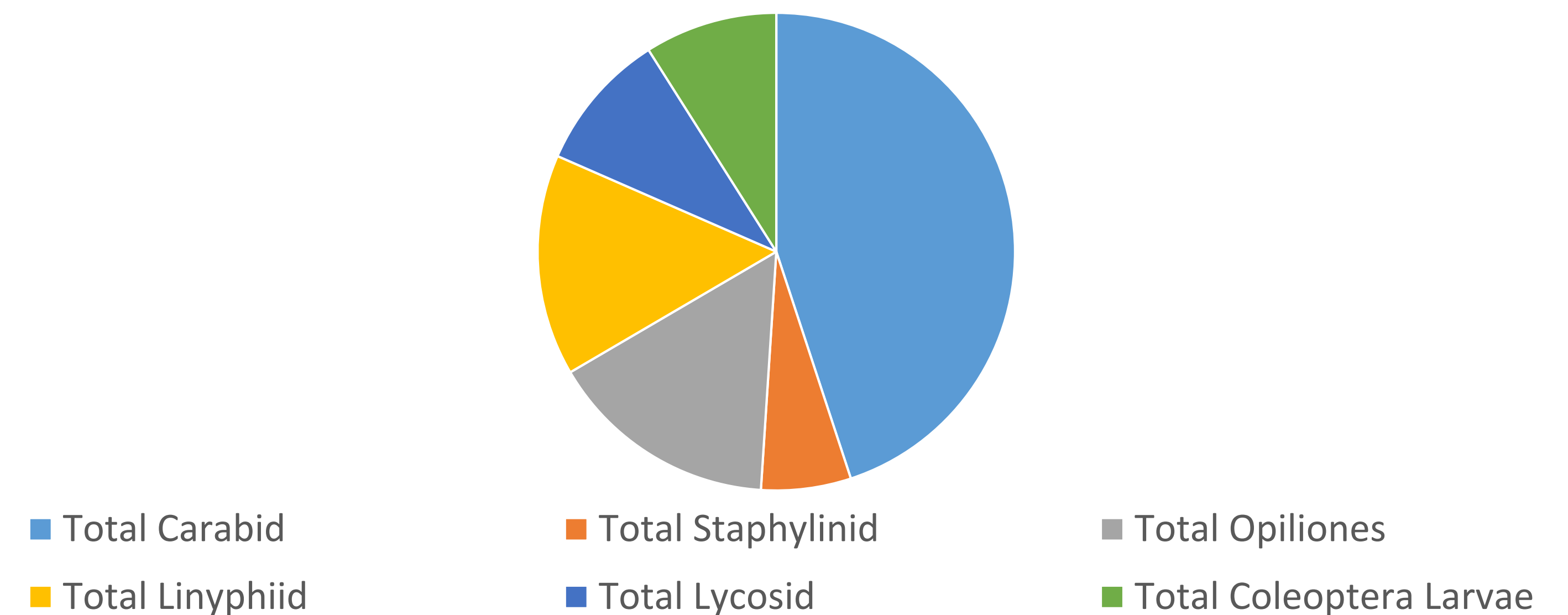


Figure 3. Relative abundance of six morphogroups of predators, caught in 5 cranberry fields in southwestern BC. Predators were caught in 4 separate trapping intervals between July and September, 2018, for a total of 35 trapping days.

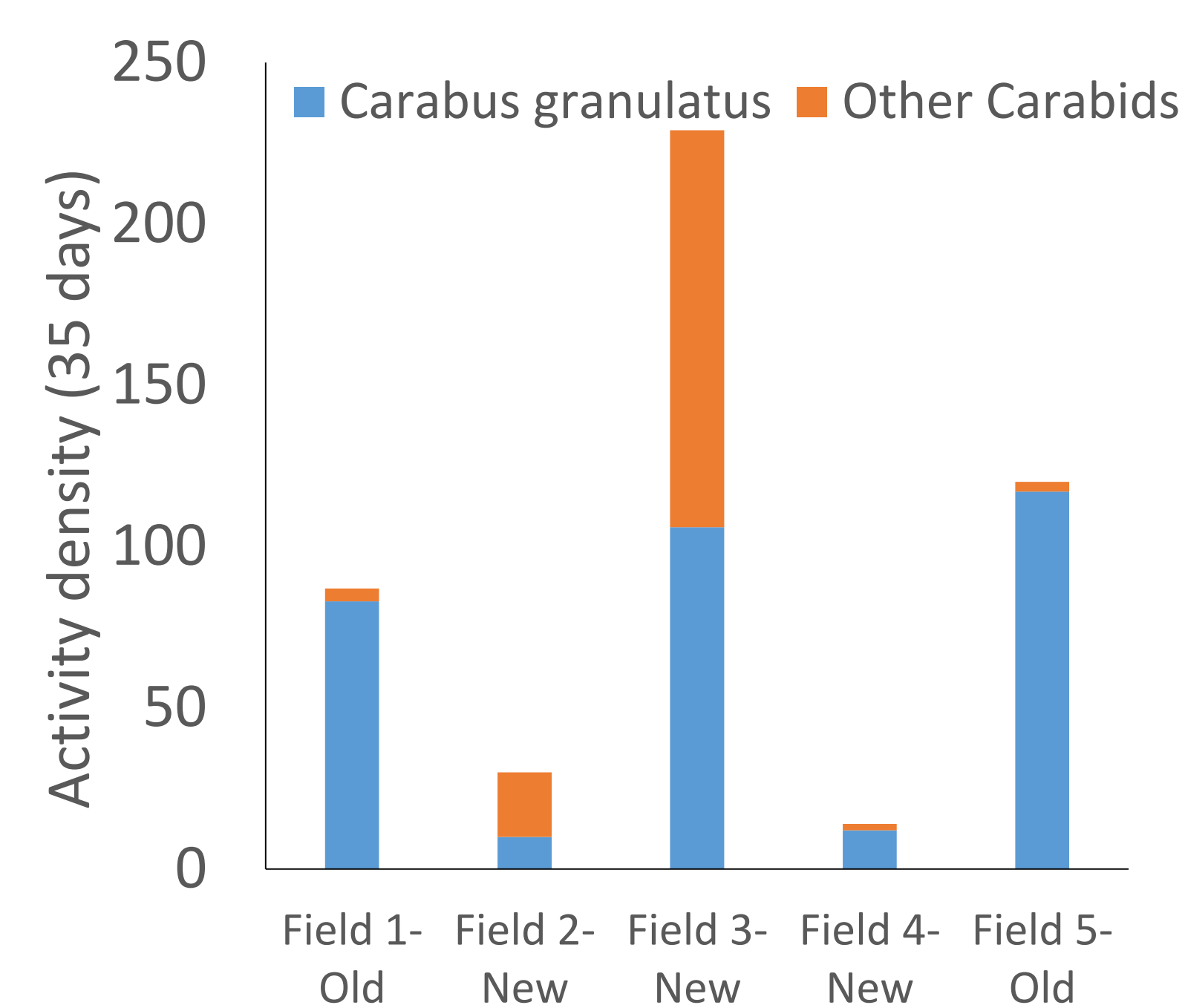


Figure 4. Relative abundance of *Carabus granulatus* compared to other carabids, trapped in cranberry fields.

The most dominant group of predators were the carabids (Fig. 3) and within this order one morphospecies was dominant - tentatively identified as *Carabus granulatus* (Fig. 4). *Carabus granulatus* is an introduced species, native to Europe. It was first recorded in New Brunswick in 1890, in southwestern BC in 1926 and has more recently established in the Prairies (Bell, Boyes, Schmidt and Philips, 2014, *Col. Bull.* 68(4):700-702). It is likely that the beetle larvae collected were also *C. granulatus*, although this must be confirmed. However, since adult *C. granulatus* are snail feeders (Bergmin and Smits, 2015, *Vita Malcol.* 13:49-51) their contribution to biocontrol in cranberries may be minimal.

## Results – Differences among fields

Predator abundance and diversity (number of morphogroups) was highest in Fields 1, 3 and 5 (Fig. 5). Fields 1 and 5 are the oldest fields. Increasing age of cranberry fields results in a thick layer of dead leaves, mature woody stems, and vegetative and fruiting stems (or uprights). Field 3 is a young field (<5 years old), however unlike the other fields it has a treeline on two of its edges. Aziz *et al.* (2018 *Ag. Ecosys. Env.* 259:700-702) document that spider and Carabid abundance is impacted by the amount of trees/woods surrounding fields. One limitation of using pitfall traps in cranberries, is we may have caught more *C. granulatus* than other smaller carabid species (e.g. *Bembidion* spp.) because *C. granulatus* is relatively large and able to navigate the complex epigeal environment in cranberries. While carabids were present in all 5 fields, linyphiids were only caught in 3 fields.

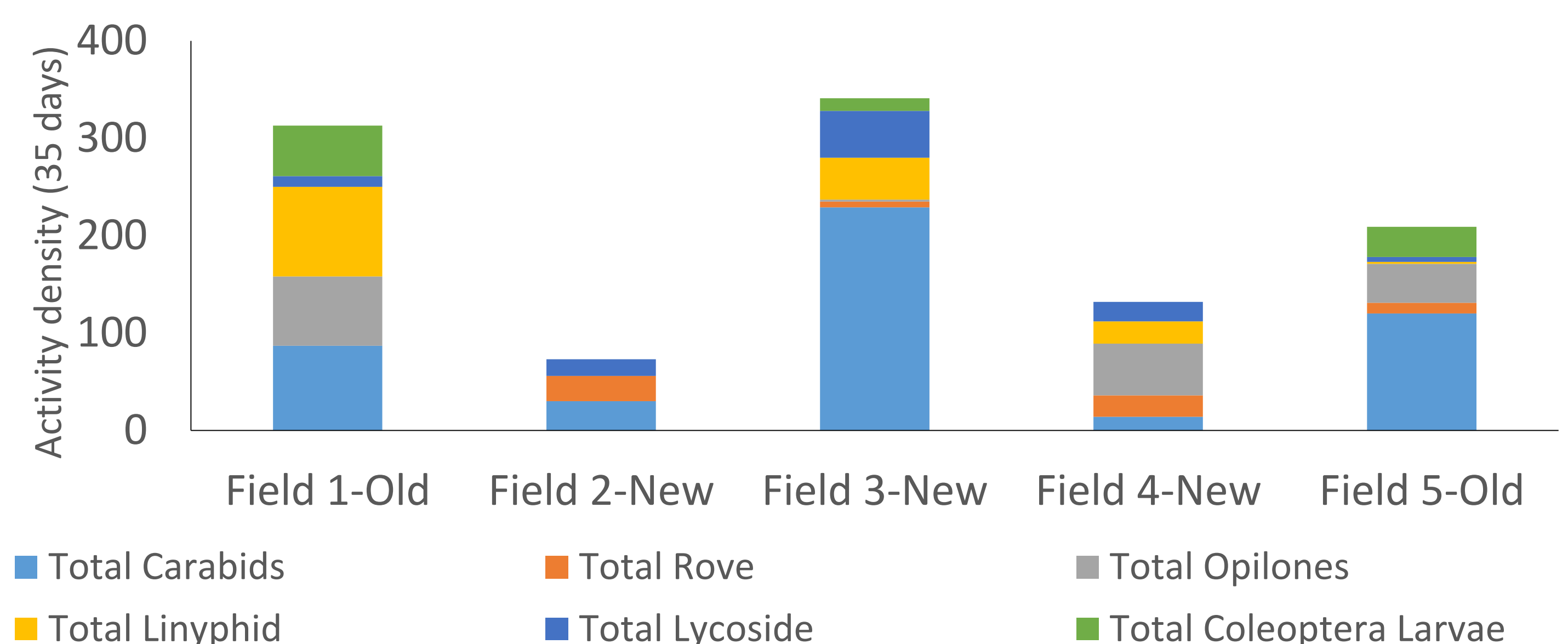


Figure 5. Pitfall trap catch comparison for five cranberry fields. For each field data are pooled for 3 traps/field and 4 separate trapping intervals (35 days total).

## Next steps – Gut content analysis?

1. Given the limitations of pitfall trapping, in complex environments, it would be worthwhile to explore other survey methods for arthropods in cranberries.
2. Given the limited diet of *C. granulatus*, it would be worthwhile to focus on beetle larvae, and other predators for additional work on the potential for biological control – e.g. gut content analysis.