

4-16-2012

See No, Smell No, Taste No Evil: How Sage- Grouse Detect Toxic Sagebrush

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See

- Some toxins, like phenolics, reflect light in the UV and visible spectrum (Fig. 1, “see” activity)¹

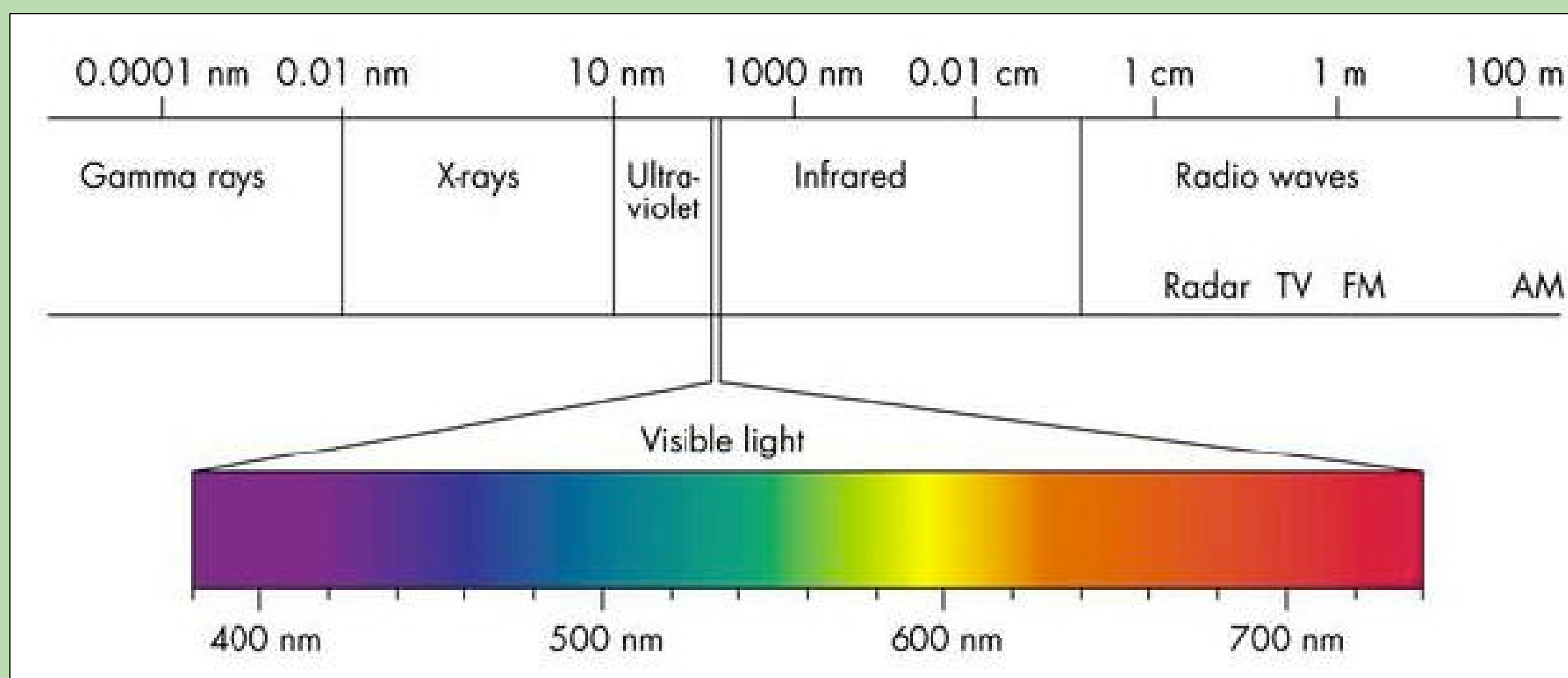


Fig 1. The electromagnetic spectrum showing the ranges of visible light and ultra-violet (UV) light.

- Grouse and other birds can see in the UV spectrum^{2,3}
- Species of sagebrush selected and avoided by sage-grouse differ in spectral profiles (Fig. 2)

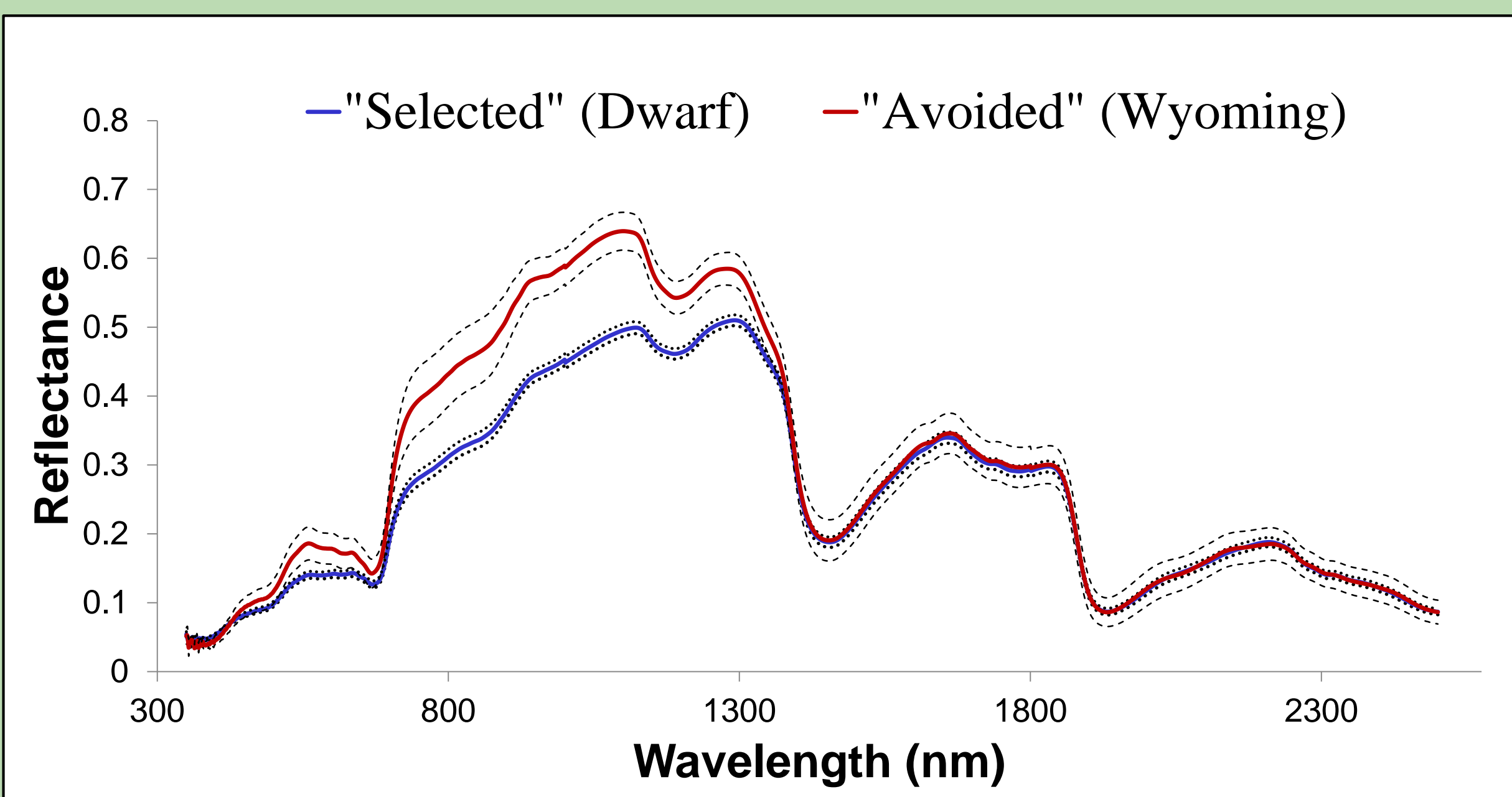


Fig 2. Average spectral profile of a sagebrush species (*Artemisia nova*) preferred (n=144) and a species avoided (*Artemisia tridentata wyomingensis*) (n=22) by sage-grouse.

We propose that sage-grouse could select less toxic plants by sight

Smell

- Monoterpenes are a class of small volatile, aromatic chemicals found in sagebrush (“smell” activity)
- Gas chromatography allows us to visualize these smells
- Sagebrush species differ in their monoterpene profile (Fig. 3)

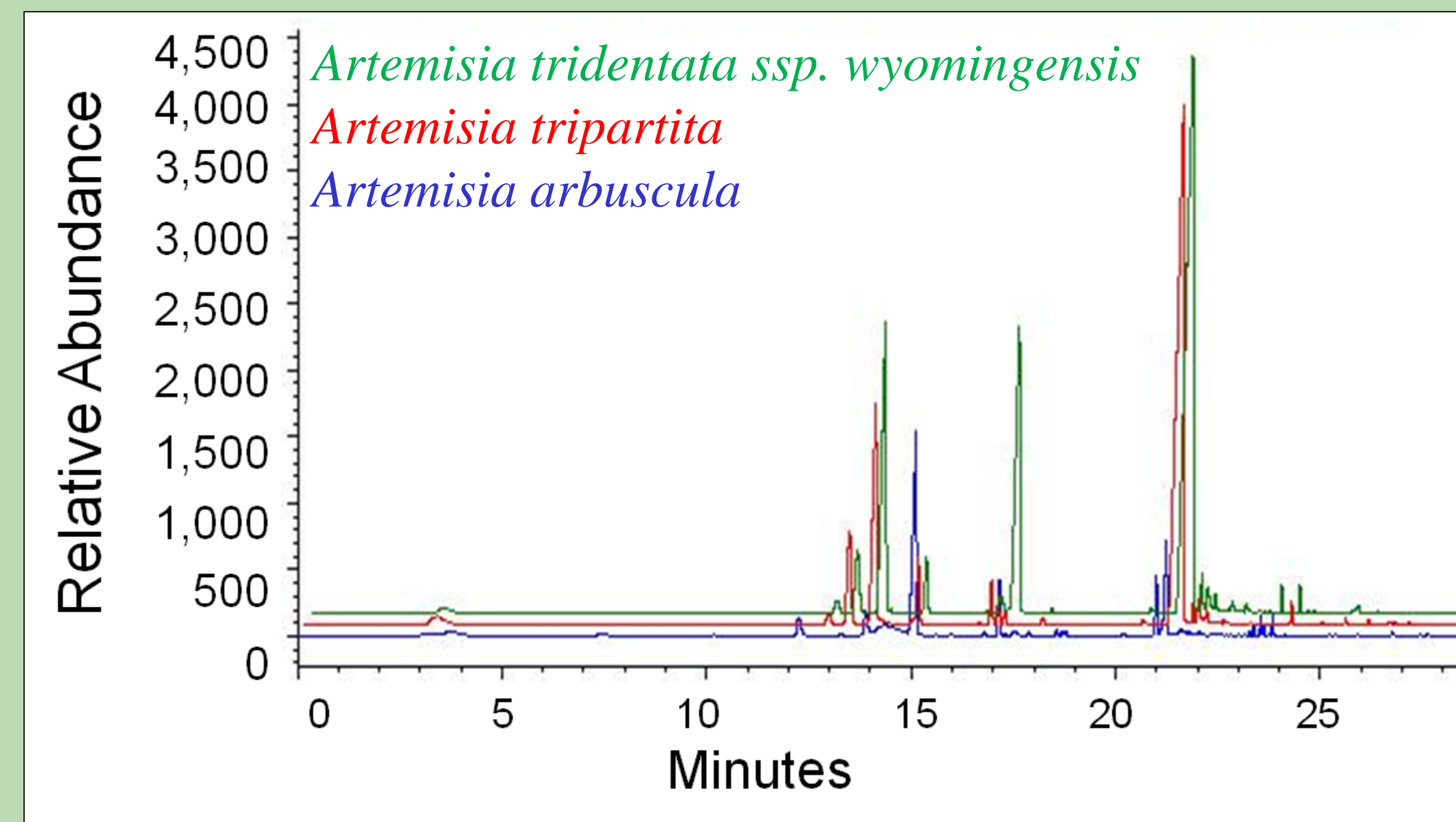


Fig 3. Gas chromatogram showing the different retention times of monoterpenes in three species of sagebrush, *Artemisia tridentata ssp. Wyomingensis* (green), *Artemisia tripartita* (red), and *Artemisia arbuscula* (blue).

- Species differ in amount of monoterpenes (Fig. 4)

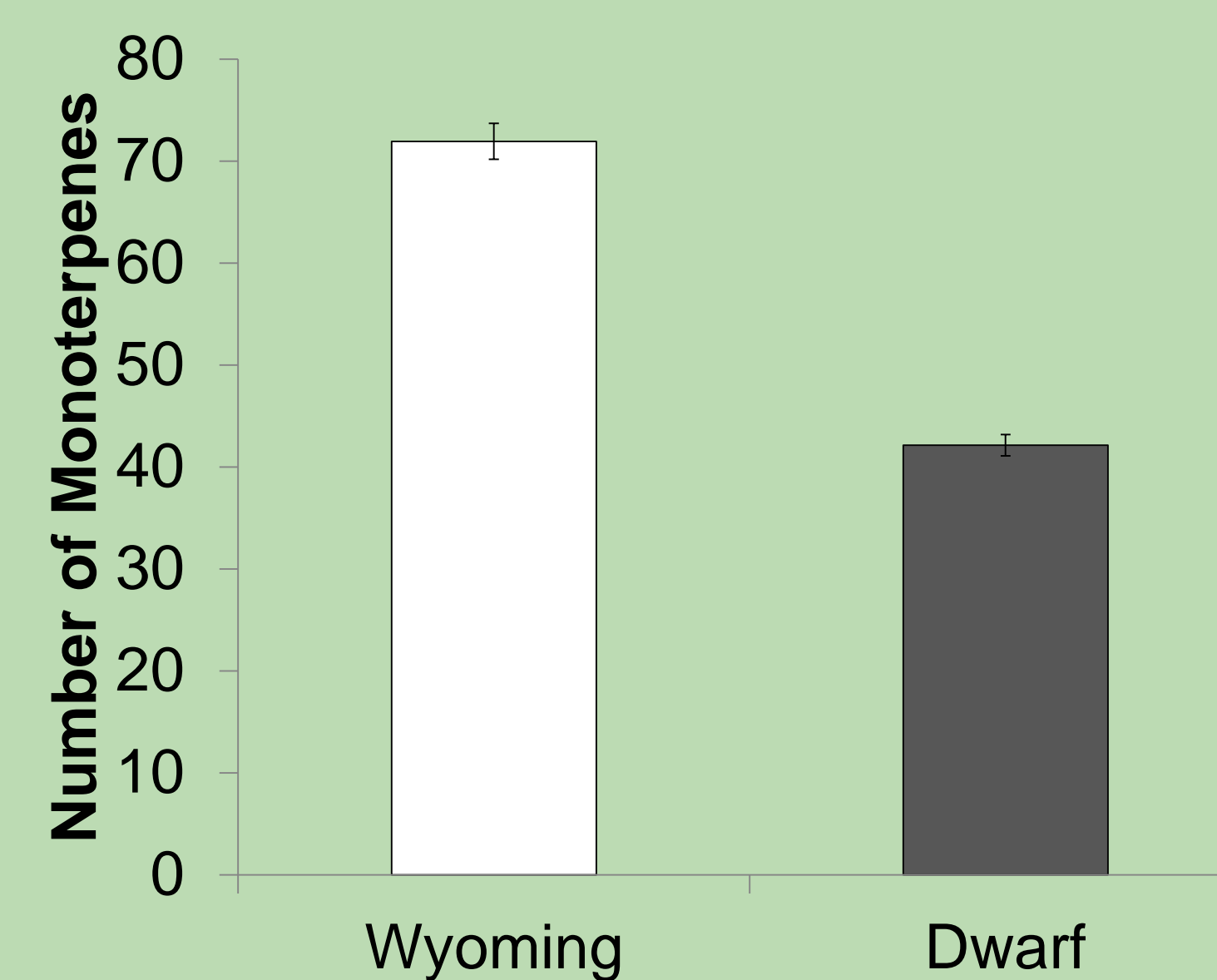


Fig 4. Number of monoterpenes detected in two species of sagebrush available to wintering sage-grouse

We propose that sage-grouse could select less toxic plants by smell

Taste

- Birds have approximately 100 oral taste buds (Fig. 5), vs. 9000 in humans⁴
- Birds have a diversity of taste receptors⁵
- Bitter taste influences diet selection in birds^{6,7}
- Chemicals in sagebrush have a bitter taste (“taste” activity)⁸

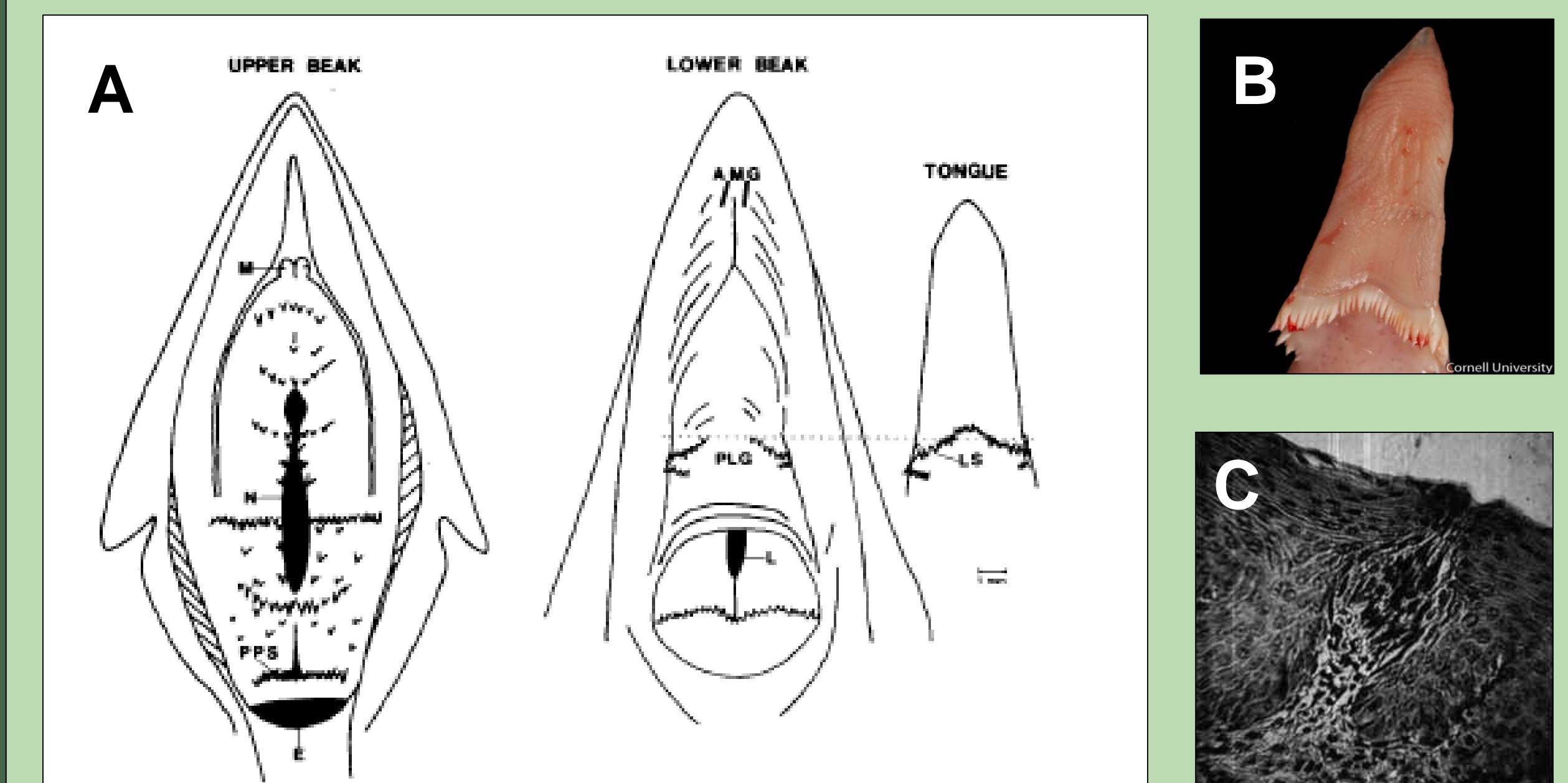


Fig 5. A. Map of taste buds (black dots) in the upper and lower beak and tongue of domestic chickens⁹, B. Bird tongue showing fold and wings and C. Pictomicrograph of taste bud¹⁰.

We propose that sage-grouse could select less toxic plants by taste

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Support

This project was supported in part by the BLM CCS grant awarded to J. Forbey.

