Report of Dwarf Bunt from California Erroneous

AMY Y. ROSSMAN, Systematic Botany and Mycology Laboratory, USDA-ARS, Rm. 304, B011A, Beltsville, Maryland 20705

Exportation of wheat (*Triticum aestivum* L.) from the Pacific Northwest of the United States to the People's Republic of China has been curtailed since 1972 because of the presence of *Tilletia controversa* Kühn in Rabenh., a fungus that causes dwarf bunt. Dwarf bunt is not known to occur in China, and the Chinese government has established a zero tolerance for *T. controversa* teliospores in imported wheat (6). A second bunt disease of wheat, common or rough-spored bunt, is caused by *Tilletia tritici* (Bjerk.) G. Wint. in Rabenh. (=*T. caries* (DC.) Tul. & C. Tul.) and occurs throughout the world wherever wheat is grown (1,13). Differentiating teliospores of *T. tritici* from *T. controversa* often is difficult because of their morphological similarity (3,7–9). The acceptance of wheat shipments by the People's Republic of China from the United States requires identification of teliospores of *Tilletia* spp., particularly if the shipment originates from an area where dwarf bunt is suspected to have occurred. Thus, it is important to know if dwarf bunt is present, absent, or has ever occurred in specific regions in the United States from which wheat might be shipped to the People's Republic of China. The wheat-growing regions of California are free of dwarf bunt, and potential exportation of wheat from California to China is being negotiated. One report of *T. controversa* from California cited in several publications (3–5,12) threatens to curtail the possible export of wheat from California to China. Because this fungus is otherwise unknown in California, an investigation was made into the validity of this report.

The report of *T. controversa* in California was based on a specimen collected by H. B. Humphrey on 30 June 1917 in Jacksonville, supposedly in California. This specimen is now preserved in the U.S. National Fungus Collections (BPI 173991), Beltsville, Maryland, with a small portion of the same collection at the Herbarium, Plant Pathology Department (WSP 63712), Washington State University, Pullman. Although initially identified by Humphrey as *T. tritici,* Fischer and Duran (5), in their paper on the distribution of dwarf bunt in the United States, reidentified this specimen as *T. controversa,* a disease not recognized in the United States until 1935 (14). Fischer and Duran (3,5) distinguished *T. controversa* from the more common *T. tritici* as *T. caries* based on the morphology of the teliospores, primarily surface ornamentation and the presence of a hyaline gelatinoid sheath, the latter a character not often evident in herbarium material. Later authors suggest that these species cannot be distinguished using only the surface morphology of the teliospores (8). For this reason, a definitive identification of the fungus on this specimen as either *T. controversa* or *T. tritici* has not been possible. However, overwhelming evidence cited below confirms that this crucial specimen was not collected in California. Rather, it originated in Jacksonville, Jackson County, Oregon.

Harry Baker Humphrey (uncle of Hubert H. Humphrey) worked for the Office of Cereal Disease Investigations, United States Department of Agriculture, Washington, D.C., from 1913 to 1943 (2). In 1917, he held the position of senior pathologist and took at least two trips around the United States collecting specimens of cereal diseases. With the help of his original itinerary and communications in the National Archives, it is possible to reconstruct the trip he took in June–July 1917, when he traveled to the West Coast via train.

Humphrey had conducted his undergraduate studies at Stanford University, and in 1917 his parents lived in Campbell, California, now near San Jose in the San Francisco area. His trip through California took him from Reno, Nevada, on 19 June to Berkeley, California, on 20 June. Based on communications addressed in care of H. S. Humphrey, he took two days of vacation at his parents' home in Campbell. His itinerary indicated that he would leave Berkeley on 24 June to arrive in Marysville, California, on 25 June, and continue to Alturas, California, on 26 June. On 27 June, he was scheduled to be in Lakeview, Oregon; and on 29 June, he was to arrive in Corvallis, Oregon. Although his itinerary stated that he would be in Corvallis on 29 June, a telegram sent to his home office in Washington, D.C., from Corvallis on 1 July 1917 suggests that he may not have arrived there until 30 June or 1 July. Thus, Humphrey most likely was in the Medford–Jacksonville area in Oregon on 30 June 1917, the date that the specimen in question was collected. Although Jacksonville, California, no longer exists, a book of old geographical names in California lists the previous existence of a town of Jacksonville in Tuolomne County near Yosemite National Park (11). It would have been highly unlikely and logistically impossible for Humphrey to collect in Jacksonville near Yosemite National Park on 30 June and then travel via train to Corvallis in time to send a telegram to Washington, D.C., on 1 July 1917. Thus, it seems likely that the specimen of *T. controversa* originated in Jacksonville, Jackson County, Oregon, a small town near the Oregon–California border, and that Humphrey inadvertently mislabeled it Jacksonville, California.

A second source confirms that Humphrey was in the Medford–Jacksonville area on 30 June 1917. Because the label data associated with many of the specimens in the U.S. National Fungus Collections were entered into a computer, it was possible to search this database for additional specimens collected by H. B. Humphrey on this trip in 1917. Two other specimens were collected by H. B. Humphrey on 30 June 1917, both of them from Medford, Jackson County, Oregon, about five miles from Jacksonville, Oregon. These specimens have inner labels stating that they were collected in Jackson County, Oregon. The inner label of the specimen in question lists the locality as Jacksonville, Jackson County, not Tuolomne County, and is on the same kind of paper with the same handwriting as those from Medford, Jackson County, Oregon. The only other specimens collected by H. B. Humphrey from California in 1917 are from Campbell, Santa Clara County, California, collected on 24 June 1917. There is no evidence that H. B. Humphrey was even near the old Jacksonville, California, while his other collections indicate that he was in or near Jacksonville, Oregon, on 30 June 1917.

Accepted for publication 3 April 1994.

A later publication by Humphrey et al (10) on the distribution of stripe rust on grasses in the western United States shows Jacksonville, Oregon, as a site where stripe rust occurs. Additional collections were made by or for H. B. Humphrey from several towns on the extreme western side of California. No localities were cited in eastern California near the old Jacksonville.

Based on this information, the most likely conclusion is that H. B. Humphrey made an error in recording the locality where the specimen in question was collected. Humphrey had recently come from California and thus mistakenly wrote California on the inner packet. The specimen of *T. controversa* reportedly from California and cited by Fischer and Duran (5) was actually collected in Oregon. Thus, there is no valid report of dwarf bunt of wheat caused by *T. controversa* in California.

The ability to obtain the evidence necessary to disprove the report of *T. controversa* from California and thus correct a historical error that has hindered the exportation of wheat from California to China was possible for several reasons. First, Humphrey deposited a voucher specimen of his collection in a recognized herbarium to be retained for future reference. This allowed the subsequent reexamination and reidentification by Fischer and Duran (5) and others. Second, the data associated with the specimens at the U.S. National Fungus Collections have been entered into a computer, so that subsets of data, such as information about the other specimens collected on 30 June 1917 by H. B. Humphrey, can be easily obtained. Third, the papers of Humphrey were deposited and maintained at the U.S. National Archives, a recognized archive, the importance of which could not be imagined at the time of deposit. The value of these activities must be recognized, and support for reference collections and archives must continue, if we are to answer questions such as this one on which our nation's trade exports depend.

ACKNOWLEDGMENTS

I thank Paul Peterson, University of North Carolina, and the staff at the National Archives, Washington, D.C., for their assistance in locating the original letters, telegrams, and other communications of H. B. Humphrey from which much of this information was taken; Michelle Seidl, previously at the Herbarium of the University of California, Berkeley, now in the Department of Botany, University of Washington, for her detective work on the location of the old Jacksonville, California, and her comment that a town named Jacksonville exists in Oregon from which the collection perhaps originated; David Farr for checking the specimen database at the U.S. National Fungus Collections for the collections of H. B. Humphrey; and Morris Bonde, Edwin Civerolo, David Farr, and Mary Palm for valuable editorial comments.

LITERATURE CITED

1. Anonymous. 1990. Distribution Maps of Plant Diseases. *Tilletia tritici.* Map No. 290. 2nd ed. Int. Mycol. Inst., Kew, England.
2. Barss, H. P. 1957. Harry Baker Humphrey, 1873-1955. Phytopathology 47:247-248.
3. Duran, R., and Fischer, G. W. 1961. The genus *Tilletia.* The President and Regents of Washington State University, Pullman.
4. Farr, D. F., Bills, G. F., Chamuris, G. P., and Rossman, A. Y. 1989. Fungi on Plants and Plant Products in the United States. American Phytopathological Society, St. Paul, MN.
5. Fischer, G. W., and Duran, R. 1956. Some new distribution and early incidence records of dwarf bunt of wheat and rye. Res. Stud. State Coll. Wash. 26:267-274.
6. Grey, W. E., Mathre, D. E., Hoffmann, J. A., Powelson, R. L., and Fernández, J. A. 1986. Importance of seedborne *Tilletia controversa* for infection of winter wheat and its relationship to international commerce. Plant Dis. 70:122-125.
7. Hess, W. M. 1982. Separation of *Tilletia caries* and *T. controversa* teliospores based upon spore wall characteristics. Phytopathology 72:993.
8. Hess, W. M., and Trione, E. J. 1986. Use of electron microscopy to characterize teliospores of *Tilletia caries* and *T. controversa.* Plant Dis. 70:458-460.
9. Holton, D. S., and Kendrick, E. L. 1956. Problems in the delimitation of species of *Tilletia* occurring on wheat. Wash. Agric. Exp. Stn. Sci. Pap. 24:318-325.
10. Humphrey, H. B., Hungerford, C. W., and Johnson, A. G. 1924. Stripe rust (*Puccinia glumarum*) of cereals and grasses in the United States. J. Agric. Res. 29:209-227.
11. Jepson, W. L. 1946. Jepson Herbarium Place Name Index. University of California, Berkeley.
12. Matsumoto, T., and Bell, T. 1992. Laboratory guide to smut fungi of quarantine significance to California. Calif. Dep. Food Agric., Sacramento.
13. Mordue, J. E. M., and Waller, J. M. 1981. CMI descriptions of pathogenic fungi and bacteria. No. 719. *Tilletia caries.* Commonw. Mycol. Inst., Kew, England.
14. Young, P. A. 1935. A new variety of *Tilletia tritici* in Montana. Phytopathology 25:40.