

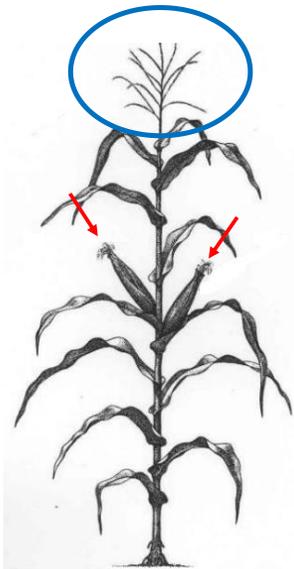
Potential impact of the introduction of the invasive weed teosinte on maize cultivation in the EU

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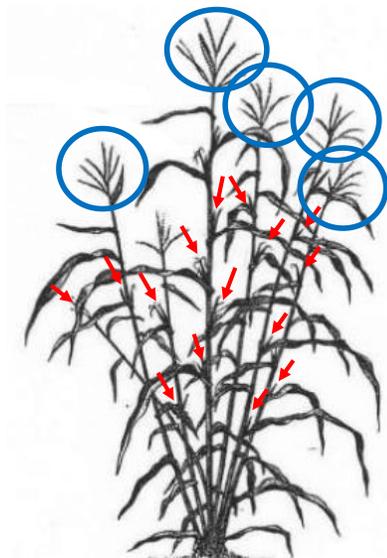


TEOSINTE

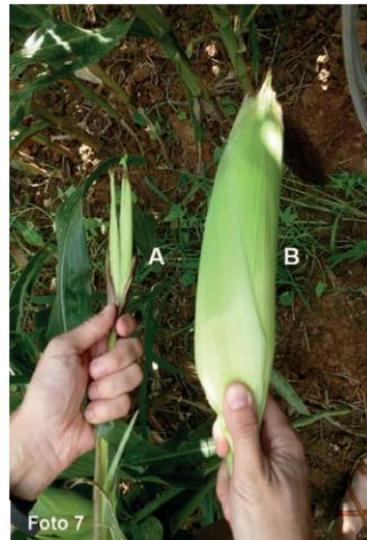
- A group of species and subspecies of the genus *Zea*, the closest wild relatives of cultivated maize (*Z. mays* ssp. *mays*).
- They are endemic from Mexico and Central America, where they grow as a wild plant or as a weed within different crops.



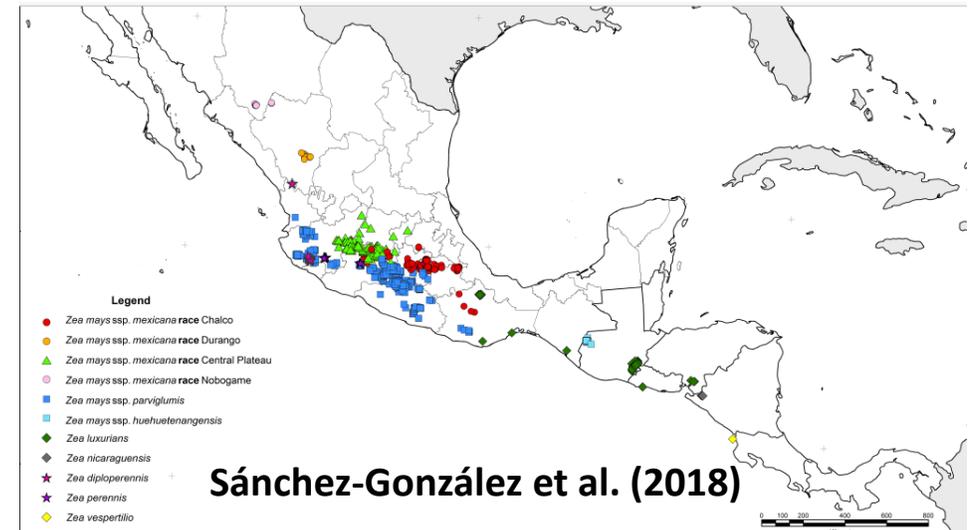
Maize



Teosinte



(Pardo et al. 2014)



- The teosinte has several secondary stems and a high number of male inflorescences and ears.
- The ears of teosinte have a single row of grains with 5 to 10 kernels, whereas maize ears can have 500 or more kernels.

Reported in the EU, associated to maize fields:

- **France** (1990) Nouvelle Aquitaine region.

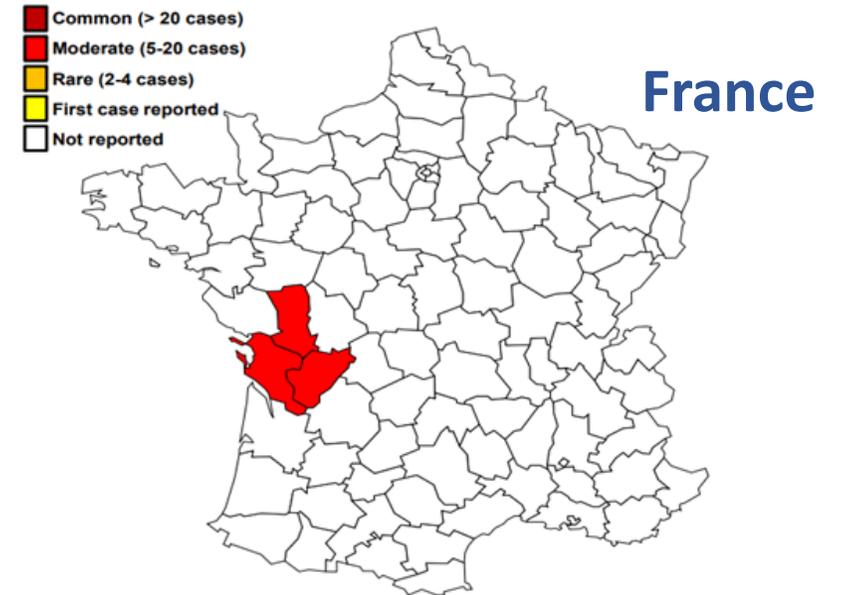
About 300 ha infested in 2017-2021

- **Spain** (since 2014) Ebro valley at Aragón and Cataluña regions.

About 540 ha infested in 2021.

This is the area where more than 90% of Europe's Bt maize is grown.

Both Spanish and French teosintes originated from *Z. mays* ssp. *mexicana* (Le Corre et al. 2020), though a more complex origin involving also *Z. mays* ssp. *parviglumis* and cultivated maize has also been suggested for Spanish teosinte.



Why TEOSINTE is problematic in EU MAIZE cultivation?

1. Teosinte behaves like a weed, causing important yield reductions in Spanish maize crops.
2. There are no selective herbicides that control teosinte without damaging maize.
3. Teosinte and maize are capable of hybridizing.



Examples of Teosinte x Maize hybrids found in Spanish maize fields

- Introgression of herbicide resistance traits and genes associated with adaptation to high latitude from the maize grown in Europe to teosinte may enhance its ability to spread and persist as a noxious weed.

- If the resistance trait is transferred from Bt-maize to teosinte, it could lead to plants with heterogeneous ranges of Cry1Ab toxin expression, accelerating resistance evolution of the target pests to Bt maize.

Preventive control measures:

- early detection by monitoring (farmers and local governments)
- using certified seeds, careful cleaning of equipment and water canals
- avoiding the use of crop residues of infested plots as feed for livestock

Cultural control measures:

In cases of **low infestation**

- false seedbed technique
- manual control

In cases of **high infestation**, it is mandatory:

- rotations without corn
- maize cultivation is prohibited until the complete elimination of teosinte seeds

The control measures have allowed to contain its advance, but a surface of about 540 ha is still currently affected by teosinte in the Ebro valley.



The results of the official control activities for the monitoring of teosinte are sent annually from the Interministerial Council of GMOs (Ministry of Agriculture, Food and Fisheries) to DG SANTE.

Relevance of new scientific evidence on the occurrence of teosinte in maize fields in Spain and France for previous environmental risk assessment conclusions and risk management recommendations on the cultivation of maize events MON810, Bt11, 1507 and GA21

European Food Safety Authority



Conclusion: *“...it is assumed that the impact of insect resistance and/or herbicide tolerance in GM teosinte hybrid progeny (potentially acquired through hybridisation between GM maize and teosinte) on TO, NTO, the abiotic environment and biogeochemical cycles would be very low under EU conditions”.*

Recommendation: *“It is encouraged that the research/monitoring activities pertaining to teosinte performed/commissioned by the ES/FR Competent Authorities be continued and expanded. This will be critical for the generation of empirical data on EU teosinte that could be used to further test specific risk hypotheses of the devised pathway to harm, and confirm previously made ERA and RM assumptions”.*

Update of environmental risk assessment conclusions and risk management recommendations of EFSA (2016) on EU teosinte

European Food Safety Authority (EFSA),
Yann Devos, Elisa Aiassa, Irene Muñoz-Guajardo, Antoine Messéan and Ewen Mullins



Initiative to create a Consortium to address the identified needs

Initiative to create a consortium to address future actions at EU level

- Participants: Research groups from Spain, France and Italy.
- Elaboration of a **Tailormade proposal** to be submitted on 2024.



Aim: to generate empirical data on EU teosinte that could be used to further test specific risk hypotheses, and assist in the establishment of risk prevention policies.

Objectives:

1. To **improve the monitoring strategies** for the detection of teosinte and hybrids in new and already reported spots (Spain, France, but also in other EU countries).
2. To determine the frequency of **hybridization under controlled and field conditions** with Bt-maize and herbicide tolerant maize varieties.
3. To **characterize further the genomic regions introgressed from maize** and their association with biological traits, focusing on weediness and invasiveness.
4. To assess the suitability of teosinte, conventional maize x teosinte hybrids and Bt-maize x teosinte hybrids as **host plants for corn borers** and non-target lepidopterans, and to **model the consequences on Bt-maize management**.