

Response of Italian ryegrass Accessions from Southern Piedmont Region in North Carolina to Spring Burndown Herbicides

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Introduction

- Italian ryegrass is a troublesome weed commonly found in agronomic systems across United States (Bridges 1992).
- Obligate outcrossing species with large seed production, which predispose this weed for evolution of herbicide resistance (Brunharo and Hanson 2018).
- Currently, Italian ryegrass has evolved resistance to 7 modes of action in United States (Heap I 2023).
- Paraquat-resistant Italian ryegrass populations were confirmed in North Carolina (Heap I 2022).

Objective & Hypothesis

Objective

- To investigate the presence of multiple-resistant Italian ryegrass in South-central North Carolina.

Hypothesis

- Italian ryegrass populations will survive multiple modes of action.

Materials and Methods

- Seed samples from Union and Stanly counties (Figure 1), NC, were randomly collected from fields naturally infested with Italian ryegrass
- Samples consisted of seedheads from multiple plants from each location
- RCBD with 5 replications and 2 runs
- Factorial 6 x 38 design
 - Each individual plant was considered a replicate
 - 5 herbicides treatments plus untreated control
 - 38 populations tested
- Herbicide treatments: clethodim (271 g ai ha⁻¹), glyphosate (1260 g ae ha⁻¹), glufosinate (880 g ai ha⁻¹), nicosulfuron (34 g ai ha⁻¹), paraquat (840 g ai ha⁻¹)
- Plants were sprayed at 10 cm height with a CO₂ pressurized backpack sprayed calibrated to deliver 140 L ha⁻¹
- At 28 days after treatment, plant survival as assessed visually as alive (green tissue with evidence of regrowth, 1) or dead (necrotic, 0)
- Accessions with ≤50% (± standard error) plant mortality were classified as resistant, as described by Faleco et al. (2022)
- Statistical analysis was conducted in R software utilizing the basic packages, mean separation was done utilizing fisher's LSD protected method at α=0.05

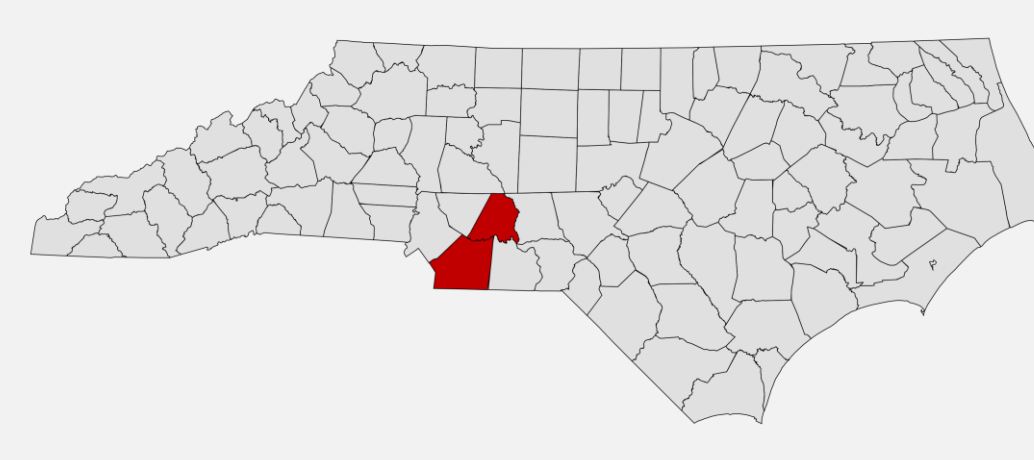


Figure 1. Stanly (North) and Union (South) counties, North Carolina.

Figure 1: Italian ryegrass percent mortality (± standard error).

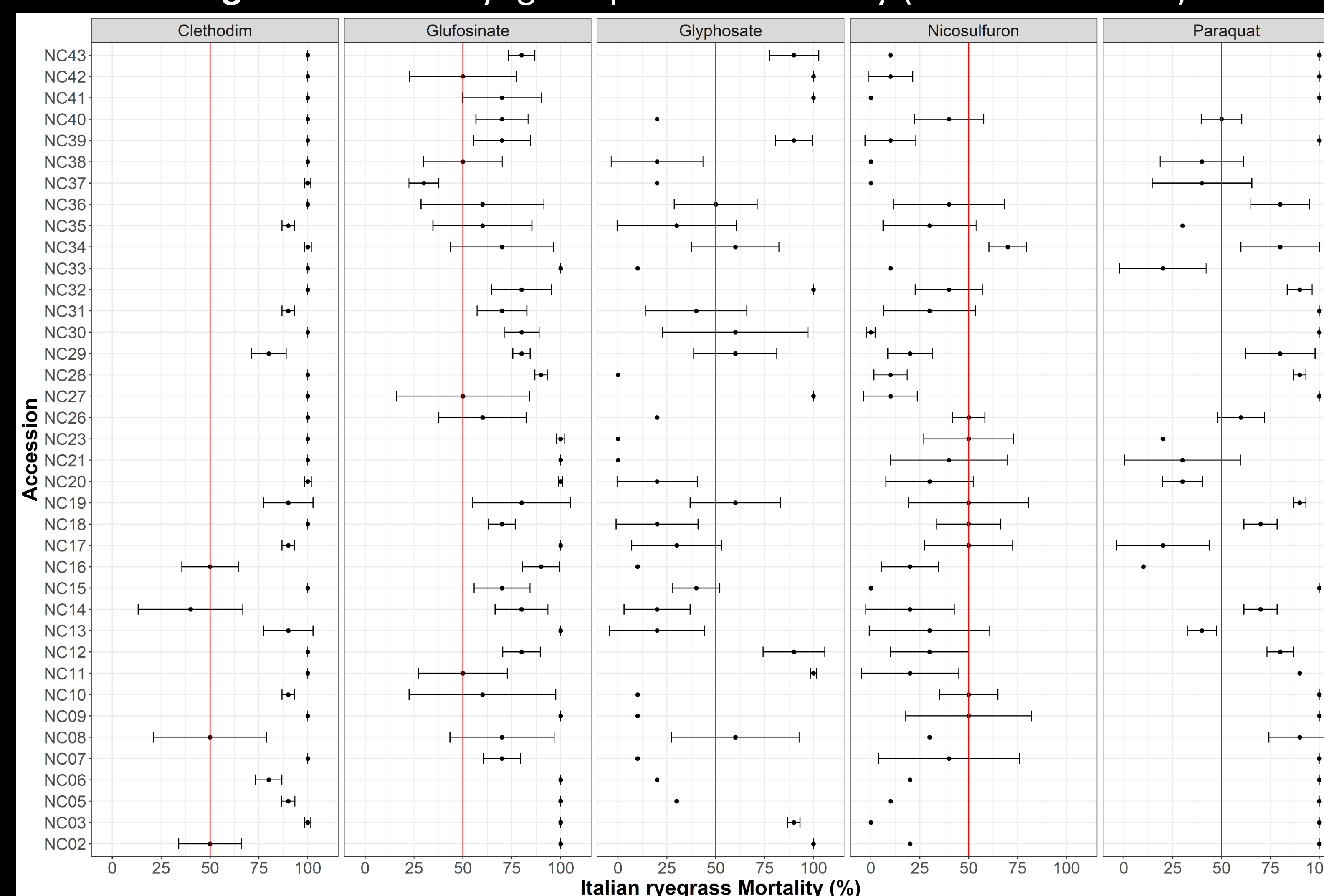


Figure 2: Percent of tested populations with mortality ≤50% for each herbicide treatment.

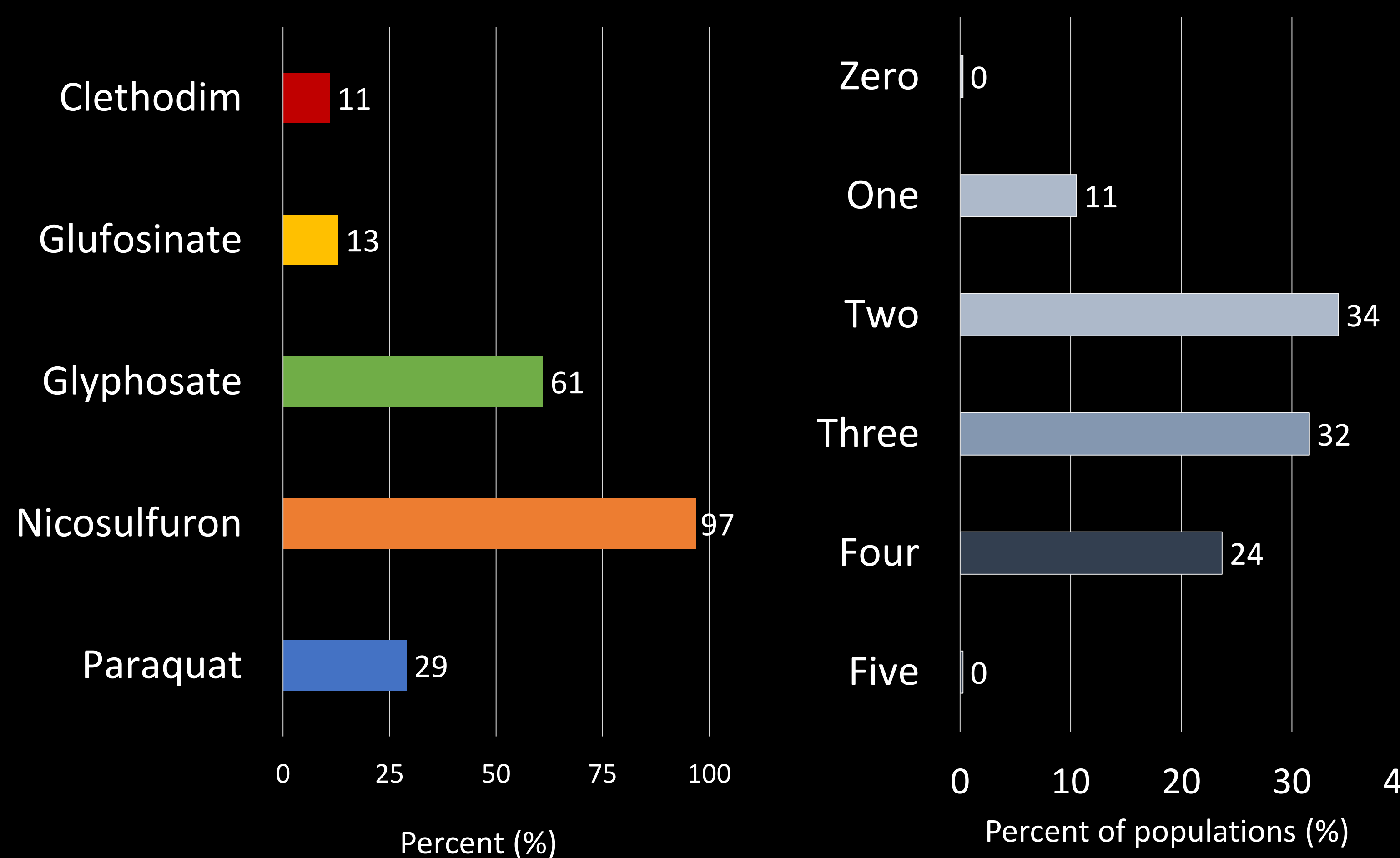


Figure 3: Percent of tested with resistance to Multiple Modes of Action.

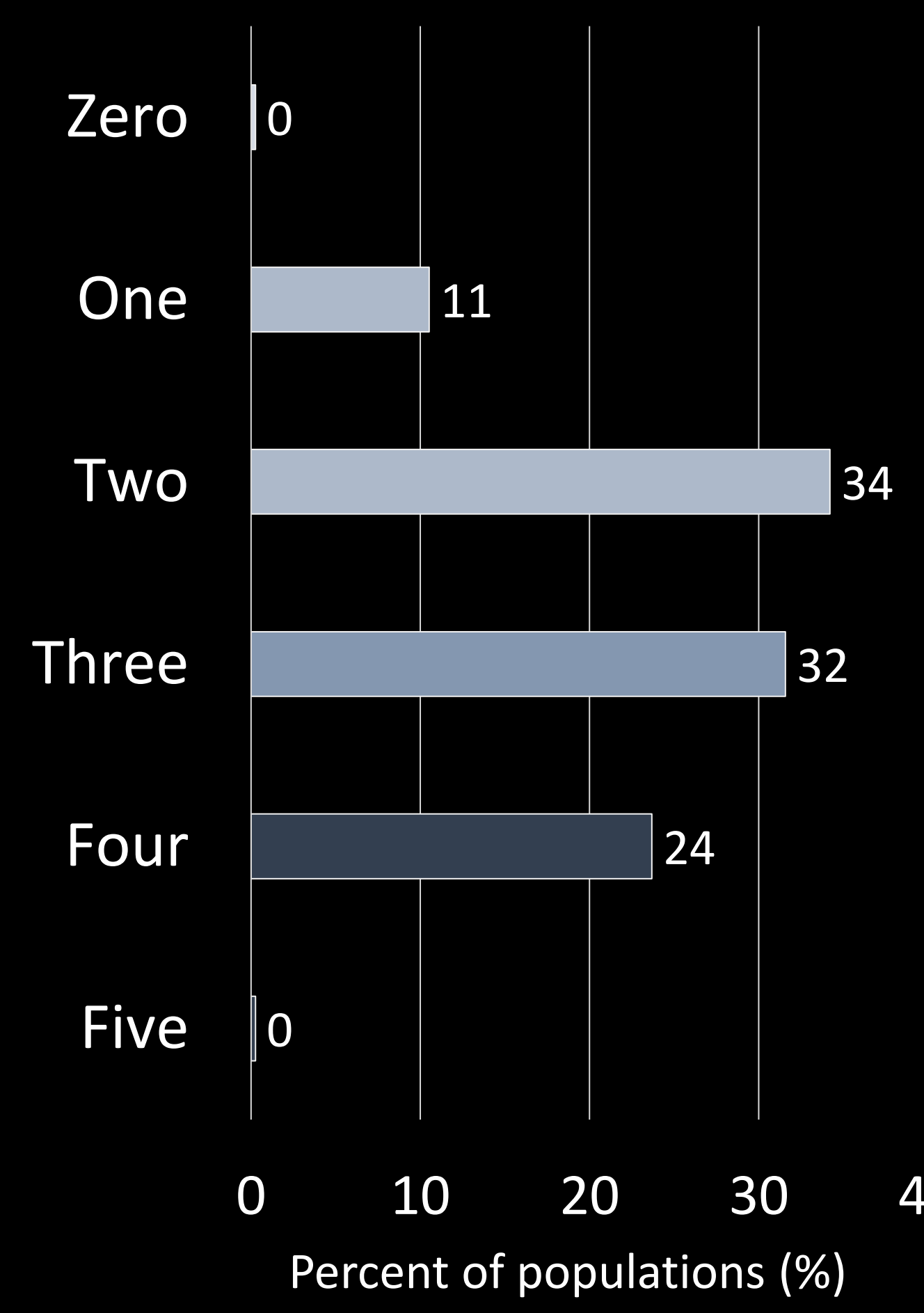
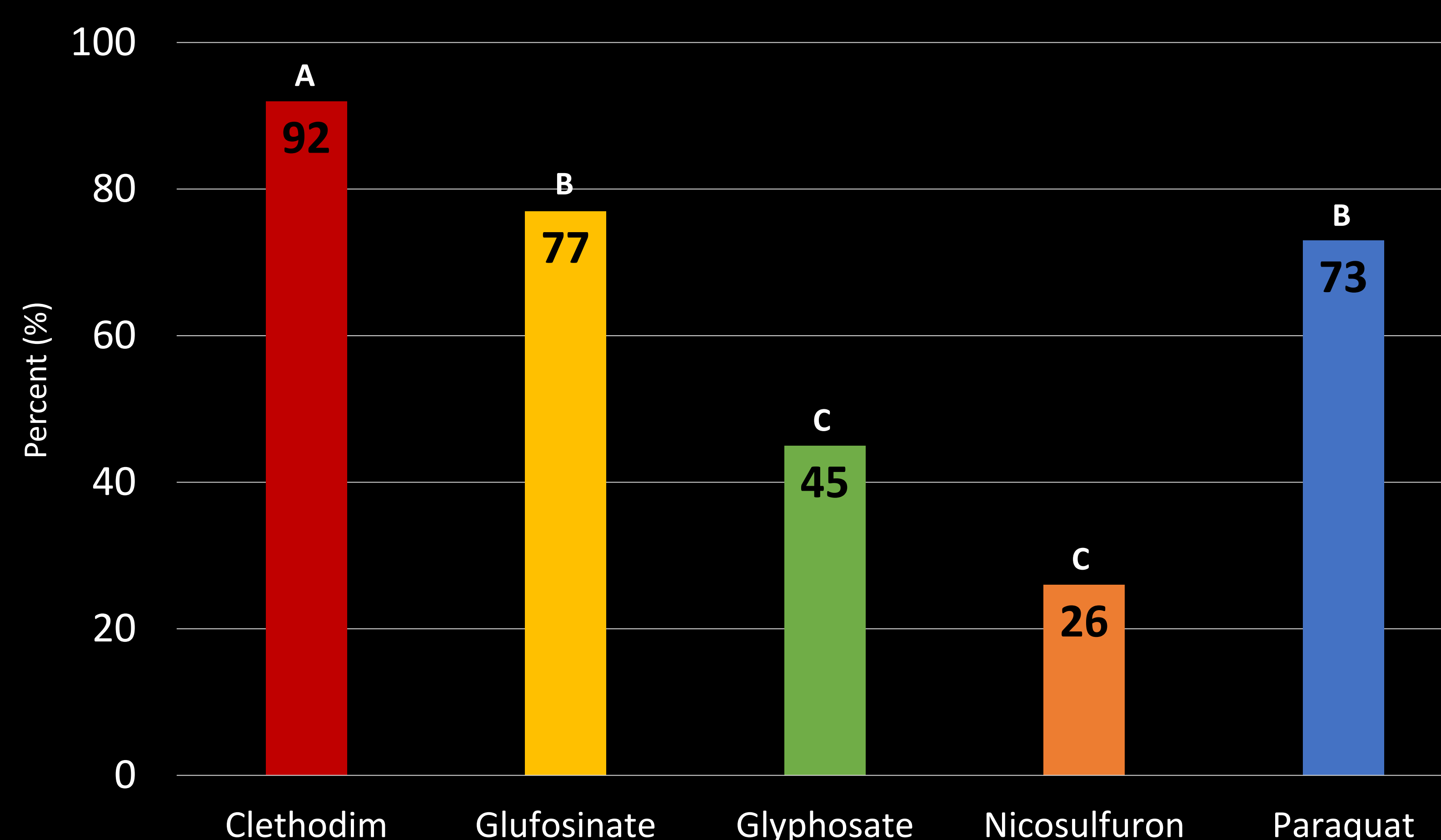


Figure 4: Italian ryegrass mortality averaged over populations.



Results & Discussion

- 11 accessions survived paraquat at 840 g ai ha⁻¹, which suggests that resistance has already spread within Stanley and Union counties, NC (Figure 1).
- 61% and 97% of accessions tested survived to glyphosate and nicosulfuron, respectively (Figure 2).
- 32% and 24% of accessions tested survived 3 and 4 herbicides out of the 5 treatments, respectively (Figure 3; Image 1).
- Clethodim presented the highest Italian ryegrass mortality with 92% across all populations (Figure 4).
- The first sighting of paraquat-resistant ryegrass in US was in California (Brunharo and Hanson 2018); however, this is the first sighting in row-crops production in US.
- Although Italian ryegrass resistant to groups 1, 2, 9, and 10 have already been reported in North Carolina (Jones et al. 2021; Heap I 2022), populations surviving multiple modes of action impose a greater threat to growers.



Image 1: Population that survived 4 of the 5 herbicides tested (left to right: nontreated control, glyphosate, nicosulfuron, paraquat, and clethodim).

Conclusions & Significance to NC

- Preliminary results suggest Italian ryegrass populations resistant to multiple herbicides and modes of action is present in NC.
- Updated knowledge of the Italian ryegrass resistance status in NC is necessary to support growers with accurate weed management recommendations.

Future Research

- Evaluate control options for multiple herbicide-resistant Italian ryegrass, including fall residuals in combination with cover crops.

Works Cited

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