Ambrosia artemisiifolia seed predation levels in Hungarian arable fields and adjacent semi-natural habitats: a key ecosystem service for weed management

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Ambrosia species

❖A problematic weed species, Originated in North America, widely spread in Europe, reported in Hungary in 1920.

❖ Control/management: mechanical, agronomic, and biological methods, with more reliance on herbicides.

❖ Requires the identification of sustainable management measures.

❖ IWM approach provides a balance in weed control while conserving the botanical diversity of weed species and weed seed predators.

Ambrosia artemisiifolia

Weed seed predation

- Weed regulation by natural mechanisms e.g., weed seed predation is a key ecosystem service (Begg, et al., 2017).
- Causes substantial weed seed losses, thus decreasing the emerged weed seedlings next season (Westerman et al., 2003).
- It provides sustainable weed management in agricultural fields, therefore, could minimize herbicide use.

Weed seed predation

- The presence of SNHs in fields edge is crucial for biological weed control, as they host beneficial organisms (weed seed predators).

- Seed predators (carabids) were found to consume weed seeds in the laboratory (Honek, et al., 2003), and in the fields.

- In Hungary: in winter wheat and the adjacent SNHs
  - Presence of arthropod seed predators was reported (Kiss et al. 1993)
  - Peter et al. (2001) studied the carabids' composition and phenology.

- Carabid beetles of 10 species were reported e.g., *Harpalus distinguendus*, *Amara aenea*, *Agonum dorsale*.

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Hypothesis and Aims

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- This work considers the potential role of ground-dwelling arthropods in weed seed consumption, seed bank reduction, and weed regulation.

- We expected that seed predators will consume *A. artemisiifolia* seeds but seed consumption levels may vary with habitat type.

Aims

✓We investigated post-dispersal invertebrate (arthropods) seed predation levels on *A. artemisiifolia* inside crop fields and SNHs

✓Compare predation levels in fields with those in SNHs

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Research Materials and Methods

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1) **Fresh seeds:** *Ambrosia artemisiifolia*, obtained from Herbiseed Twyford, UK

3) **Sandpaper 25/10cm, P=60**

2) **Meshes metal wire 1x1, 2x2 cm diameter**

4) Glue Spray Amount Adhesive (400ml/282 g

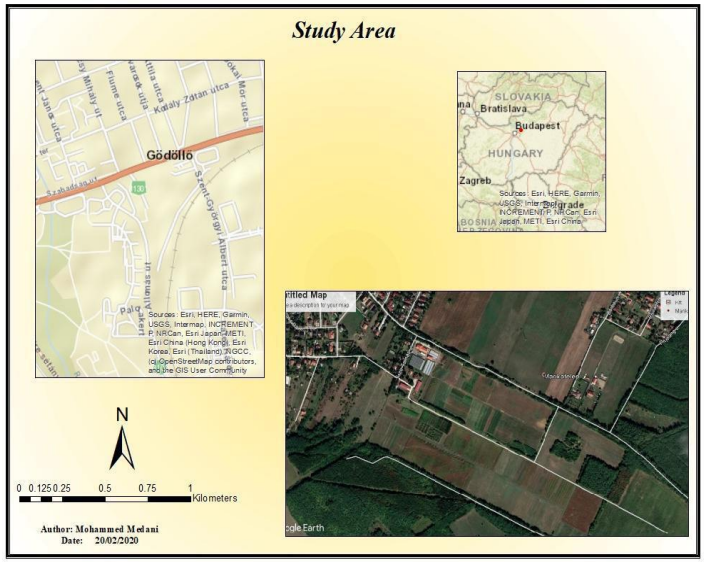
Research methods

SNHs adjacent to studied fields

Winter wheat field

Seed cards are placed inside wheat fields (Osman, Szárítópuszta, Gödöllő, 2019).

Materials and Methods



Location: MATE university research farm (Szaritopuszta), Gödöllő, Hungary (maize, winter wheat fields, and SNHs).

The field edge consisted of small forest patches and herbaceous undergrowth with grasses.

Experimental design

Seed cards as the standard method (Westerman et al., 2003), and metal wire meshes as an exclusion technique from vertebrates.

exclusion cards

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Research Methodology

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- 4 sampling rounds were performed in a wheat field in summer (June 2019, 2021), maize fields in autumn (November 2019 and October 2020), and in adjacent SNHs.
- 160 cards/round, placed at 10m from the edge, 40 transects (20 inside fields+20 in SNH), 4 cards/ transect, 20 seeds/card
- Remaining seeds were counted 24 h after exposure and lasted for 5 and 7 days (due to unfavorable weather).

Research Methodology

❖ Number of remaining seeds converted to seed predation relative to the total number of glued seeds using Abbott's formula (Abbott, 1925)

$$Mi=(Ci-Ri)/Ci$$

- **Mi** = proportion of seed predation
- **Ri** = number of remaining seeds on the cards
- **Ci** = total number of glued seeds

❖ R statistical software (version: 3.5.2., R. Core Team 2018).

- Tukey test between groups.
- Wilcoxon test, linear models, single-factor (ANOVA).

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Results of seed consumption

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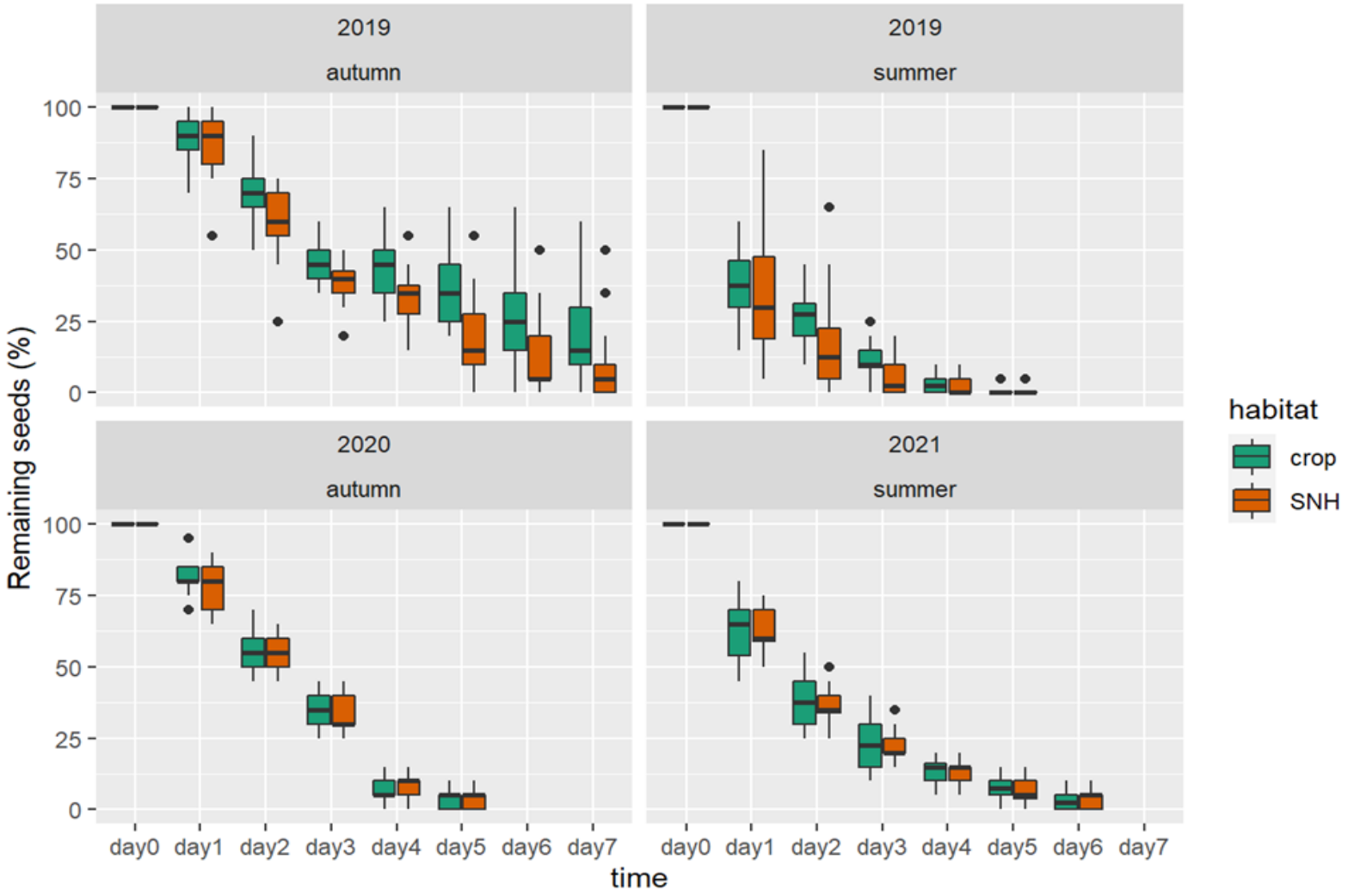
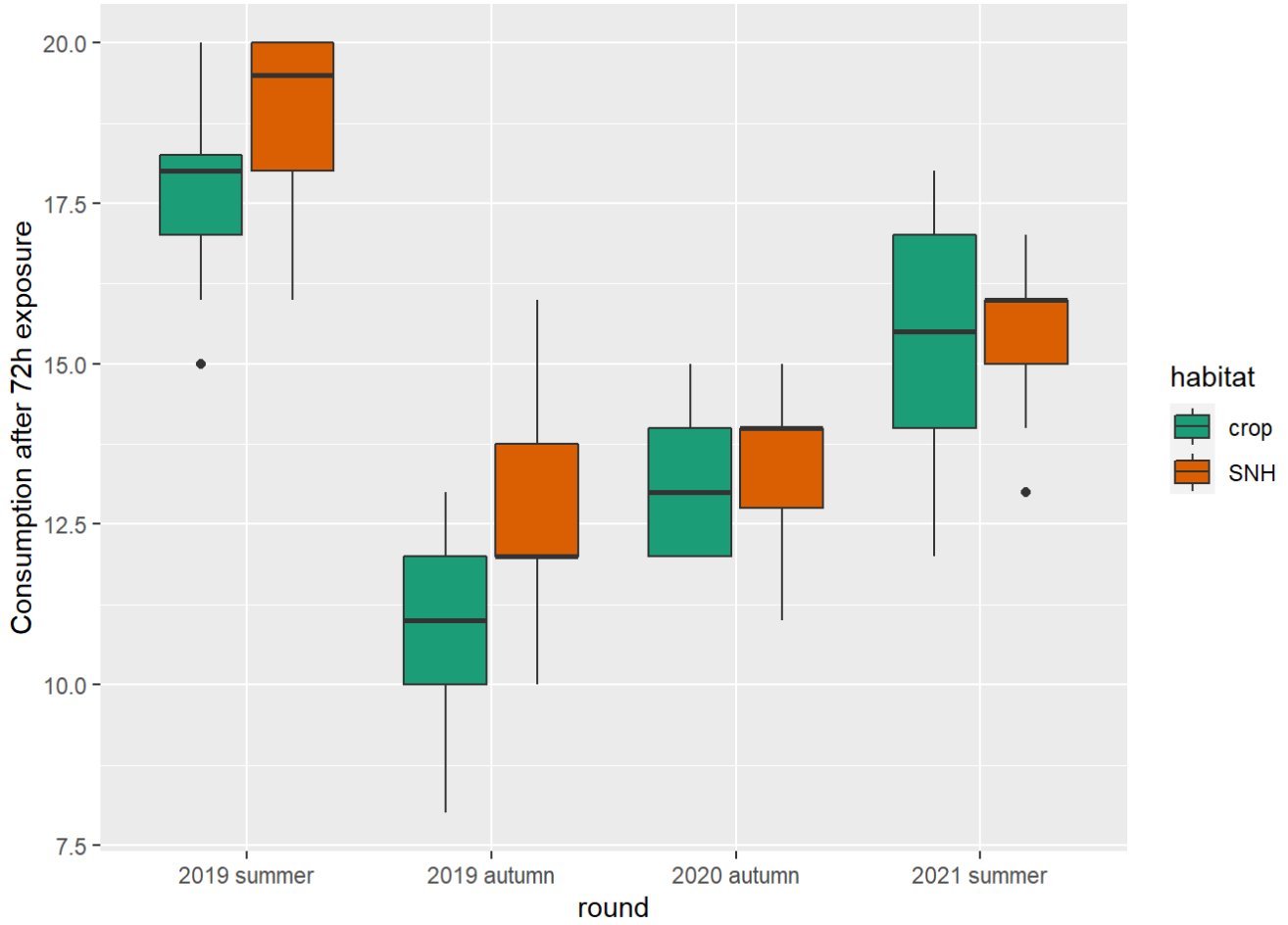
Seed consumption % and ±SD, on *A. artemisiifolia* in crop fields and SNHs, during 5-7 days, in 2019-2020, and 2021, Osman *et al*, Gödöllő, Hungary

Year	Season	Habitat	%Cons.± SD
2019	autumn	crop	81.7 ±15.3
2020	autumn	crop	97.2 ±2.5
2019	summer	crop	99 ±2
2021	summer	crop	97 ±3.4
2019	autumn	SNHs	93.8 ±7.7
2020	autumn	SNHs	96.5 ±3.2
2019	summer	SNHs	99 ±1.8
2021	summer	SNHs	96 ±3.6

- High seed consumption rates on Ambrosia seeds, overall average of 95.2 ± 8.5%.
- There was seed predation in 100% of the exposed cards.
- That indicates the potential of this ecosystem service.



Temporal patterns of *A. artemisiifolia* seeds consumption (%) inside crop fields and SNHs, Osman *et al*, Gödöllő, Hungary



A. artemisiifolia seed consumption (day0 - day3) inside crop fields and SNH. Osman _et al_, Gödöllő, Hungary

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Conclusions

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- High seed predation patterns were observed in all cards in crop fields and SNH, during exposure periods, in both seasons.
- Seed consumption levels were significantly higher in summer than in autumn, with slight differences in habitat types.
- Weed seed predation may contribute to sustainable/integrated weed management of *A. artemisiifolia* in agricultural fields.

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Thanks for your Attention

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