the Ricardo, but these are not clear. A comparison of the Fish Lake Valley and late Cedar Mountain fauna is unsatisfactory because of the lack of material from Cedar Mountain; however, identifiable specimens which are closely related and found in both localities appear to represent the same species. From the available evidence these faunas are the same or very closely related.

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FAUNAL LISTS

Cedar Mountain		Fish Lake Valley
Middle Miocene	Lower Pliocene	Lower Pliocene
	BIRDS *Nettion carolinense* (Gmelin) *Marila collaris* (Donovan) near *Querquedula cyanoptera* (Vieillot)?	BIRDS *Branta esmeralda* Burt
MAMMALS *Meterix* cf. *latidens* Hall *Bassariscus parvus* Hall	MAMMALS	MAMMALS *Meterix latidens* Hall *Metechinus nevadensis* Matthew *Mystipterus vespertilio* Hall
Tephrocyon near *kelloggi* Merriam	?Aelurodon	*Aelurodon haydeni* (Leidy) *Hypolagus* cf. *vetus* L. Kellogg *Sylvilagus*?
New genus (Castoridae) *Mylagaulus* sp.		*Eucastor tortus* Leidy *Mylagaulus* sp. *Entoptychus*?
Meniscomys		*Diprionomys magnus* L. Kellogg *Diprionomys parvus* L. Kellogg *Diprionomys quartus* Hall *Diprionomys tertius* Hall *Macrognathomys nanus* Hall *Peromyscus dentalis* Hall
Hypohippus near *osborni* Gidley	*Hypohippus nevadensis*	*Hypohippus* near *nevadensis* Merriam
Merychippus cf. *isonensus* (Cope)	*Pliohippus* cf. *leidyanus* Osborn	*Pliohippus* cf. *leidyanus* Osborn
	Hipparion cf. *occidentalis* Leidy	*Hipparion* cf. *occidentalis* Leidy
		Prosthennops cf. *crassigenis* Gidley
	Procamelus gracilis Leidy	*Procamelus gracilis* Leidy *Procamelus* cf. *robustus* Leidy *Alticamelus* cf. *priscus* Matthew

SEED TRANSMISSION OF COTTON WILT[1]

MANY Fusaria which cause diseases of plants have been assumed to be disseminated inside the seeds. With cotton wilt, caused by *Fusarium vasinfectum*, the possibility of the disease being carried by the seed has been questioned. Gilbert[2] stated that "tests covering a period of four years to determine whether wilt is carried by the seed have given negative results." Later, Fahmy,[3] Neal[4] and Dastur[5] planted seed from wilt-infected cotton plants with negative results, and also failed to isolate Fusarium in culturing such seeds. The only previous evidence indicating seed transmission of cotton wilt was obtained by Elliott.[6] He obtained wilt in plants grown from seeds from infected plants and showed also that Fusarium spores placed on the exterior of cotton seed remained viable for at least 5 months.

PLANTING SEED FROM WILT-INFECTED PLANTS

During the fall of 1929, a quantity of seed of the variety "Half and Half" was selected from a field in Brazos County, from plants known to be infected with Fusarium wilt as proved by isolations from the roots and stems. These seed were stored in the laboratory at room temperature and in 1930 divided in two lots. The seed of one lot were planted in a series of 40 cylinders, each 18 inches in diameter and 24 inches deep. These were sunk in the ground, closed at the bottoms by tight galvanized iron plates and filled with sifted Norfolk fine sandy loam soil material from an elevated, uncleared wooded section in Brazos County, known to have been uncultivated for at least 50 years. Untreated seed from the wilt-infected cotton plants were planted in wilt-free soil in 20 cylinders and seed delinted with sulphuric acid and then surface sterilized with 1:1000 mercuric chloride solution were planted in 20 more cylinders. Plants in 2

[1] Published with the approval of the director as Contribution No. 209, Technical Series, of the Texas Agricultural Experiment Station.

[2] W. W. Gilbert, "Cotton Wilt and Root Knot," U. S. Dept. of Agr., *Farmers' Bull.*, 625, 1914.

[3] Tewfik Fahmy, "The Fusarium Disease of Cotton (Wilt) and Its Control," Ministry of Agr., Egypt. Tech. and Sci. Series, *Bull.* 74, 1927.

[4] D. C. Neal, "Cotton Diseases in Mississippi and Their Control," *Miss. Agr. Exp. Sta. Bull.*, 248, 1928.

[5] J. F. Dastur, "Cotton Wilt," Memoirs of the Dept. of Agr. in India, Botanical Section, 17: 29–73, 1929.

[6] J. A. Elliott, "Cotton Wilt, a Seed-borne Disease," *Journ. of Agr. Res.*, 23: 387–393, 1923.

of the cylinders of each lot developed typical Fusarium wilt, which attacked 3.3 per cent. of the total of 667 plants. On the other hand, not a single plant developed wilt in the 723 plants which grew from seeds from normal plants of the "Gorham Lonestar" variety, planted in the same soil in 40 adjoining cylinders as checks.

Seed were planted also in large wooden boxes, each 5 feet wide and 15 feet long, and filled with soil material similar to that used for the cylinders. One box was planted with untreated seed from wilt-infected plants and another with the delinted seed. Typical wilt appeared in both boxes. Of 644 plants, 2.2 per cent. developed Fusarium wilt. The third box was planted with seed from normal plants, and not a single case of wilt appeared with the 238 plants.

Fusarium was recovered from all the wilted plants in the cylinders and boxes, and successfully reinoculated on cotton seedling grown in pots of steam-sterilized soil. Identification of the Fusaria isolated as *F. vasinfectum* was confirmed by Dr. C. D. Sherbakoff.

Isolation of Fusarium vasinfectum from Wilt-infected Cotton Plants

This work was carried on in 1929 and 1930 with wilt-infected cotton plants selected from a field near Edge, Brazos County, and in 1931 with plants selected in a wilt-infested plat at College Station, Texas. The plants were secured during early fall as soon as the bolls were matured and opened, and seeds from them were cultured the following spring and summer. Before culturing the seeds, tissue cultures were made with parts of the tap-roots, stems and peduncles, to ascertain actual wilt infection, and the few plants which failed to yield Fusarium were discarded. Seeds to be cultured were delinted with sulphuric acid, washed in running tap water, disinfected for one minute in 1–2000 solution of mercuric chloride in 25 per cent. alcohol, and finally rinsed three times in sterilized water. These surface-sterilized seeds were then planted in potato-dextrose agar in Petri dishes, usually placing 6 seeds per dish.

TABLE 1

Summary of Isolations of *Fusarium vasinfectum* from Seed from Wilt-infected Cotton Plants. The Plants were Brought in During the Early Fall, and Seeds were Cultured the Following Spring and Summer

Year plants were selected	Number of plants from which seeds were cultured	Number of plants from which seeds yielded *F. vasinfectum*	Total number of seeds cultured	Per cent. of seeds which yielded *F. vasinfectum*
1929 ...	9	1	464	2.2
1930 ...	45	9	4202	4.6
1931 ...	9	2	428	23.7
Total for 3 years	63	12	5094	5.9

As summarized in Table 1, *Fusarium vasinfectum* was recovered from only a small percentage of the seeds during 1929 and 1930. During 1931, a larger percentage of the seeds showed internal infection with *F. vasinfectum*. In 1930, *F. vasinfectum* was recovered from the tap-roots, main stems, peduncles and some seeds from every boll of 9 of the 45 plants from which cultures were made. With the remaining 36 plants, the fungus was obtained from the tap-roots, main stems and peduncles, but not from the seeds of any of the bolls. With the 8 infected cotton plants cultured during 1931, *F. vasinfectum* was recovered from the tap-roots, main stems, peduncles and from some of the seeds from all the bolls from two plants. The remaining 6 plants yielded Fusarium from the tap-roots, main stems, peduncles, but not from the seeds. This work has demonstrated that *Fusarium vasinfectum* may be carried inside the seeds of cotton plants infected with Fusarium wilt, although it is not necessarily present in seeds even from plants with infected tap-roots, stems and peduncles.

In culturing the seeds from wilt-infected plants, it was noticed that many of the seeds which yielded *F. vasinfectum* had failed to germinate. It is obvious that the disease could nevertheless be transmitted by such dead seeds as well as inside the viable seeds.

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