Project Title: Qualitative & Quantitative Surveys of Pollinators in Vineyards
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Report on Pollinators in Vineyards
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Grapes are wind pollinated. Grape blossoms do not produce nectar. Bees in general cannot and do not forage directly on grapes. Honeybees can and will feed on cracked berries in late summer or fall seeking the sugar water in an overripe grape.

Starting in spring and summer 2014 and continuing through this year (2015) we have been actively monitoring endemic bee populations in several specialty crops we produce in central Washington State. In 2014 these crops included juice and wine grapes, hops, and blueberries. In 2015 we added spearmint and peppermint. In 2012 and 2013 we conducted similar studies in fields of alfalfa produced for seed. In our studies in wine grapes we started surveying in early May in 2014 to adhere to Courtney Grula, the graduate student that was conducting the study's academic schedule. In 2015 we rectified this by commencing our surveys by hiring a temporary time-slip employee in mid-March.

We conduct our surveys with colored bee bowls. The colors we use are white, yellow, and blue. Prior research has demonstrated that these three colors collectively attract a diversity of bees. We conduct these surveys by placing 2 bee bowls of each color in 4 locations for each crop and each crop location is paired with sets of bee bowls placed in a nearby less disturbed (natural, typically riparian?) habitat that has alternative blooming host plants and an open water source. The bee bowls are party cups filled about 1/3 full of liquid for a 24 hr period each week. Tables 1 and 2 below were included in my 2014 report to the grape industry. The bees we capture this summer will be sorted by December.

In general honey bee abundance in vineyards is negligible and significantly less than the riparian areas that were surveyed. Halictids were by far the most abundant type of bee captured among the riparian sites in proximity to vineyards. Halictids are typically small to moderate-sized bees and are often metallic in coloration. Our preliminary suspicions are that the preponderance of the halictids we have captured are in the genera *Agapostemon*. These bees are commonly referred to as "sweat bees" or "metallic green bees." In prior survey work we have completed in the Walla Walla and Yakima Valleys we have identified 3 or possibly 4 species of Agapostemon. These species, particularly the females are nearly morphologically indistinguishable. It is on my scientific wish list to develop a DNA barcode method to differentiate among these 3 or 4 species using mitochondrial DNA. If the current student I have working on this project gets all the bees collected this summer sorted by January or February she'll get the honor of developing the DNA barcode for Agapostemon. Otherwise the bees I have in the freezer can wait for the next student in the pipeline to conduct this study. We have preliminary evidence that another small, ground-nesting halictid, *Halictus farinosus*, is quite abundant as well.

Our conclusions are that bees are in low abundance in most conventional Pacific Northwest vineyards and that pesticide applications would have little or no impact on extant bee populations. The lack of Halictids in vineyard is likely due to the deficit irrigation practices in vineyard. Halictids are primarily soil dwelling and the dry soils in vineyard due to deficit irrigation are not conducive to colonization by soil dwelling bees. All the hopyards surveyed in 2014 were treated with imidacloprid. There was a far greater abundance of hailctids in hopyards compared to vineyards. Hops are irrigated much more then

vineyards and I speculate that this creates a better nesting habitat in hopyards for halictids then vineyards.

Table 1. One way analysis of variance results for crop detailing pooled results for trap color and week for average number of bees captured per trap for honey bees *Apis melifera* and bees in the families Halictidae and Megachilidae within each cropping system. Within each bee grouping (honey bee, Hallictidae, and megachilidae) pariwise student t-tests between riparian and crop are detailed.

Crop	df=	Honey bees	Hallictidae	Megachilidae
Mean square	4	11.842**	3523.888**	3.312**
Error	1495	0.477	46.003	0.229
Riparian	n=443	0.409±0.037	8.201±0.444	0.235±0.804
Blueberries	n=264	0.458±0.054	2.924±0.285[a]	0.011±0.106[a]
Concords	n=262	0.011±0.007[a]	0.882±0.152[a]	0.042±0.319[a] n=60
Grapes	n=280	0.186±0.053[a]	5.443±0.535[a]	0.075±0.302[a]
Wine grapes	n=251	0.064±0.017[a]	0.598±0.098[a]	0.008±0.089[a]

**/ANOVA is significant for Crop at $p<0.01$

a/ abundance of bees captured within this crop is significantly lower then within the riparian habitats.

Table 2 details the overall abundance of bees at the individual vineyard sites and compares the abundance of bees at the species level for honey bees and at the family level for the Halictuidae and Megachilidae between traps place within vineyards

Table 2. Bees captured ± standard error by grou and site

	Honey bees	Halictididae	Megachilidae
Canoe Ridge	0.102±0.046[a]	0.186±0.078[a]	0[a]
Columbia Crest	0.067±0.032[a]	0.050±0.028[a]	0[a]
Riparian	0.746±0.122	2.085±0.247	0.424±0.155
Hogue 1	0.076±0.039[a]	0.970±0.182[a]	0.030±0.021[a]
Riparian	0.197±0.054	7.167±0.690	0.379±0.122
Hogue 2	0.015±0.015[ns]	1.091±0.299[a]	0[b]
Riparian	0.106±0.044	3.242±0.336	0.076±0.033

a/ Means of bees captured per trapare significantly lower ($p<0.01$) in candidate vineyard then in the companion riparian habitat.

b/ Means of bees captured per trap are significantly lower ($p<0.05$) in candidate vineyard then in the companion riparian habitat.

ns/ Means of bees captured per traps are not significantly different ($p>0.05$) in candidate vineyard then in the companion riparian habitat.