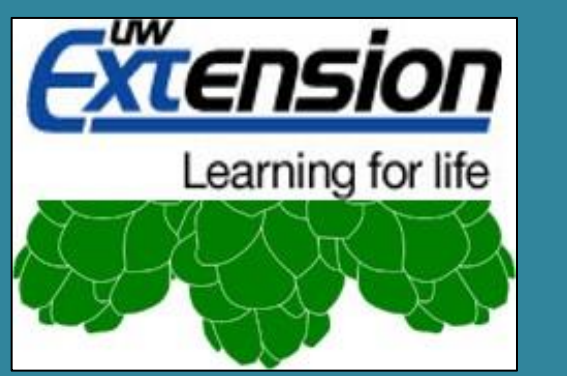




Mefenoxam insensitivity in Wisconsin hop *Pseudoperonospora humuli* populations

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Introduction

- Hops have become a significant specialty crop in Wisconsin (WI) and other Midwestern U.S. states
- Downy mildew caused by *Pseudoperonospora humuli* has been a persistent and increasing disease due to relatively high humidity and frequent precipitation during the production season in this region
- Phenylamide fungicides, including mefenoxam and metalaxyl, have been shown to be highly effective in controlling downy mildew, however, this class is highly prone to pathogen resistance development and insensitivity within *P. humuli* populations has been documented in other hop growing regions^{1,2}
- Use of phenylamide fungicides in WI has been limited due to 1) knowledge of resistance in other states, 2) concern of disease control failure, and 3) expense
- Our objective was to screen *P. humuli* populations from WI hops yards in 2015 & 2016 to inform prescriptive use of phenylamide fungicides to growers for improved downy mildew control statewide**

Materials & Methods

- A leaf disk assay modified from Gent (2008)¹ was used to evaluate the phenylamide sensitivity status of WI *P. humuli* populations in 2015 and 2016
- Isolates of *P. humuli* were collected from intact spikes in August of 2015 and April-June of 2016 from 5 hop yard locations in 4 counties (Figs. 1 & 2)
- Leaf disks sourced from 'Nugget' hop plants maintained in a disease-free greenhouse on the campus of University of Wisconsin-Madison; disks applied to media 24 hr prior to pathogen inoculation (Fig. 4)
- Petri plates prepared with 10 ml of 1% water agar (control) or 10 ml 1% water agar amended with 25 µg/ml of mefenoxam (Ridomil Gold® SL, Syngenta) (Fig. 3)
- Total number of sporulating sites counted on leaf disks after 5-7 days incubation under ambient laboratory conditions
- Isolate determined as 'insensitive' or resistant if pathogen sporulation incidence on fungicide-amended plates ≥ 50% of incidence on control plates
- An isolate was excluded from the test if less than 50% of sites showed sporulation on non-amended media

Results & Conclusions – 2015 & 2016

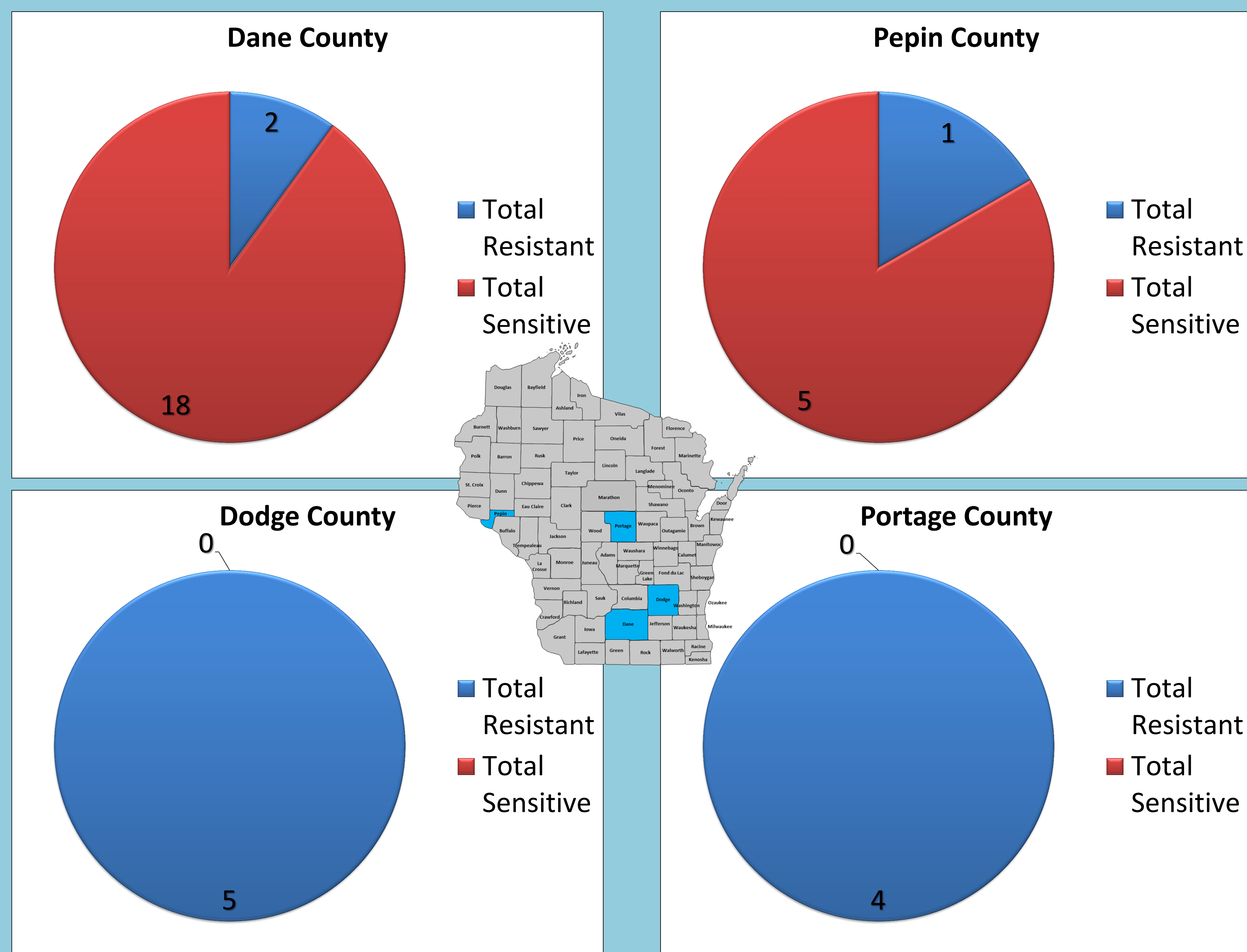


Figure 1. Number of sensitive and resistant isolates detected in each of 4 counties in WI representing collections made in 2015 and 2016. 35 isolates were successfully screened from 56 total isolates collected.

- 12 isolates were insensitive to mefenoxam of 35 total isolates analyzed**
- Insensitive isolates were detected in all 4 counties sampled**
- Recommendations for prescriptive use of phenylamide fungicides will need to be made on a site-by-site basis**

Figure 2 (right). A. Intact spike showing *P. humuli* sporulation on leaf undersides. B. Sporangia were removed from hop leaves by agitating infected leaves in ~20 ml of water. C. Sporangial suspensions were adjusted to 10⁴ sporangia/ml prior to inoculation on leaf disks.

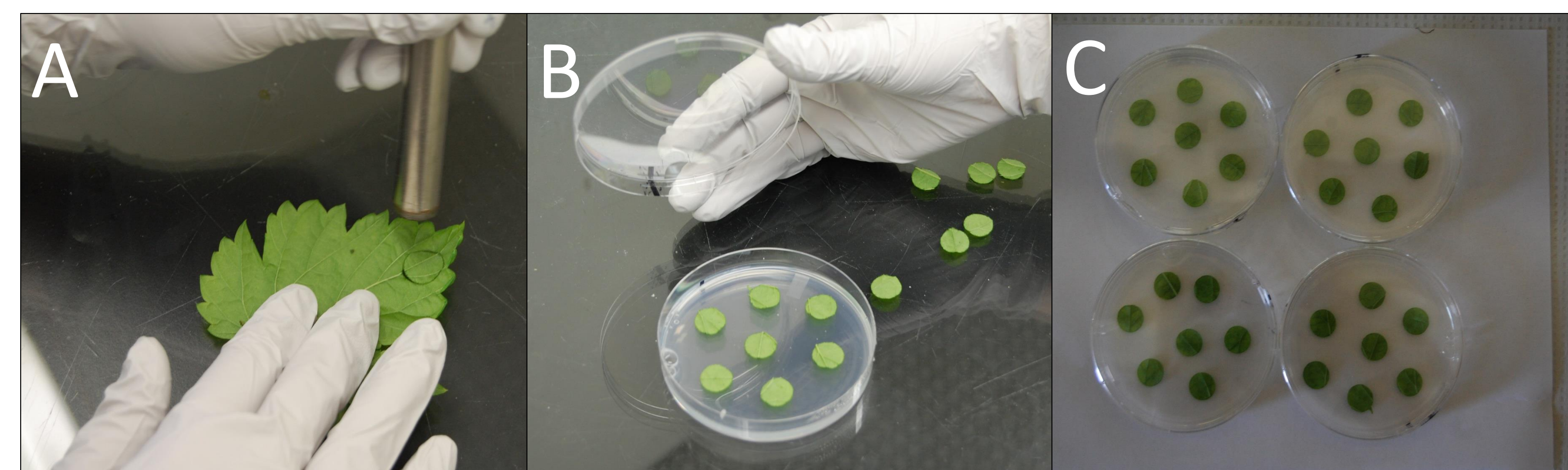
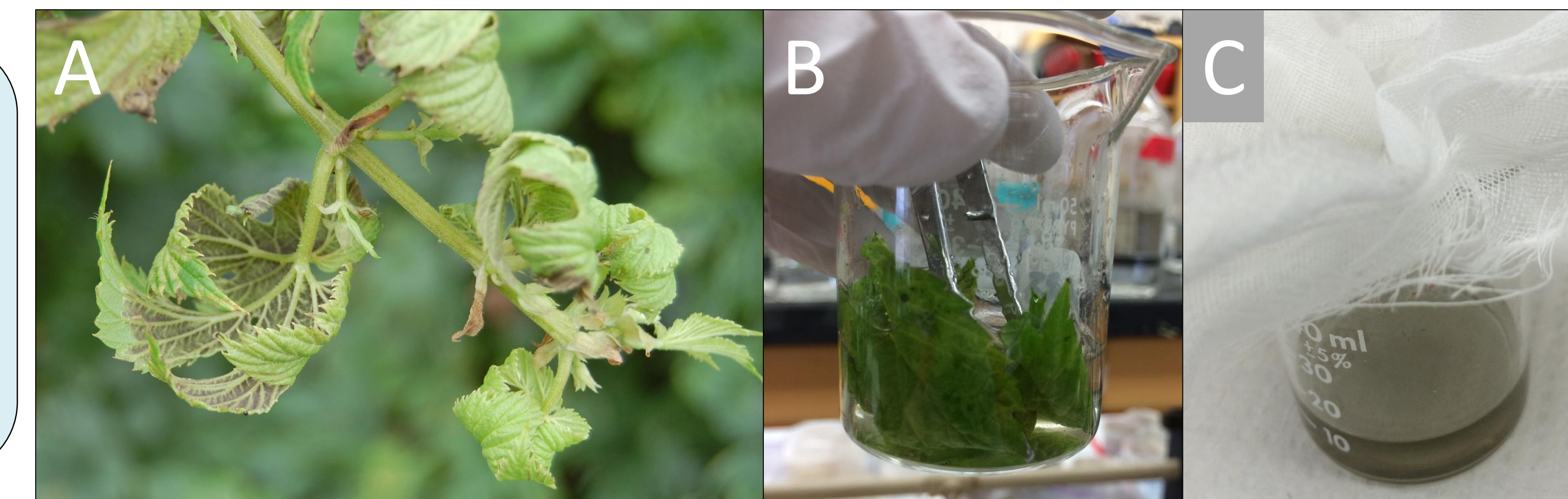
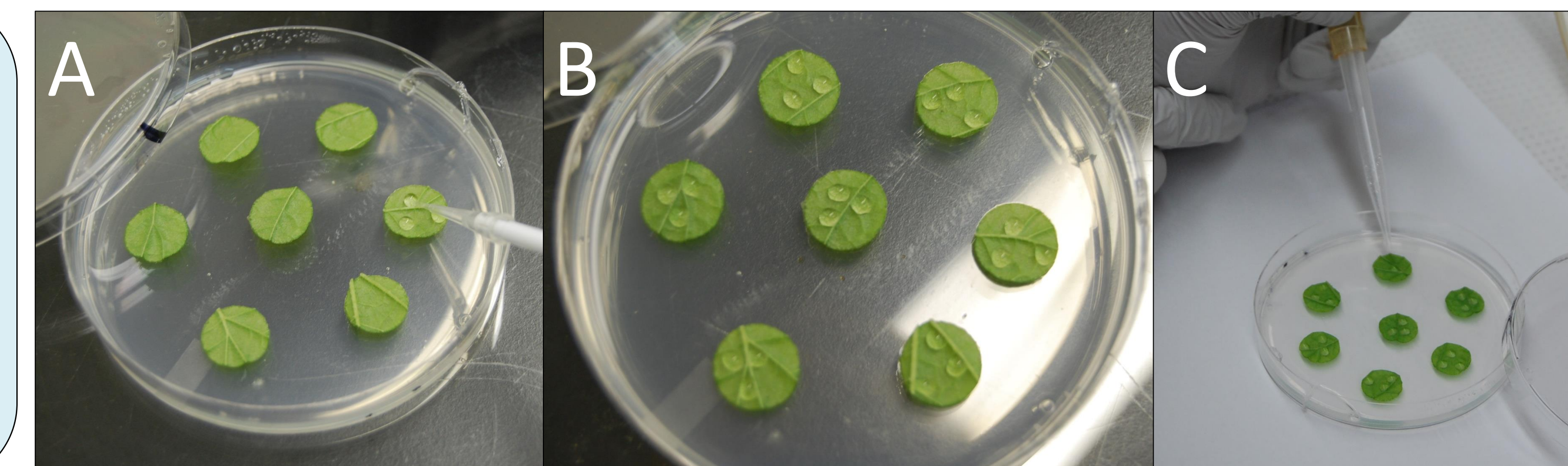


Figure 3 (left). A. Leaf disks 1 cm in diameter were cut with a cork borer. B. Seven leaf disks were arranged on each plate. C. Test for each isolate consisted of two non-fungicide amended control plates and two fungicide-amended plates.

Figure 4 (right). Inoculation procedure. A. Each leaf disk inoculated with 10 µl of inoculum in 3 locations. B. Seven leaf disks x 2 plates x 3 inoculate sites per disk = 42 replication sites per treatment. C. Inoculum droplet removed via aspiration 24h after inoculation.



References

- Gent, D. H., Nelson, M. E., Grove, G. G. 2008. Persistence of phenylamide insensitivity in *Pseudoperonospora humuli*. *Plant Dis.* 92:463-468.
- Hunger, R. M., Horner, C. E. 1982. Control of hop downy mildew with systemic fungicides. *Plant Dis.* 66:1157-1159.

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