

# Wing polymorphisms of *Pterostichus melanarius* (Coleoptera: Carabidae) (Illiger, 1978) in Alberta pulse crops

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## Abstract

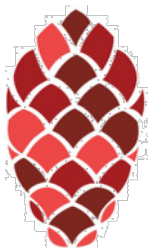
In a 6 week research project, a wing-dimorphic carabid species was studied to identify the proportions of macropterous (large functional wings) individuals and brachypterous (short, rudimentary wings) individuals from different pulse growing regions of Alberta. *Pterostichus melanarius* L. (Coleoptera: Carabidae) can be short-winged (SW) due to brachyptery being a dominant gene or long-winged (LW) individuals causing macroptery. Although macroptery is a recessive trait, the LW morph persists through the recolonization of populations due to human disturbance. Their ability to fly facilitates their dispersal across Alberta to uncolonized areas. Samples of *P. melanarius* were captured as bycatch from pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae) pitfall traps from the East, Capital, and Central regions of Alberta. Traps were positioned on a 175 meter transect pea and faba field margins in spring and again in the fall. Captured *P. melanarius* were identified and separated by collection site and date and stored in 95% ethanol until measurements. The beetles from the bycatch samples were sexed using tarsal characteristics. Anterior tarsal segments of the front pair of tarsi are dilated in males and normal in females. After being identified and recorded as “M” or “F”, they were mounted on a foam board with insect pins for measurement. The elytra (forewings) length and width was measured followed by measurement of their hindwings. They were classified as “SW” or “LW” depending on the functionality of their wings. Out of 440 individuals from the Capital region, 17.1% of captured *P. melanarius* were LW and 83.0% were SW. From the Central region 21.6% of 495 beetles were LW and 83.4% of them were SW. In the East region less *P. melanarius* were captured and from 94 individuals, 46.8% were LW and 53.2% were SW. Macropterous individuals are more common in the East region due to recolonization of populations whereas in the Central and Capital region the proportions of SW are much larger. In regions that have established populations of *P. melanarius* the proportions of SW are greater than LW.

Key words:

*Pterostichus Melanarius*, wing polymorphism

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# Wing polymorphisms of *Pterostichus melanarius* (Coleoptera: Carabidae) (Illiger, 1978)

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### Introduction

*Pterostichus melanarius* is a common ground beetle found throughout North America but is native to Europe<sup>1</sup> (Fig. 1). Populations of *P. melanarius* are wing dimorphic with some macropterous individuals with large functional wings and other brachypterous individuals with short, rudimentary wings<sup>2</sup>. Populations with both wing morphs occur in Alberta. The prevalence of this species increases particularly in Alberta's agricultural areas.

*Pterostichus melanarius* is very common in Alberta due to rapid colonization due to wing dimorphic populations. The SW (short-winged) *P. melanarius* have the dominant gene causing brachypterous individuals<sup>3,4</sup>. The LW (long-winged) trait is the recessive gene, causing macroptery. The inheritance of the two wing types is explained by Mendelian inheritance. Although the LW gene is recessive, the LW morph persists through the recolonization of populations due to human habitat disturbance. Macropterous individuals are important for dispersal of *P. melanarius* to uncolonized areas because of their ability to fly.

The purpose of this project is to identify the proportion of LW and SW individuals of *P. melanarius* captured in pitfall traps as bycatch in three pulse growing regions in Alberta.

### Methods

#### Sample collection

- Pterostichus melanarius* were collected from pitfall traps baited with pea leaf weevil, *Sitona lineatus* (Coleoptera: Curculionidae), pheromone in three regions of Alberta (East, Central, and Capital).
- Pitfall traps were positioned along a 175m transect at the edge of pea and faba fields from May – June and again from August – September, 2018.
- Pterostichus melanarius* were identified (by collection site and date) and stored in 95% ethanol until measurement.

#### Separation by sex

- Beetles were separated by sex using tarsal characteristics<sup>5</sup> under a microscope (10X).
- Anterior tarsal segments of the front pair of tarsi are dilated in males.
- Beetles were recorded as "F" or "M" depending on their sex.

#### Elytra and wing measurements

- Beetles were mounted on a foam board with insect pins and the elytra (forewings) length and width were measured (1-2, 3-4) (Fig. 2).
- The length of one hindwing was measured and each beetle was classified as 'SW' or 'LW' depending on the functionality of their wings.

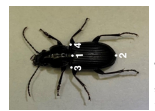


Fig. 2. Illustration of measurements: 1-2 – elytra length, 3-4 – elytra width



Fig. 3. Long wing and short wing



Fig. 1. Adult *Pterostichus melanarius*

### Results

- Out of 440 individuals from the Capital region, 17.1% of captured *P. melanarius* were LW and 83.0% were SW.
- Out of 495 individuals from the Central region, 21.6% were LW and 83.4% were SW.
- Out of 94 individuals from the East region, 46.8% were LW and 53.2% were SW.

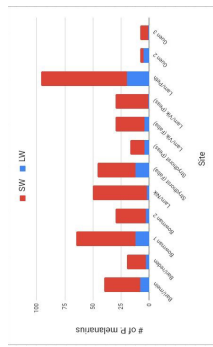


Fig. 4. Proportions of LW and SW captured from each site of the Capital region.

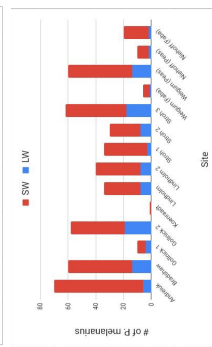


Fig. 5. Proportions of LW and SW captured from each site of the Central region.

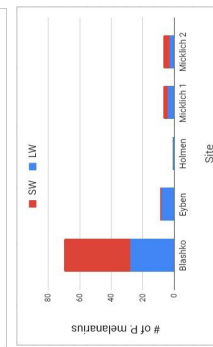


Fig. 6. Proportions of LW and SW captured from each site of the East region.

- SW carabids are more prevalent than LW as a result of brachyptery being the dominant gene of this species.
- The proportions of SW are greater than LW in more established regions such as Capital and Central region.
- LW *P. melanarius* are more common in the East region due to the recolonization of populations.

### Conclusions

- From the data collected we recognize that *P. melanarius* is less prevalent in newly colonized areas such as the East region and is almost absent in the Peace region.
- In regions that have established populations of *P. melanarius* the proportions of SW are greater than LW.
- As colonies disperse across Alberta, the proportions of LW increase because of their ability to fly.

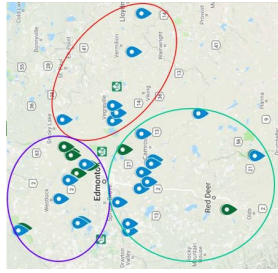


Fig. 7. Sites in the East region, Capital region, and Central region

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