

Exploring root rot pathogens in wheat-pea rotations in Kansas

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Introduction

In 2018, over 277,000 bushels of wheat were produced on 7.7 million acres of land in Kansas alone. Based on the price of wheat by the end of 2018, this accounted for \$1.44 million. This wheat is normally rotated with soybeans or fallow, but recent interest has arisen regarding the growth of peas in northern Kansas. As of 2019, there are both research and commercial growing operations underway.

Many plant diseases have been especially prevalent during the summer because of the high rainfall and heat. In order to assess the severity of pea disease in Kansas, as well as explore potential interconnectivity between wheat and pea pathogens, a survey was conducted, and efforts were made to isolate and culture fungal pathogens of both wheat and pea.

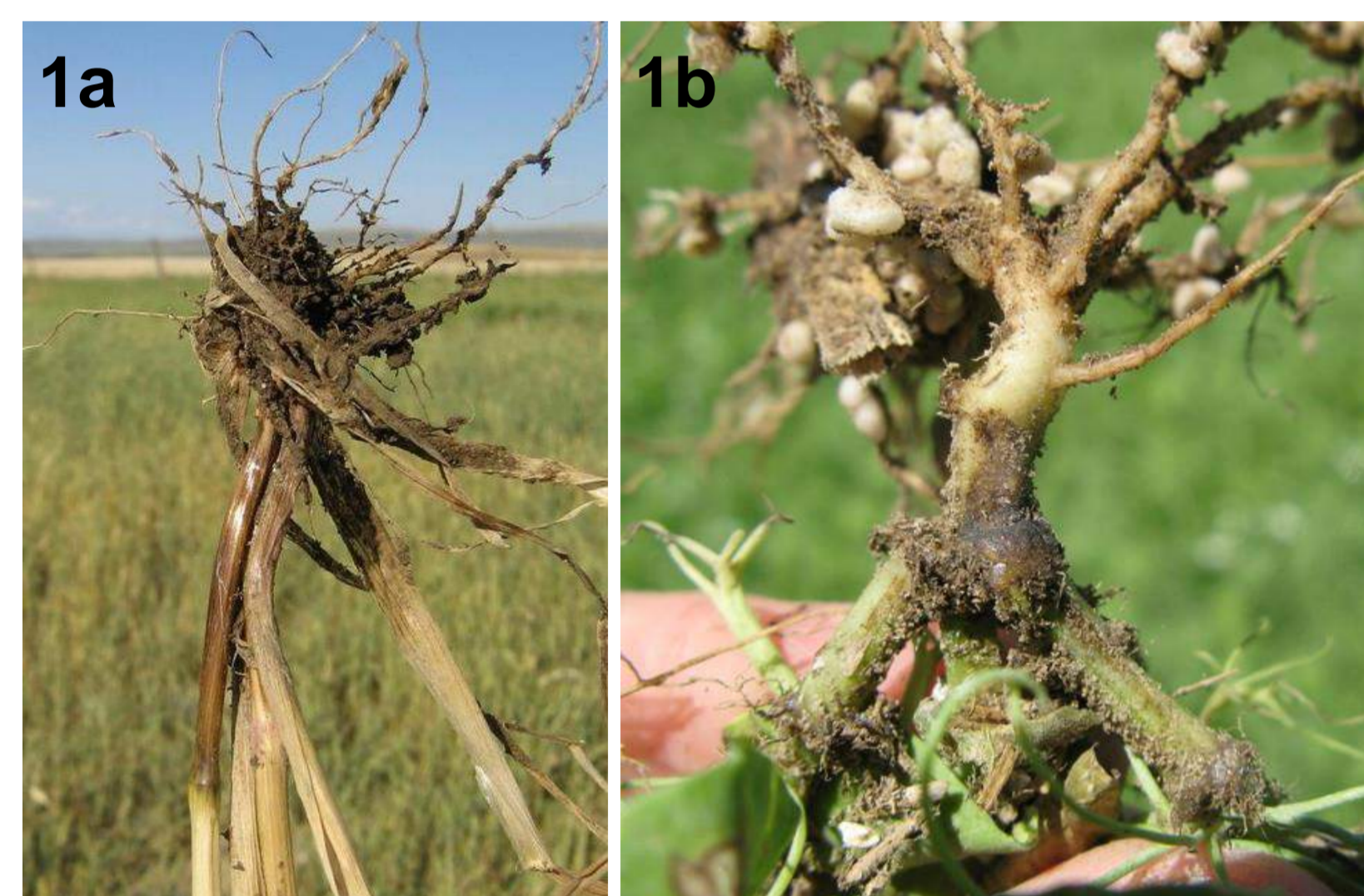


Figure 1a. (Left) Fusarium root rot of wheat. (Ernesto Moya, Bugwood.org)

Figure 1b. (Right) Fusarium root rot of peas. (Mary Burrows, Bugwood.org)

Materials and Methods

- Wheat samples were obtained from the diagnostic lab, cleaned, and stored in a 4°C freezer until they were cultured.
- Additional wheat samples were delivered from statewide travels by the Applied Wheat Pathology Lab and Dr. Erick DeWolf.
- Pea samples were collected during a statewide survey of multiple experimental trials and growers' fields.
- All samples received a unique ID number and were then cleaned and surface-sterilized using 10% bleach followed by 70% ethanol and two rinsing steps with ddH₂O.
- Root cuttings (< 1 cm) were plated on ¼ strength PDA containing ampicillin (100 µg/L) and neomycin (50 µg/L).
- Plates were grown in a 22°C incubator for 5-14 days with 12H dark/light.
- DNA was extracted using CTAB extraction protocol. Quality and concentration were measured using a nanodrop spectrophotometer.
- ~20 ng of DNA was added to Promega PCR MasterMix (Promega, Madison, Wisconsin) using the PCR protocol outlined in White et al. (1990). DNA sequencing was performed by McLab of San Francisco, California.



Figure 3. Counties surveyed for wheat root rot.

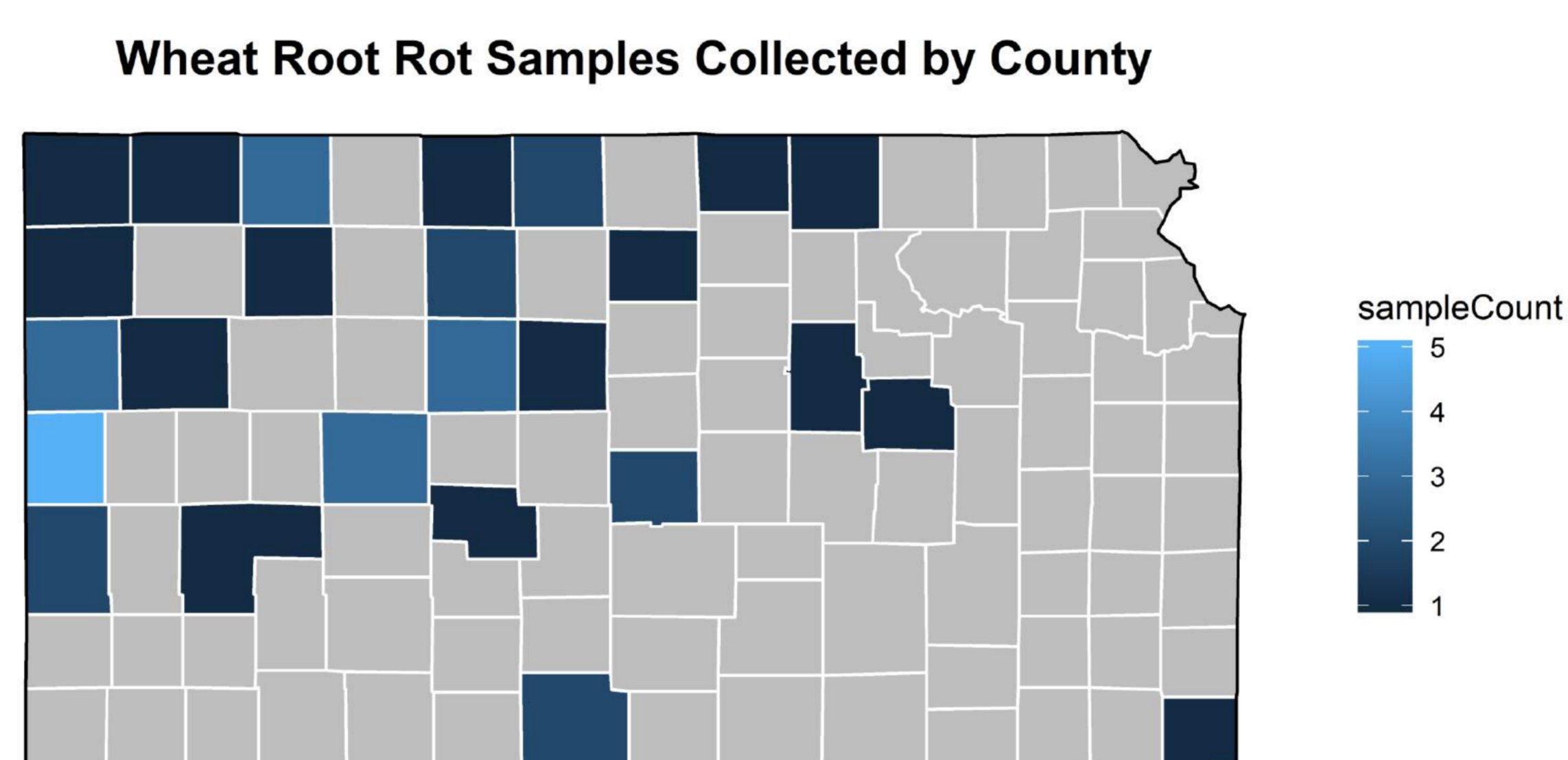
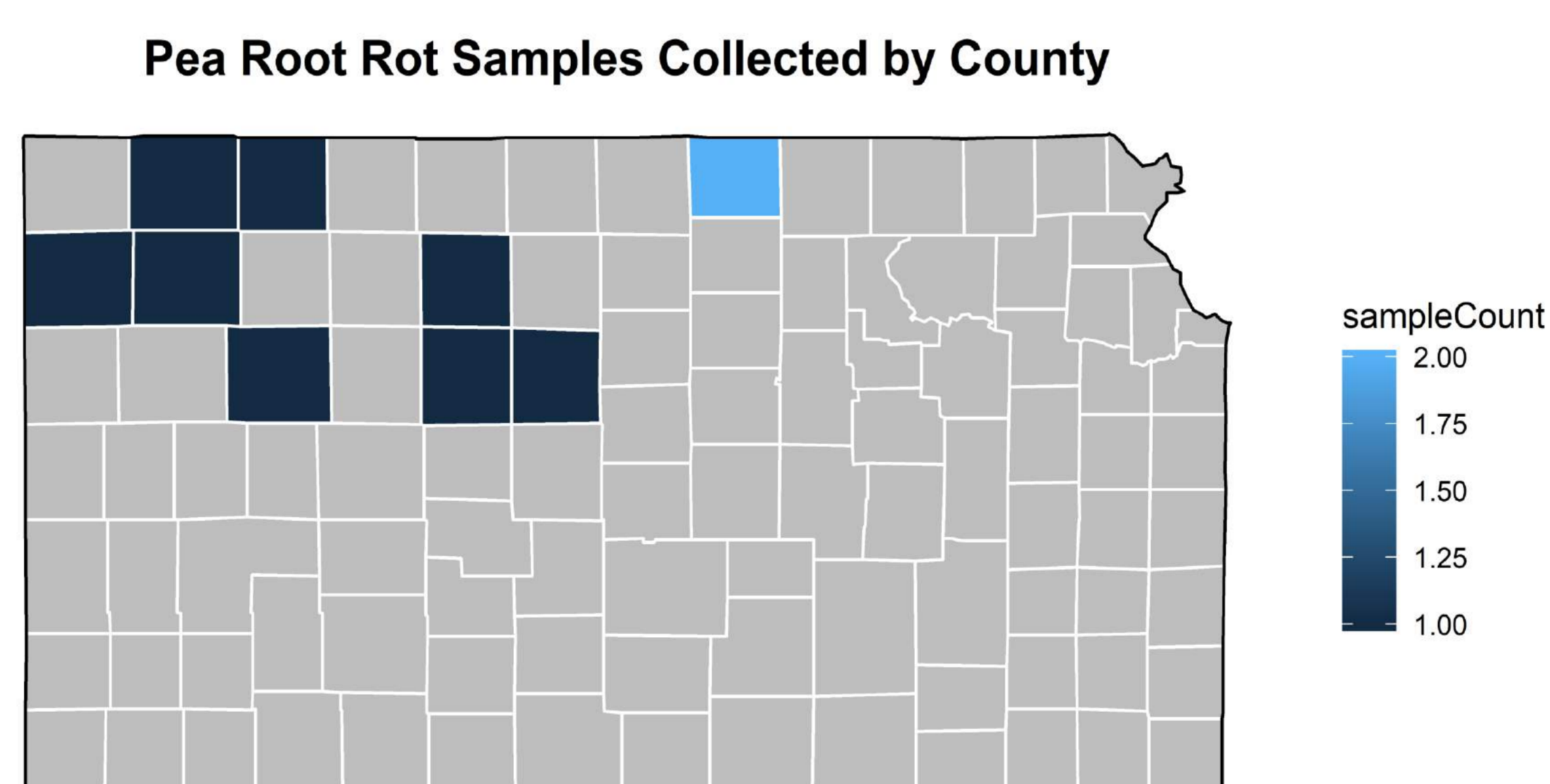


Figure 4. Counties surveyed for pea root rot.



- Over 630 miles of statewide travel resulted in visiting 8 experimental plots and 2 growers' fields to survey for pea diseases in Kansas.
- Wheat was surveyed in 23 counties with the combined help of both the Applied Wheat Pathology Lab and Dr. Erick DeWolf.

Figure 5a. and 5b. Pea fields with symptoms of pea root rot in low lying areas of a producer's field in Ellis Co, KS.

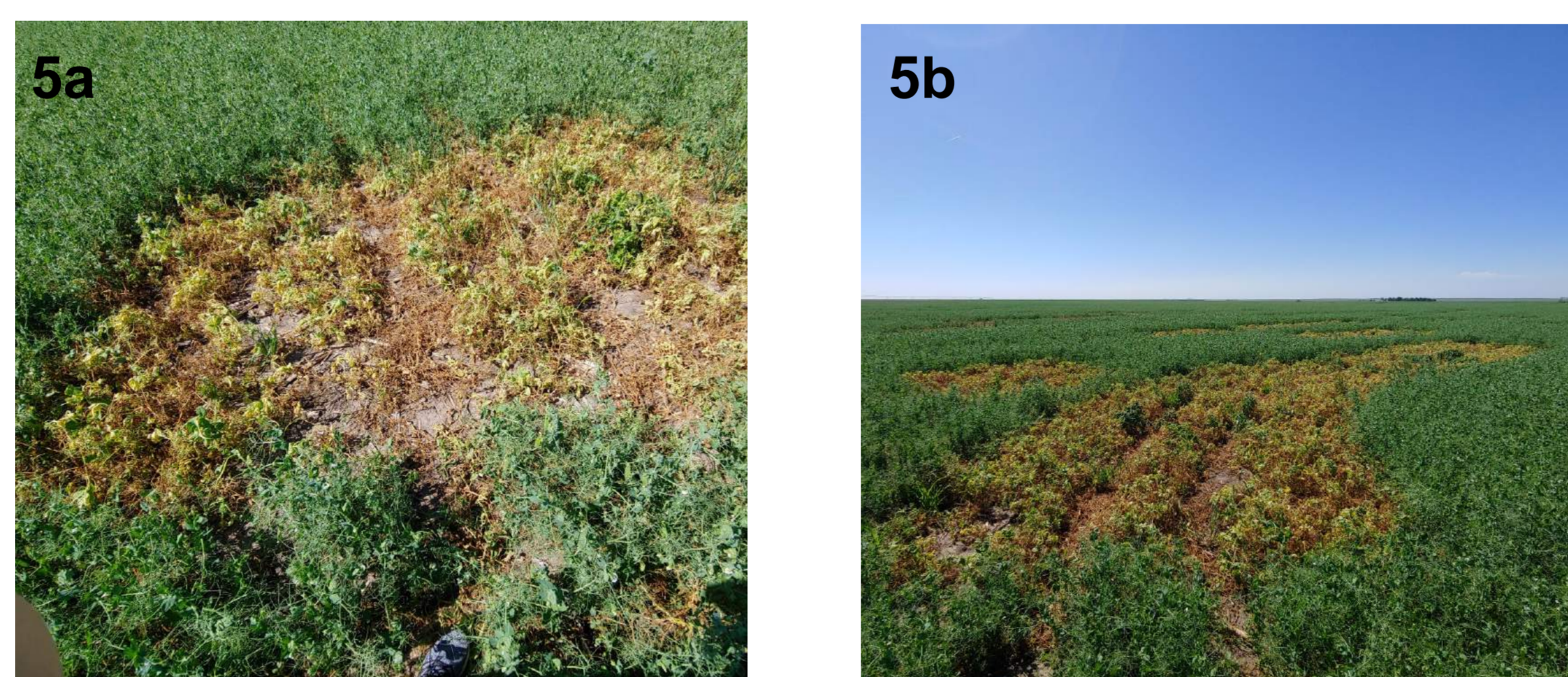


Figure 6. Diversity of fungal samples isolated from wheat and pea roots.



Results

Figure 6. Chromatograph showing DNA sequencing results of select pea roots.

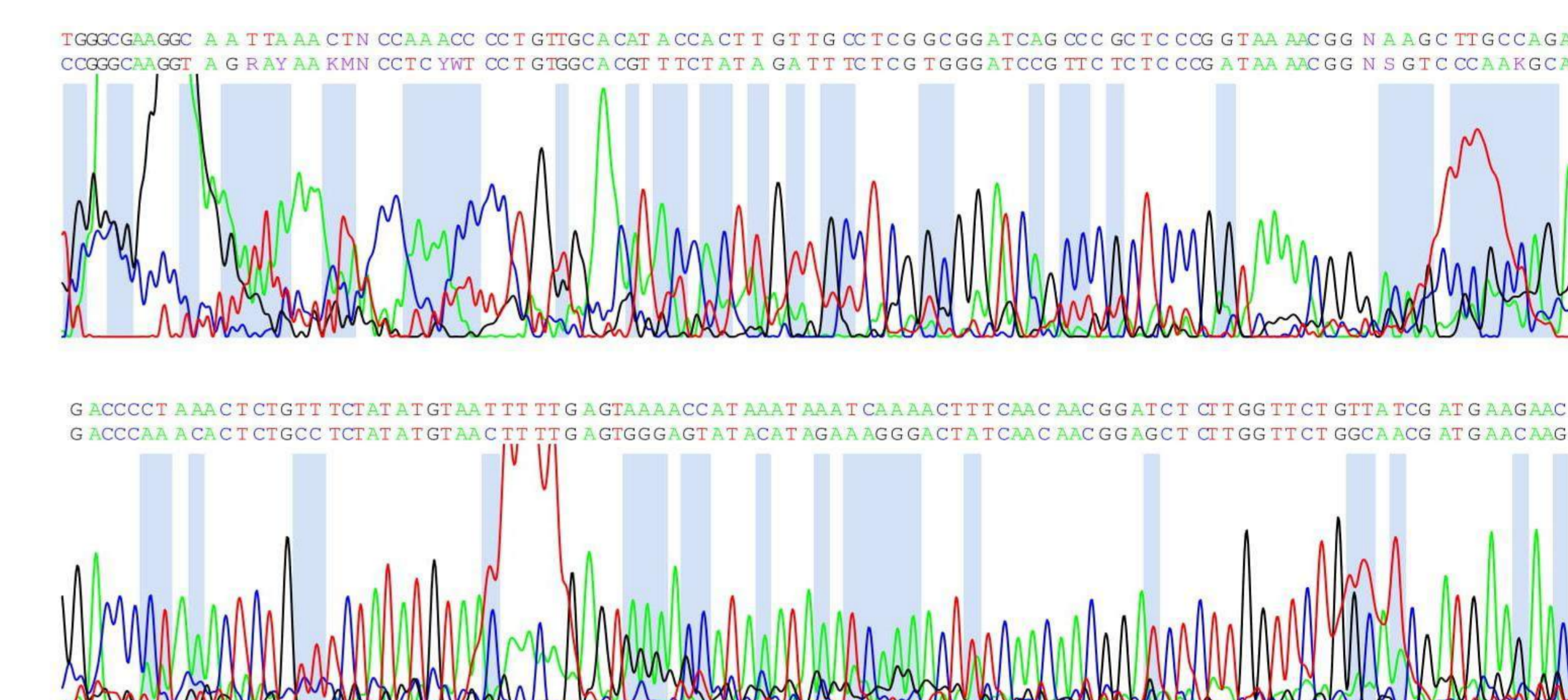


Figure 7. Sequence alignment of pea roots with *Fusarium oxysporum*. To date, 13 different fungal species have been identified from wheat and 2 from pea.

Range 1: 4 to 493 [GenBank](#) [Graphics](#) ▼ Next Match ▲ Previo

Score	Expect	Identities	Gaps	Strand
880 bits(476)	0.0	484/490(99%)	0/490(0%)	Plus/Plus
Query 1	CGTAGGTGAACCTGCGGAGGGATCAITACCAGATTACAACTCCCAACCCCTGTGAACA	60		
Sbjct 4	CGTAGGTGAACCTGCGGAGGGATCAITACCAGATTACAACTCCCAACCCCTGTGAACA	63		
Query 61	TACCACTTGTTCCTCGGCGGATCAGCCCGCTCCCGTAAACGGGACGGCCCGCCAGAG	120		
Sbjct 64	TACCACTTGTTCCTCGGCGGATCAGCCCGCTCCCGTAAACGGGACGGCCCGCCAGAG	123		
Query 121	GACCCCTAAACTCTGTTCTATATGTAACCTTGTGAGTAAACCCATAAATAAATCAAACT	180		
Sbjct 124	GACCCCTAAACTCTGTTCTATATGTAACCTTGTGAGTAAACCCATAAATAAATCAAACT	183		
Query 181	TTCAACAACGGATCTCTTGGTTCGGCATCGATGAAGAACGACGCAAAAATGCGATAAGTA	240		
Sbjct 184	TTCAACAACGGATCTCTTGGTTCGGCATCGATGAAGAACGACGCAAAAATGCGATAAGTA	243		
Query 241	ATGTGAATTGCAGAAITCAGTGAATCATCGAATCTTTGAACGACATTGCGCCCGCCAGT	300		
Sbjct 244	ATGTGAATTGCAGAAITCAGTGAATCATCGAATCTTTGAACGACATTGCGCCCGCCAGT	303		
Query 301	ATTCTGGCGGGCATGCGTGTTCGAGCGTCATTCAACCCCTCAAGCACAGCTTGGTGTGG	360		
Sbjct 304	ATTCTGGCGGGCATGCGTGTTCGAGCGTCATTCAACCCCTCAAGCACAGCTTGGTGTGG	363		
Query 361	GACTCGCGTTAATTCGCGTTCCTCAAATGATTGGCGGTTCAGTCCAGCTTCCATAGCGT	420		
Sbjct 364	GACTCGCGTTAATTCGCGTTCCTCAAATGATTGGCGGTTCAGTCCAGCTTCCATAGCGT	423		

Summary and Future Work

- Multiple fungi were identified from survey samples using morphological and molecular techniques.
- Future surveys with broader sampling will be necessary to get a better understanding of pathogens shared between wheat and peas.
- The Applied Wheat Pathology Lab will continue isolating and identifying fungal organisms present in survey samples.