

WHAT AFFECTS BEE AND PEST ABUNDANCE ON PIGEON PEA IN MALAWI?



PROBLEM:

- Bees are pollinators. Pollination is an essential ecosystem service that ensures that plants (including crops like pigeon pea) produce fruit and seeds. If more bees visit flowers, crops produce more fruit and seeds.
- Pigeon pea is a great crop for smallholder farmers to grow. It is drought resistant, improves soil properties and is very nutritious. It flowers in May – which is the dry season in Malawi. However, many farmers are discouraged by the large numbers of blister beetles (beetles of the family Melloidae) found feeding on pigeon pea flowers.
- From previous studies, we know that the abundance of both bees and pests on crops is affected by surrounding landscape. In temperate regions with a lot of large-scale agriculture, like in Europe and the USA, we usually find more bees and less pests in areas with a lot of natural habitat, such as forests or natural grasslands. This benefits crop yield by improving pollination services and reducing pest damage without the need to use chemical pesticides.
- **HOWEVER:** we don't know if this is also true in Malawi. Few studies have been done in sub-Saharan Africa to know how landscape effects bee and pest abundance on crops and how this affects crop yields. This is the first of such studies performed in Malawi.



A blister beetle commonly found feeding on pigeon pea flowers. This individual is a species from the genus *Hycleus*.



A carpenter bee (*Xylocopa inconstans*) foraging on a pigeon pea flower. ©FAO/Nature Kenya/Dino Martins.

Vogel C, Chunga TL, Sun X, Poveda K, Steffan-Dewenter I. 2021. Higher bee abundance, but not pest abundance, in landscapes with more agriculture on a late-flowering legume crop in tropical smallholder farms. PeerJ 9:e10732
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HOW DID WE PERFORM THE STUDY?

1. We selected 10 pigeon pea fields across Mzimba district, located in landscape with different amounts of natural habitat and agricultural area.
2. On each field, we walked 3 transects on different days, and counted the abundance of bees and blister beetles.
3. For 15 plants on each field, we quantified the proportion of flowers damaged by blister beetles.
4. We performed an insect exclusion experiment by bagging 15 clusters of flowers (to exclude both beetles and bees) and compared the pod set between bagged and unbagged flower clusters.



Tracking the formation of pods between an open cluster of flowers (left) and a bagged cluster of flowers (right). The bag prevents both pollinators and pests from visiting the flowers.

MAIN RESULTS

Effect of landscape composition on bee and blister beetles

- We found relatively few bees – 84 individuals belonging to 13 different species. The community was dominated by honeybees (*Apis mellifera*).
- Bee species diversity and blister beetle abundance was not affected by the differences in landscape.
- We found more bees on fields with more surrounding agriculture. Why? Malawi is in the seasonal tropics, which means insect abundance and diversity is highest just after the onset of rain. As pigeon pea flowers in May, when it is already dry season, it is logical to find more bees in areas where there are still flowers, since this is their source of food.
- This result contrasts with studies from larger-scale temperate agriculture, but is similar studies performed in Kenya on pigeon pea. This shows that context is important, and therefore, smallholder farmers in sub-Saharan Africa need more representation in agro-ecological research.
- Pigeon pea is an important food source for bees in agricultural areas, and can help them survive the dry season which is a period of scarcity for them. Therefore, growing pigeon pea should be encouraged to help maintain bees in agricultural areas for pollination services.

Effect of landscape composition on beetle damage and fruit set.

- The proportion of flowers damaged by beetles was not affected by the landscape composition.
- The proportion flowers turning into pods was not affected by the landscape composition.

Effect of bees and beetles on pod production

- We did not find a direct effect of excluding bees and beetles on the formation of pods. In other words – bagged (no beetles and no bees visiting flowers) and open clusters (bees and beetles both visiting flowers) had about the same pod set. There are two explanations for this: (1) beetle damage and bee pollination cancel each other out, meaning there is no net effect on pod set. Or (2) farmers may also be over-estimating the effect of blister beetles as they are so large and conspicuous.