Fusarium sp. associated with stem diseases on sunflowers

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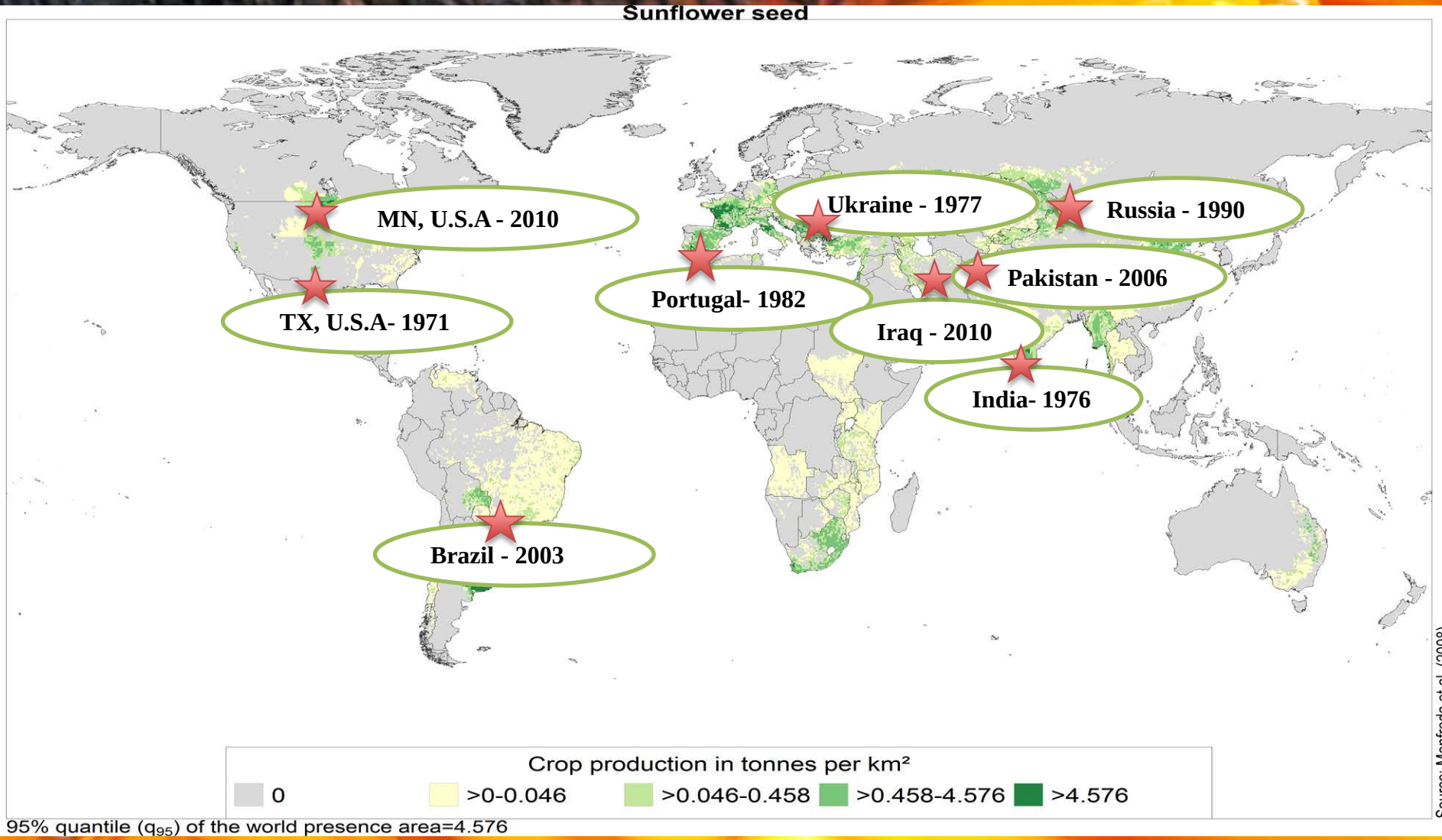
Near Hazelton, ND (2012). Picture by Gary Koslofsky (Syngenta), Courtesy : Dr. Tom Gulya



Fusarium sp. (alone or associated with other fungi)

(Mathew *et al*., 2010, Abdullah and Al-Mosawi, 2010, Sharfun-Nahar and Mushtaq, 2007, de Souza-Motta *et al*., 2003, Antonova *et al*., 2002, de Baron, 1983, Bhargava *et al*., 1978, Bilai, 1977, Orellana, 1971)

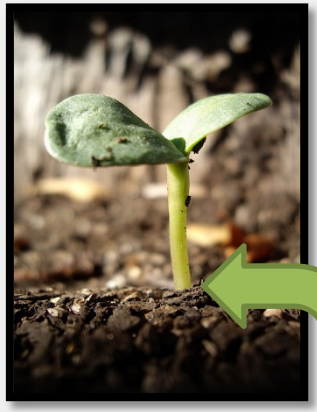
Disease cycle

Collar-, stem- and seedling rots, damping-off, stunting, wilting, yellowing, and reduction in growth (Nahar and Mustaq, 2006)

Summer

Stalks are infected by ascospores/conidia

Spring



Invade the roots

Spring

Crop debris bearing perithecia and sporodochium provide primary inoculum

Winter

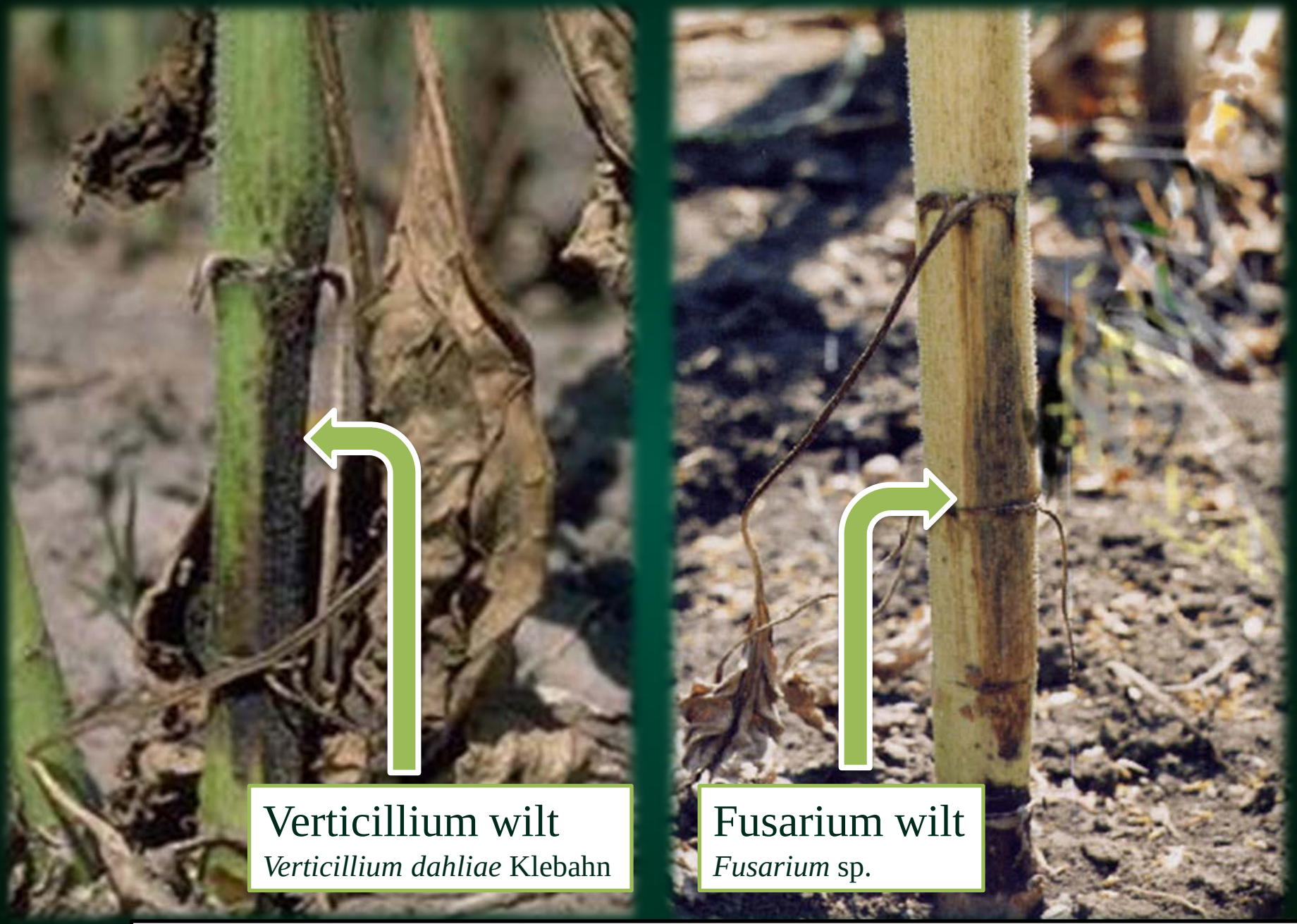
Spring

Temperatures between 24-32°C; and warm moist soils

Pictures by Dr. Sam Markell and Dr. Tatiana Antonova/Dr. Tom Gulya

Fusarium wilt on sunflowers. Rostov, Russia (2002). Picture by Dr. Tatiana Antonova, Courtesy : Dr. Tom Gulya

Verticillium wilt, United States (U.S.). Picture by Dr. Howard Schwartz (Colorado State University)



Pictures by Dr. Howard Schwartz (Verticillium wilt) and Dr. Tatiana Antonova/Dr. Tom Gulya (Fusarium wilt)

Fusarium sp. on sunflowers

- Fusarium a minor disease (Gulya *et al*., 1997)
- Severe problem in Russia (Dr. Tatiana Antonova , VNIIMK, personal communication)
  - ➢Disease incidence up to 80%
  - ➢Twenty species isolated from roots, stems, leaves, and heads
  - ➢*F. oxysporum* Schltdl. most widely spread
  - ➢*F. sporotrichioides* (Sherb.) Bilai most aggressive
- *Fusarium* species are associated with seeds
  - ➢ Cause seedling blight, chlorosis, and wilting in particular (Abdullah and Al-Mosawi, 2010, Sharfun-Nahar and Mushtaq, 2007, Antonova *et al*., 2002)
  - ➢Infection reduces oil content (Antonova *et al*., 2002)

Characterizing *Fusarium* sp. associated with sunflower stem disease

- A total of 1146 stalks (from 2010 survey) were chopped, sterilized, and plated on potato dextrose agar (PDA) for 7-10 d.
- Plates scored for *Fusarium* sp. (Leslie *et al*., 2006)
- *Fusarium* species confirmed by sequencing and phylogenetic analysis of the translation elongation factor 1-alpha (EF1-α) gene (Jacobs *et al*., 2004)
- Eight species confirmed in the U.S., namely, *F. acuminatum* (48.0% of the recovered isolates), *F. sporotrichioides* (35.8%), *F. graminearum* (7.4%), *F. avenaceum* (3.4%), *F. equiseti* (2.7%), *F. oxysporum* (1.4%), *F. culmorum* (0.7%), *and F. proliferatum* (0.7%).

Mathew *et al*., 2011

Objectives

i. To compare the aggressiveness of eight *Fusarium* species in the greenhouse;

ii. To compare symptoms produced by most aggressive and wilt causing *Fusarium* species with *V. dahliae* over time.

Objective : Compare aggressiveness of *Fusarium* species

- Two inoculation methods:
  - Stem-wound
  - Petiole-wound
- Isolates representing eight species were used on three-week old (V4-V6) sunflower confection hybrid cv. ‘CHS RH3701’.
- Sunflower seeds sown in 3.8-l plastic pots and placed under a 16-h light/dark conditions at 25 ± 2^{o}C.
- The inoculum was a mycelial plug (5 mm in diameter).
- Six replications (plants) established for each isolate using a completely randomized design.
- Plants were assessed for lesion development at 14-d.

The micropipette tip containing the inoculum placed over cut petiole

5 mm diameter inoculum on stalk using micropipette tip

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Pictures by Dr. Sam Markell

- Lesion length (vascular discoloration, external) and inter-nodal/ petiole length (where the wound was made) was measured.

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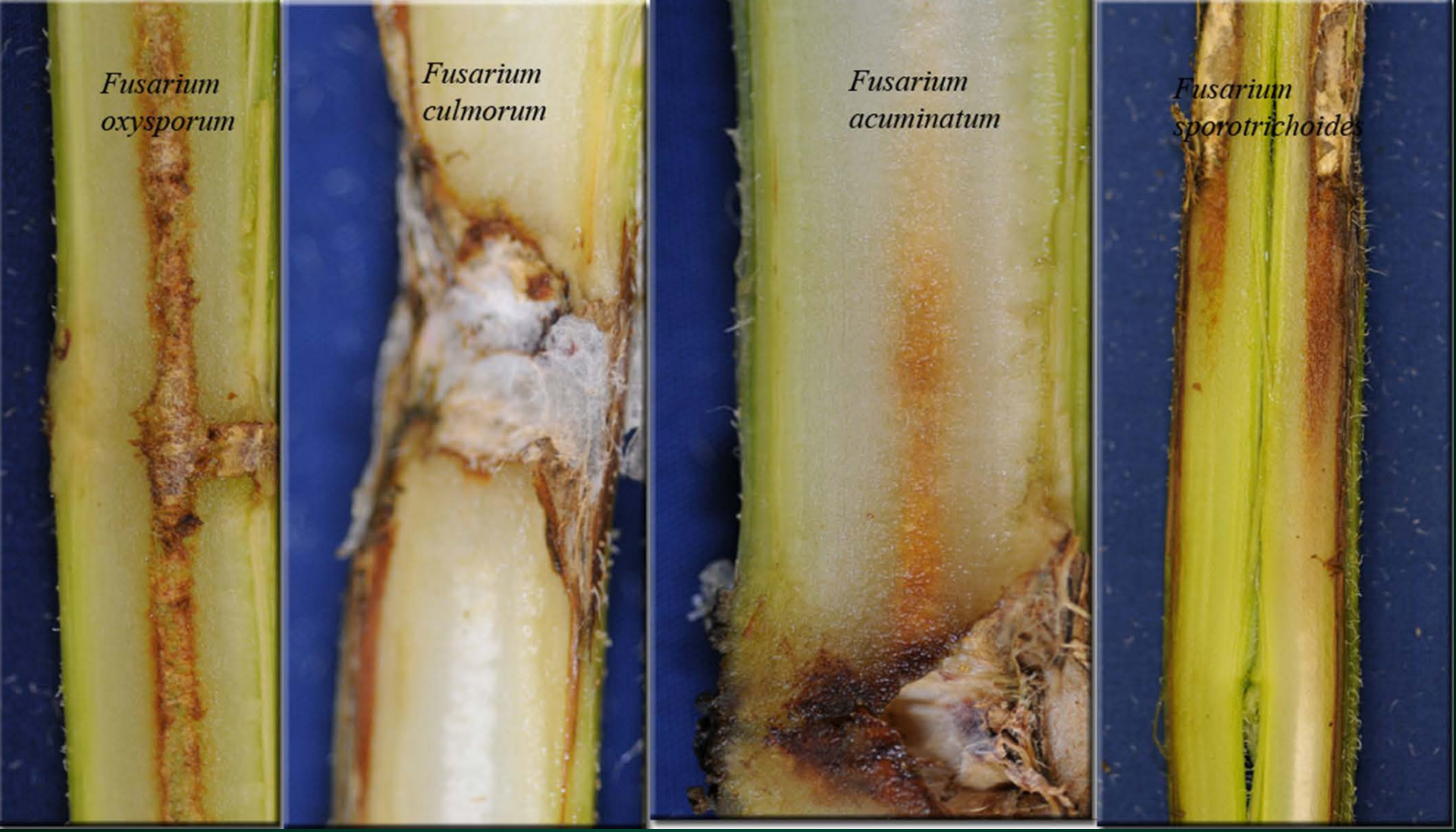
Pictures by Dr. Sam Markell



- The trial was analyzed on SAS v 9.3.

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Pictures by Dr. Sam Markell

Fusarium species	Stem-wound		Petiole-wound
	Lesion length[a] (%)	Vascular discoloration[a] (%)	Lesion length[a] (%)
Non-treated	10.20 c	5.76 d	15.56 e
F. acuminatum	17.62 bc	60.15 b	71.76 bc
F. equiseti	63.29 a	83.32 a	83.35 ab
F. avenaceum	34.00 b	55.18 b	55.43 cd
F. culmorum	19.40 bc	40.84 bc	44.88 d
F. graminearum	17.43 bc	26.39 c	36.83 de
F. proliferatum	15.97 c	26.74 c	18.41 e
F. oxysporum	15.59 c	32.97 c	42.55 d
F. sporotrichioides	53.41 a	100.00 a	100.00 a
LSD ($p \leq 0.05$)	16.75	19.42	21.41
***p*-value**	< 0.0001	< 0.0001	< 0.0001

[a] Means followed by the same letter are not significantly different at $p \leq 0.05$ according to Fishers protected least significant difference (LSD) test.

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Analyzed on SAS v 9.3

Summary

- There were significant differences ($p<0.0001$) among the *Fusarium* species with regard to lesion length (%) and vascular discoloration (%).

- *F. sporotrichioides* and *F. equiseti* were the most aggressive species. Results are consistent with previous research (Antonova *et al*., 2002, Nahar and Mushtaq, 2007).

- *F. graminearum* and *F. proliferatum* were least aggressive; they were not significantly different ($p< 0.0001$) from *F. oxysporum*. To the best of our knowledge, this is the first report of *F. graminearum* on sunflowers.

In progress

To compare symptoms produced by most aggressive and wilt causing *Fusarium* species with *V. dahliae* over time.

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