Figure-1: Wheat head armyworm larvae and damaged wheat seeds

Pheromone lures as monitoring tools for wheat head armyworm

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Wheat head armyworm by the name itself portraits that it is an insect pest of wheat that feeds on a wheat head (Figure 1). Traditionally, this insect pest has caused very minor damage to wheat, but in the recent years considerable wheat crop injury has been noticed, particularly in the Golden Triangle area of Montana. Seed damage inflicted by wheat head armyworm larvae are usually tough to differentiate from other stored product pests and the damaged seeds. The larvae of wheat head armyworm damage to seeds is categorized as 'IDK' (insect damaged kernels) and infestations in the field are generally sporadic. According to the literature, wheat head armyworms consist two species; *Dargida terrapictalis* (Buckett) and *Dargida diffusa* (Walker) (Lepidoptera: Noctuidae) and the later species is known to present in Montana. The incidence of *Dargida diffusa* occurs every year in Montana particularly in the Golden Tringle. A Pacific Northwest Extension Publication covering the identification, biology and integrated pest management of the wheat head armyworm complex in the Pacific Northwest is available online for free to download, http://smallgrains.wsu.edu/wp-content/uploads/2017/06/PNW696.pdf.

To develop an Integrated Pest Management (IPM) strategy for wheat head armyworm pest control, Montana State University-Western Triangle Agricultural Research Center (MSU-WTARC) has been working since 2015 on developing diverse IPM tools that include discovering environmental friendly biopesticide products and pheromone based pest monitoring techniques. In 2015, WTARC entomology/insect ecology research team members tested the efficacy of several commercially available biopesticide products against the wheat head armyworm larvae under laboratory conditions. Entrust WP (spinosad 80%) was found to be effective and fast acting, resulting in close to 100% mortality within three days after application. Additionally, these studies demonstrated that entomopathogenic (insect killing) fungus Xpectro OD (*B. bassiana* GHA + pyrethrins) and Mycotrol ESO (*B. bassiana* GHA) were also able to kill the wheat head armyworm larvae but it took a longer time (6-9 days). Additionally, these results have published in the Journal, *Toxicology Reports* (Reddy and Antwi, 2016) and it can be downloaded free from the journal website).The Entomology/Insect Ecology team at WTARC is committed to moving this research from the laboratory to research field and finally to farm field application.

Figure-2: Universal moth trap in winter fields at WTARC

Auxiliary research work on the field monitoring of wheat head armyworm adults population using sweep nets and synthetic sex pheromones also began in 2016 under Montana State University's Extension Implementation Plan for Integrated Pest Management that was funded by USDA-NIFA. In this regard, field studies were undertaken in Pondera and Choteau County to determine the population levels and pheromone dose response to use in pest monitoring. Although, a sex attractant for whet head armyworm was identified by Underhill and his coworkers in 1977, the pheromone dose was not yet determined for field application.

At all study sites, wheat head armyworms were captured in pheromone traps or sweep net at about the same date, June 05-15, in 2015 and 2016. The highest adults were captured between last week of June and first week of July. Regardless of study locations, significantly higher number of wheat head armyworms were captured on traps with pheromone lures while none were captured on traps without pheromone lures (control treatment).

The right dose of pheromone compounds in the rubber septa lures is important as the higher dose will have repellent action against the insects. Our field trapping studies indicated that traps with rubber septa containing 1 mg of the compounds (Z)-11-hexadecenyl acetate (Z11-16Ac) and (Z)-11-hexadecenal (Z11-16Ald) with Hercon Vaportape captured similar number of moths when compared with pheromone traps with rubber septa consisting 3 mg and 10 mg. This clearly indicates that 1 mg of pheromone compounds is adequate to capture the moths and use of higher will not be helpful.

The results will be helpful to develop the monitoring, mass trapping and mating disruption techniques for the wheat head armyworm in the coming years.