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History of Phytopathology from the Ottoman Empire to the Republic with its Global and Local Dimensions

Küresel ve Yerel Boyutlarıyla Osmanlı'dan Cumhuriyet'e Fitopatolojinin Tarihi

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Abstract Plant diseases lead to significant yield losses in agricultural production, creating profound impacts in social, economic, and commercial domains. This study aims to examine in detail the historical development of phytopathology from the Ottoman Empire to Republican Turkey. The primary goal of the research is to shed light on the global history of plant pathology while addressing key milestones in the field and developments specific to Turkey. In particular, the invention of the microscope in the 17th century, the potato blight crisis in Ireland in the 19th century, and the impact of World War I in the early 20th century on the development of phytopathology are emphasized. Following the scientific and technological advancements in the West during the Ottoman modernization process played a crucial role in the development of phytopathology in Turkey. Although agricultural education began during the Ottoman period with the Tanzimat reforms, institutional shortcomings and the lack of sustainable policies prevented lasting progress during this process. During the Republic period, phytopathology education underwent a process of modernization, facilitating the advancement of significant scientific research in the discipline. Starting from the 1950s, phytopathology departments were established in universities, where relevant courses were offered, and extensive research was conducted in collaboration with agricultural pest control institutes. This process reveals how phytopathology evolved within Turkey's educational and bureaucratic structure and its effects on society.

Öz Bitki hastalıkları, tarımsal üretimde önemli verim kayıplarına yol açarak, toplumsal, ekonomik ve ticari alanlarda derin etkiler yaratmaktadır. Bu çalışma, fitopatolojinin Osmanlı İmparatorluğu'ndan Cumhuriyet dönemi Türkiye'sini de kapsayan tarihsel gelişimini detaylı bir şekilde incelemeyi amaçlamaktadır. Araştırmanın temel amacı, fitopatolojinin küresel tarihine ışık tutarken, bu alandaki önemli dönüm noktalarını ve Türkiye özelinde yaşanan gelişmeleri ele almaktır. Özellikle, 17. yüzyılda mikroskobun icadı, 19. yüzyılda İrlanda'da meydana gelen patates mildyösü krizi ve 20. yüzyılın başındaki Birinci Dünya Savaşı'nın fitopatolojinin gelişimindeki etkileri vurgulanmaktadır. Osmanlı modernleşmesi sürecinde Batı'daki bilimsel ve teknik ilerlemelerin takip edilmesi, Türkiye'deki fitopatolojinin gelişiminde belirleyici bir rol oynamıştır. Tanzimat reformlarıyla birlikte Osmanlı döneminde tarım eğitimi başlamış olsa da, kurumsal eksiklikler ve sürdürülebilir politikaların olmaması nedeniyle bu süreçte kalıcı bir gelişim sağlanamamıştır. Cumhuriyet döneminde ise, fitopatoloji eğitimi modernleşme sürecine girmiştir ve bu alanda önemli bilimsel çalışmalar gerçekleştirilmiştir. 1950'lerden itibaren üniversitelerde fitopatoloji anabilim dalları kurularak, ilgili dersler verilmiş ve zirai mücadele enstitüleriyle iş birliği içinde kapsamlı araştırmalar yapılmıştır. Bu süreç, fitopatolojinin Türkiye'deki eğitim ve bürokratik yapı içinde nasıl evrildiğini ve toplum üzerindeki etkilerini ortaya koymaktadır.

Keywords Phytopathology · Plant Diseases · Ottoman Empire · Republican Era · Agriculture · History of Science

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Anahtar Kelimeler Fitopatoloji · Bitki Hastalıkları · Osmanlı Devleti · Cumhuriyet Dönemi · Tarım · Bilim Tarihi

Introduction

Since the time plants were introduced into agricultural practices, humanity has been in a constant struggle against diseases and pests.[1] The first recorded plant disease in history is estimated to be powdery mildew, observed in olive trees between 460-377 BCE. Similarly, between 370-286 BCE, the Greek philosopher Theophrastus, one of the first specialists in the field of plant diseases in antiquity, studied the impact of the environment on diseases affecting cereals, legumes, and forage crops.[2] These plant diseases are generally caused by fungi, viruses, and bacteria.[3] In tropical climates, pests cause diseases, while in cold and rainy climates, bacteria, parasites, and fungi are the primary causes of diseases.[4] Due to climate diversity in Turkey, 60 different agricultural products are cultivated, and around 300 plant diseases are estimated to affect these crops.[5] Discoveries and research on plant diseases have developed over a long historical process as a result of accumulated experience and knowledge. Thus, Phytopathology emerged as a scientific discipline.

Phytopathology, defined as the science of plant diseases, explains how diseases develop in plants and identifies methods for their prevention.[6] The development of phytopathology has been influenced by a wide geographical area and a long historical process, ranging from Ancient Greece and Rome to the civilizations of India and China.[7] As civilizations advanced and military, political, economic, and commercial relations between different societies increased, epidemic diseases also began to spread.[8] Additionally, since phytopathology focuses on the production of healthy, high-quality, and efficient food, its scope is not limited to agriculture but directly concerns economics and trade as well.[9] The increasing food demand resulting from the growing population has both expanded the cultivation areas of various crops and increased the international trade network in the spread of plant diseases.[10] Indeed, the Food and Agriculture Organization (FAO) of the United Nations reported in 1947 that the annual loss in wheat and rice amounted to 33 million tons, a quantity sufficient to feed 150 million people each year.[11]

Since the yield losses caused by plant diseases in the agricultural sector affect society, economy, trade, and financial systems, phytopathology is an interdisciplinary field that breaks down the thick walls between the physical and social sciences. Therefore, it is evident that studying the history of phytopathology will shed light on a wide range of fields, from agriculture to economics and from society to politics. Indeed, the

[1] Bekir Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları* (Ankara: Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü, 1968), 8-15.

[2] M. Timur Döken, *Fitopatoloji* (Erzurum: Atatürk Üniversitesi Ziraat Fakültesi Ofset Tesisi, 1992), 1; Sonali Parvan et all, "Plant Disease- Introduction, History and Importance" *Advances in Plant* Pathology (Publisher: Sharma Publications & Distributions, 2023), 12.

[3] Ahmet Çınar, *Genel Fitopatoloji* (Adana: Çukurova Üniversitesi Ziraat Fakültesi, 1981), 1.

[4] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 8-15; Selahattin Kuntay, *Fitopatoloji* (Ankara: Ziraat Vekâleti, 1941), 7.

[5] Döken, *Fitopatoloji*, 5.

[6] Frank Lincoln Stevens, "Problems of Plant Pathology," *Botanical Gazette* 63, 4 (1917): 297; Döken, *Fitopatoloji.* 1; Çınar. *Genel Fitopatoloji,* 7-8; Philip Stewart, Sabine Globig (eds.), *Phytopathology in Plants* (Canada: Apple Academic Press, 2011).

[7] İbrahim Karaca, *Bitki Koruma Tarihi ve Stratejisi* (İzmir: Ege Üniversitesi Basımevi 1991), 1-2, 56.

[8] Frank Lincoln Stevens, "The Relation of Plant Pathology to Human Welfare," *American Journal of Botany* 8, 6 (1921): 316.

[9] Frank Lincoln Stevens, "Problems of Plant Pathology," *Botanical Gazette* 63, 4 (1917): 297; Döken, *Fitopatoloji,* 1; Çınar, *Genel Fitopatoloji,* 7-8.

[10] Frank Lincoln Steven, "The Science of Plant Pathology," *Journal of Elisha Mitchell Scientific Society* 21, 2 (1905): 66.

[11] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 8-15; Kuntay, *Fitopatoloji*, 7.

increase in plant diseases resulting from growing agricultural production, along with new scientific studies, the training of specialized personnel, and the development of institutional and technical infrastructure, have facilitated the advancement of phytopathology. However, the technical advancements that made this development possible and raised awareness included the invention of the microscope in the 17th century, the potato blight observed in Northern Europe in the mid-19th century, and the food and supply crises caused by World War I in the early 20th century. The food demands of the growing population, the military use of food and supplies during periods of crisis in wartime, and the declining tax revenues and increasing trade deficits due to yield losses caused by plant diseases highlight the importance of phytopathology for the state, society, and economy. Therefore, this study aims to examine the historical development of phytopathology, a highly strategic scientific discipline, both on a global scale and with a specific focus on Turkey. The development of phytopathology in Turkey directly reflects the scientific modernization journey of both the Ottoman Empire and the Republic of Turkey.

The Global History of Phytopathology: Microscopes, Epidemics, and Wars

The invention of the microscope by Leeuwenhoek in the 17th century was a pivotal moment in the establishment of phytopathology as a scientific discipline. However, after existing for a period under the umbrella of Botany, phytopathology became an independent scientific discipline and profession starting in the 19th century.[12] For example, the first scientists to study plant diseases in the 1850s were botanists.[13] In addition to botany, animal science and chemistry, as well as medicine and veterinary science, have contributed to the emergence of phytopathology as a practical scientific discipline.[14] For this reason, H. H. Whetzel classifies phytopathological studies from the 17th century to the mid-19th century as pre-modern research, while those conducted from the 19th century onward are considered modern research.[15] According to Erdiller, in terms of historical development phases, phytopathology consists of five distinct periods. The period up to 1600 is defined by the lack of scientific capabilities. The years from 1600 to 1850 are considered the Preparatory Period of phytopathology. From 1850 to 1900, the field entered the Etiological Period, followed by the Ecological Period from 1900 to 1950. Finally, from 1950 onwards, it has been known as the Biological Period.[16] This situation indicates that phytopathology not only has a rich and diverse historical background but also a promising future.[17] Throughout this long historical process, the field of phytopathology has shown significant development and has been divided into various sub-disciplines. Symptomatology, which studies disease symptoms; Etiology, which examines the causes of diseases; Pathology, which investigates disease conditions; Epidemiology, which studies epidemics; and Hygiene and Therapy, which focuses on prevention and treatment practices for diseases.[18]

The invention of the microscope in the 17th century accelerated studies on plants, further facilitating research in plant pathology and microorganisms.[19] This situation created awareness of plant diseases in political, social, and economic life, leading to the establishment of the first law concerning plant diseases

[12] Karaca, *Bitki Koruma Tarihi ve Stratejisi*, 1-2, 56.

[13] E. C. Stakman, "The Role of Plant Pathology in the Scientific and Social Development of the World," *AIBS Bulletin* 8,5 (1958): 18.

[14] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 8; Venus W. Pool, "The Present Status of Plant Pathology," *The Plant World* 12,9 (1909): 206.

[15] Jonathan Yuen et all. "History of Plant Pathology," *CABI Digital Library* (2020): 12. https://www.cabidigitallibrary.org/doi/pdf/ 10.5555/20203465541 (Acessed on 19 September 2024).

[16] Erdiller, *Fitopatoloji*, 911.

[17] Stakman, "The Role of Plant Pathology in the Scientific and Social Development of the World," 15.

[18] Döken, *Fitopatoloji*, 10.

[19] Stakman, "The Role of Plant Pathology in the Scientific and Social Development of the World," 17.

in the city of Rouen, France, in 1660.[20] As time progressed and scientific research gained momentum, Carl von Linnaeus developed taxonomy in the 18th century by classifying plants and animals. Tozetti conducted studies on wheat rust in Italy during a period in the 18th century that laid the foundations for experimental phytopathology. In the early 19th century, J.J. Plenck wrote a work titled *Physiology et Pathologia Plantarum*, while Neumann authored a book called *Plant Medicine*.[21]

Another significant turning point in the development of phytopathology after the invention of the microscope was the potato blight (Phytophthora infestans) that began in Ireland and Northern Europe in 1830 and spread across Europe. Due to potato blight, potato production in Ireland decreased by 80% in 1846. When examining the social and economic consequences of this situation, it is noted that out of Ireland's eight million population, two million people died, and many others were forced to emigrate to the United States. This disaster led to serious socio-economic consequences, raising significant awareness of phytopathology[22] and establishing it as a recognized institutional discipline. The first research institutions for nematode studies were established during this period.[23] The cause of this disease was identified as *Phytophthora infestans* by Anton de Bary, a German scientist considered the father of phytopathology and the founder of mycology, in 1861.[24] In France, Montaigne and in England, Berkeley identified the fungus as the cause of the disease. Influenced by this accumulated knowledge, the book titled *The Diseases of Cultivated Crops, their Causes and their Control*, written by Kuhn in 1858, is considered the first textbook in the field of modern phytopathology. At the same time, the first step toward phytopathology becoming an independent academic discipline was taken in 1883 at the Royal Veterinary and Agricultural University in Denmark.[25]

Another dynamic in the development of phytopathology was World War I, which began as a major military crisis on a global scale but deeply affected social and economic life due to its total war nature. The war years were a period of severe war economics globally, with food and supplies being used for strategic military purposes. Consequently, the American Phytopathological Society established the War Emergency Board of American Plant Pathologists to address issues related to food production and preservation during the war.[26] In fact, advancements in phytopathology over time led to the emergence of Plant Protection. Plant Protection involves measures taken to protect plants from diseases and pests, as well as treatment practices implemented after a disease occurs.[27] In the 20th century, Germany's Biologische Bundesanstalt, a pioneering institution in plant protection, initiated independent research and was later renamed the Kaiser Wilhelm Institute and subsequently the Max Planck Institute. Additionally, academic units dedicated to plant pathology were established in Copenhagen, Smela (Russia), Washington, and London.[28]

Since the First World War caused a serious war economy in Europe, phytopathology studies were largely moved to the United States from 1917 onwards. This situation is closely related to both the late involvement of the USA in the war and the phytopathology studies that started in the last quarter of the 19th century. As a matter of fact, a committee was established in the USA in 1884 to investigate the diseases and health problems of plants. In this process, on the one hand, the American Ministry of Agriculture provided support

[20] Erdiller, *Fitopatoloji*, 11.

[21] Karaca, *Bitki Koruma Tarihi ve Stratejisi,* 35-42.

[22] Karaca, *Bitki Koruma Tarihi ve Stratejisi,* 44-50.

[23] Erdiller, *Fitopatoloji*, 13.

[24] Döken, *Fitopatoloji,* 2; Çınar, *Genel Fitopatoloji,* 3.

[25] Erdiller*Fitopatoloji*, 12; Yuen. et. all, "History of Plant Pathology",12-15.

[26] C. L. Shear and Neil E. Stemen, "Plant Pathology to Day" *The Scientific Monthly* 7,3 (1918): 243.

[27] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 7.

[28] Karaca, *Bitki Koruma Tarihi ve Stratejisi,* 62-66.

and on the other hand, botany departments were founded in universities.[29] In addition to public institutions, the contribution of civil society cannot be overlooked. During this process, the American Phytopathological Society played a significant role in the institutionalization of phytopathology.[30]

Between 1907 and 1917, significant efforts by the American Phytopathological Society led to the establishment of phytopathology departments at American universities. Epidemic diseases ensured that phytopathology remained relevant and continued to develop, although the focus was primarily on economically valuable crops. However, the research conducted by phytopathology specialists was limited to the vegetation process of the crops, and the value-added production stage after harvest was not studied.[31] However, it is observed that in the United States, phytopathology developed primarily through disease-focused research. In this context, studies in areas such as virology, soil microbiology, and parasitic physiology have gained prominence. In the 1960s, the American Phytopathological Society organized short lectures for academics at Oregon State University and the University of Massachusetts to teach this academic discipline to high school students.[32]

Until the late 19th century, books were significant sources for the dissemination of knowledge. However, after this period, academic journals began to gain importance alongside books to maintain the currency of information. *Hedwigia, Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz, Centrallblatt für Bakteriologie,* and *Journal of Phytopathology* published in the United States in 1911 have emerged as prominent academic journals.[33] In the Ecological Period (1900-1950), as described by Erdiller, international congresses discussing chemical control and physiological methods, as well as the establishment of committees, became prominent.[34] However, with the increase in the number of scientists and the growing demand for science, journals became insufficient, leading to the advent of the congress era. The first scientific meeting discussing plant diseases was the International Agriculture and Forestry Congress held in Vienna in 1890. Additionally, the International Phytopathology Committee was established at this congress. Notable phytopathologists, such as Paul Sorauer and Erickson, drew attention during the conference. The first congress under the name of phytopathology was the International Congress of Phytopathology held in Rome in 1914 with the participation of scientists from 30 countries. Following the congresses, Phytopathological Societies were established in the United States in 1911, in Germany in 1934 and in Turkey in 1970 in order to increase the exchange of information and strengthen solidarity among phytopathologists. However, due to the agricultural, economic, and social significance of phytopathology, its organization and institutionalization in the public sector occurred after World War II.[35] In the period following the 1950s, referred to by Erdiller as the Biological Period, there was a noticeable acceleration in studies on plant diseases and the investigation of disease epidemics, along with the introduction of new methods for combating these diseases. The socio-economic dimension of plant diseases and pests was evaluated at a symposium held in Rome in 1967 by the Food and Agriculture Organization of the United Nations, with representatives from 36 countries participating.[36] Since the 1980s, the most significant driving force behind phytopathology has been the convergence of molecular biology and genetics.[37]

[29] Karaca, *Bitki Koruma Tarihi ve Stratejisi,* 1-2, 77; Shear and Stemen, "Plant Pathology to Day" 235.

[30] Stackman, "The Role of Plant Pathology in the Scientific and Social Development of the World," 18.

[31] Shear and Stemen, "Plant Pathology to Day," 236-239.

[32] Ira W. Deep, "Plant Pathology," *North American Colleages and Teachers of Agriculture (NACTA)* 11, 2-3 (1967): 33-34.

[33] Karaca, *Bitki Koruma Tarihi ve Stratejisi,* 3-4, 57; İbrahim Karaca, 1992, *Türkiye'de Fitopatoloji Tarihi*, İzmir: Ege Üniversitesi Basımevi, 67-68.

[34] Erdiller, *Fitopatoloji*, 14.

[35] Karaca, *Bitki Koruma Tarihi ve Stratejisi,* 3-4, 57; Karaca, *Türkiye'de Fitopatoloji Tarihi,* 67-68.

[36] Erdiller, *Fitopatoloji*, 14-15.

[37] Erdiller, *Fitopatoloji*, 12; Yuen. et. all. 2020, "History of Plant Pathology", 12-15,

The invention of the microscope in the 17th century, the mid-19th century potato blight in Ireland, and the emphasis on healthy food during World War I were pivotal events in the global historical development of phytopathology. The story of phytopathology in Turkey is also part of the modernization process, which can be described as the pursuit of Western developments in fields such as education, politics, economics, and agriculture from the Ottoman Empire to the Republican era.

Turkey's Phytopathological Journey: People, Institutions, and Modernization

The Western-style modernization that began during the reign of Sultan Selim III in the Ottoman Empire continued to intensify during the Tanzimat Period (1839–1876).[38] One of the innovations in the field of education during the Tanzimat Period was the inclusion of specialized institutions for each profession. During this period, due to the absence of a coherent and stable state policy and a dedicated ministry in the field of agriculture, farming was largely seen as a peasant activity and was practiced using relatively primitive methods. The Ottoman Empire's involvement in agriculture was largely limited to agricultural taxes such as *aşar* and *agnam*. Mustafa Reşit Pasha[39] who had served as an ambassador in London and Paris before becoming Grand Vizier, established Mekteb-i Ziraat-ı Şahane (the Imperial School of Agriculture) and the Ministry of Agriculture in 1846 in an effort to institutionalize agriculture within both education and politics.[40] The belief that competent bureaucratic personnel could be developed for the agricultural sector also contributed to the establishment of the Ministry. After the 1838 Baltalimanı Trade Agreement, which integrated the Ottoman economy into global capitalism, agricultural products gained a significant share in exports.[41] Consequently, the state shifted its focus towards a trade-oriented agricultural policy rather than prioritizing agricultural production. For this reason, the Ministry of Agriculture was attached to the Ministry of Commerce just four months later.[42] The reason for this merger was the Ministry of Agriculture's need for a substantial budget and the potential for long-term outcomes from investments.[43] However, by 1850, a department called the Ziraat Meclisi (Agricultural Council) was established within Ticaret ve Umur-ı Nafia Nezareti (Ministry of Commerce and Public Works). Although an independent Ministry of Agriculture was re-established in 1869, it was transformed back into a directorate three years later and attached to the Ministry of Commerce and Public Works. This situation clearly indicates that the Ottoman Empire lacked a systematic and institutional agricultural policy.[44]

Although the Ministry of Agriculture was not sustainable, the first steps in agricultural education were taken in Istanbul. When cotton cultivation at the Ayamama Farm in Yeşilköy failed due to climatic conditions, the first Higher Agricultural School was established on this land through the initiative of Mustafa Reşid Pasha. The school's director was Elhac Bekir Ağa, and education commenced with 46 students. The curriculum of the school was modeled after that of the Grignon Higher Agricultural School in France. This was due to the presence of several notable Ottoman citizens of Armenian descent who received agricultural education at Grignon in the 19th century. One of these individuals was Agaton. In 1843, during Mustafa Reşid Pasha's tenure as ambassador in Paris, he introduced Agaton to King Louis-Philippe of France as a promising

[38] İlber Ortaylı, *İmparatorluğun En Uzun Yüzyılı* (İstanbul: Hil Yayınları, 1987), 73; Erik Jan Zürcher, *Modernleşen Türkiye'nin Tarihi* çev. Yasemin Gönen, (İstanbul: İletişim Yayınları, 2000), 87-90.

[39] Volkan Çeşme, "Osmanlı'da Ziraatı Modernleştirme Sürecinde Halkalı Ziraat Mektebi (1892-1928): Kuruluşu ve Yapısı," *Osmanlı Bilimi Araştırmaları*, 15, 2 (2014): 2014:40.

[40] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 5-7.

[41] Şevket Pamuk, *Türkiye'nin 200 Yıllık İktisadi Tarihi* (İstanbul: İş Bankansı Kültür Yayınları, 2015), 97-104.

[42] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 5-7.

[43] Çeşme, "Osmanlı'da Ziraatı Modernleştirme Sürecinde Halkalı Ziraat Mektebi (1892-1928): Kuruluşu ve Yapısı," 40.

[44] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 5-7.

expert in agriculture. Following Mustafa Reşid Pasha's recommendation, Agaton was appointed as a teacher at the Higher Agricultural School in 1848. However, due to transportation difficulties, the swampy areas surrounding the school, and inadequacies in the building and educational materials, the school was closed three years later.[45] Like the ministry, the initiative in agricultural education has also failed.

Agop Amasyan, a graduate of the Grignon Agricultural School and a key figure in the agricultural reforms in the Ottoman Empire between 1879 and 1889, was one of the bureaucrats from the Ministry of Commerce and Agriculture.[46] Amasyan, considered the founding father of today's agricultural education, published a regulation regarding the establishment of the Halkalı Higher Agricultural School on August 14, 1884. The construction of the school, which was established based on the French educational curriculum, was completed in 1889. However, due to the widespread occurrence of cattle plague, İzzet Pasha, one of the prominent bureaucrats of the Ministry of Commerce and Agriculture, believed that there was a need for a veterinary school instead of an agricultural school. Although the school initially opened as a veterinary school, it was renamed the Halkalı Agricultural and Veterinary School in 1891, two years later. This situation arose from the outbreak of the cotton boll weevil (eurygaster integriceps) observed in Çukurova in 1887. In fact, a similar situation was seen in Diyarbakır in 1905, and the locust invasion in Western Anatolia during World War I highlighted the importance of agricultural combat. As a result, a temporary Agricultural Combat Organization was established under the Ministry of Agriculture in 1915, and directorates affiliated with this organization were set up in provinces and districts.[47] This situation also highlighted the importance of fields such as Entomology and Phytopathology. In fact, as part of the fight against locusts in 1915, Dr. H. Bürcher and his team from Germany were invited, and the Locust Law, which came into effect on March 7, 1916, established a system of locust officers during a period marked by wartime economy and a shortage of agricultural engineers. As evident, the agricultural policy of the time, though lacking in planning and programming, inadvertently established the institutional foundations for both agricultural education and agricultural bureaucracy. The first document concerning Phytopathology in Turkey was a letter sent in 1875 from the Prime Ministry to the Ministry of Customs outlining foreign trade measures against the phylloxera[48] threat. Five years later, in 1880, the Phylloxera Regulation[49] was enacted, followed by the Phylloxera Law in 1912.[50]

At the institutional level, the history of phytopathology in Turkey began with the opening of the Halkalı Agricultural School in 1892. It can be argued that phytopathological studies started later compared to other agricultural sciences. Certainly, the historical development of phytopathology has evolved in relation to the increase in plant diseases[51], the process of institutionalization, new scientific research, and the training of specialized personnel.[52]

[45] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 8-10; Mahmut Akpınar, "Bir Tanzimat Bürokratının Portresi: Krikor Agaton Efendi (1823-1868)," *Tarih İncelemeleri Dergisi* 28, 2 (2013): 334.

[46] Özkan Keskin, "Üzümün Bağı Asmanın Kurdu: Osmanlı İmparatorluğunda Filoksera ile Mücadele," *Tarih İncelemeleri Dergisi* 30, 2 (2015): 482.

[47] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 8-13, 83.

[48] Phylloxera originated in America and it is possible to say that the Ottoman Empire took the most comprehensive measures against phylloxera in agricultural diseases. Donald Quatert, *Anadolu'da Osmanlı Reformu ve Tarım 1876-1908* çev. Nilay Özok Gündoğan- Azat Zana Gündoğan, (İstanbul: İş Bankası Kültür Yayınları, 2008), 185.

[49] Although phylloxera was first detected in the Ottoman borders in 1885, the first regulation dates back to 1880. For the regulation, see: Düstur I, Tertip Zeyl I, İstanbul: 1299, 84-85.

[50] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 9-10.

[51] Agricultural diseases spread widely during the 19th century, negatively impacting the economic structure of the Ottoman Empire. For instance, in the 19th century, various agricultural diseases such as yellows, shaking, and powdery mildew disrupted viticulture and hindered agricultural production in Ottoman vineyards. Abdullah Kara ve Mustafa Çavdaroğlu, "20 Yüzyılda Osmanlı Devleti'nde Tarımsal Hastalık Olarak Mildiyö ve Halkalı Ziraat Mektebi Muallimlerinden Ali Rıza Bey'in Mildiyö Hastalığına Karşı Kullanılan Yöntemlere Dair Göürşleri", *Bellek Uluslararası Tarih ve Kültür Araştırmaları Dergisi* 2, 1 (2020): 81.

[52] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 1-3, 64.

With the spread of plant diseases, the Ottoman government began seeking new solutions, one of which was through the press and publications. According to a report from 1893, the annual expenses for printed materials such as journals[53], pamphlets, books, and newspapers on this subject exceeded 10,000 kuruş.[54] In addition, schools were to be established. The most notable of these was the work carried out by the staff of Halkalı Agricultural School, which played a prominent role.

In 1909, Ali Rıza Erten, a graduate of the 14th class of the Halkalı Agricultural School, studied Plant Pathology at the University of Paris. During his time in France between 1909 and 1912, he took courses from prominent botanists such as Wantingham and Fon, as well as pathologists like Perillieus, Griffon, Macublon, and Marshall, and served as their assistant. After returning to Turkey in 1912, Erten worked for a while at the İzmir Seydiköy School of Viticulture and Horticulture, and was subsequently appointed to the position at the Halkalı Higher Agricultural School and the Ministry of Agriculture's Plant Disease Station. For the first time in Ottoman history, courses in Phytopathology were offered by Ali Rıza Erten at the Halkalı Higher Agricultural School in 1914. While Erten taught Botany and Phytopathology, Süreyya Özek taught Agricultural Biology and Entomology. Therefore, Erten is regarded as Turkey's first specialist in Phytopathology. As a result of Erten's five years of work, his study titled *Nebatat Hastalık ve Düşmanları* (Plant Diseases and Their Enemies), published in 1928, is the first book written in the field of Phytopathology in Turkey.[55]

In addition, the existence of the Vaccination Surgery School, which focused on combating plant diseases, particularly phylloxera, is recorded in the archives. A document from 1893 specifically mentions this school. Furthermore, archival records indicate that efforts to establish additional Vaccination Surgery Schools were made in subsequent years to continue the fight against such agricultural diseases.[56] In these schools, methods and techniques for combating plant diseases were researched. The most prominent chemical method that emerged was the use of copper sulfate, commonly known as *göz taşı*.[57] In fact, shipments of copper sulfate were sent to various regions of the Empire.[58] In addition to all these measures, the Ottoman Empire closely monitored plant disease issues and developments abroad. Particularly, the filoxera disease, which originated in America and quickly spread to Europe via France, prompted the Empire to take various precautions to prevent its spread into Ottoman territories. In this context, it was decided to impose a ban on the importation of plants, saplings, and other related goods in order to stop the entry of filoxera through imports. These measures were part of the efforts to protect agricultural production within the Empire's borders.[59]

The educational aspect of agriculture has achieved stability through the establishment of schools and the involvement of specialists. However, the establishment of the Ministry of Agriculture and its organization in provinces is essential for the determination and sustainability of agricultural policies, as well as for the applicability of knowledge in the public domain. However, the realization of this will require waiting for the declaration of the Republic.

[53] Numerous newspapers have published informative articles on plant diseases. For instance, the *Osmanlı Ziraat and Ticaret Newspaper* featured articles under the heading *Nebatat Hastalıkları* (Plant Diseases) For detail: *Osmanlı Ziraat ve Ticaret Newspaper*, 1, 5, 56-57; For the purpose of establishing a scientific and practical guide for farmers *Bağçevan Newspaper* was published: *Bağçevan*, 1, 1-2.

[54] BOA, ŞD, 2619/48.

[55] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 13-18; Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 12.

[56] BOA, ML. EEM, 729/71; BOA. ZB, 402/64; BOA, İ. HUS, 4/9.

[57] *Resimli Ziraat Newspaper*, 5, 49-54.

[58] BOA, BEO, 2774/208001

[59] BOA, DH.MKT. 1330/95; BOA, BEO, 1382/103628.

During the Republican era, agricultural education built upon the foundation established in the Ottoman period and continued to develop in accordance with the conditions of the time. In 1927, the law titled Islahat-ı Tedrisat-ı Ziraiye initiated modernization in agricultural education, leading to the closure of all agricultural schools. In 1930, the Higher Agricultural School was established at the Atatürk Forestry Farm in Ankara, followed by the establishment of the Higher Agricultural Institute in the Dışkapı area in 1933. In agricultural education, the German model, which prioritizes analytical thinking, was adopted instead of the rote-learning and repetitive French educational model. While traces of the German educational model can be observed at the Higher Agricultural Institute, it is an institution composed of five faculties. The institute also hosts instructors such as Friedrich Falke, who sought refuge in the Republic of Turkey from Nazi Germany. Although there were initially no direct courses in Phytopathology at the Institute, information about plant diseases was taught in various subjects. In 1934, after starting to work at the Agricultural Pest Control Institute in Ankara, the German-born Phytopathology specialist Prof. Dr. Gustav Gassner began teaching Phytopathology courses at the Higher Agricultural Institute in 1936. His assistants were Mediha Özkan and Alaeddin Göydün.[60] Another expert in the field of plant protection is Prof. Dr. Bodenheimer. Between 1930 and 1936, courses in Phytopathology and Entomology were offered under the titles of Natural Sciences and Agricultural Studies. Starting from 1937, Entomology and Phytopathology were taught as independent courses.[61] Additionally, in 1937, the German phytopathologist Hans Bremer began working at the Bornova Agricultural Pest Control Institute and, after three years in İzmir, was transferred to the Ankara Central Agricultural Pest Control Institute in 1940 and his work period was extended by the Ministry of Agriculture.[62] Bremer played a significant role in the development of Mediha Özkan, Selahattin İren, and Abdullah Gürcan. In fact, the original work on *Turkish Phytopathology*, translated into Turkish by Mediha Özkan, was authored by Bremer.[63] At this point, the Ankara Higher Agricultural Institute holds significant importance in agricultural education during the Republic era, following the Halkalı Agricultural School in the Ottoman period.

Turkish Phytopathology was initially continued by German scientists following Ali Rıza Erten's tenure as a member of parliament, but another important Turkish scientist in this field is Selahattin Fehmi Kuntay. After graduating from the Halkalı Agricultural School in 1926, Kuntay pursued his doctoral studies in Botany in Germany for six years and became the first scientist to conduct research on weeds in 1939. This work was published by the Ministry of Agriculture in 1944.[64] In 1944, Kuntay initiated the establishment of a Phytopathology Institute affiliated with the Faculty of Agriculture at the Ankara Higher Technology Institute. The need for phytopathology research within the Faculty of Agriculture and the economic importance of phytopathology motivated Kuntay to pursue such an initiative. On April 4, 1947, the Higher Agricultural Institute decided to establish a Plant Diseases Institute, which also included Entomology. Indeed, it was Bekir Alkan who developed and advanced the Entomology studies initiated by Süreyya Özek in 1914 at this institute during the 1940s. Through this institute, the institutional infrastructure for Phytopathology was also established.[65] In 1950, the Department of Plant Protection was established.[66]

[60] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 34.

[61] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 13.

[62] For documents regarding the extension of the service period, please refer to the relevant records: Presidency of the Republic of Turkey Directorate of State Archives Republic Archive (BCA) 30-18-1-2/ 121 - 88 – 11; BCA 30-18-1-2/ 181-86-8; BCA 30-18-1-2/ 115-83-2; BCA 30-18-1-2/ 112-92-5.

[63] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 115-118.

[64] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 36-37; Feza Günergun, Cumhuriyet Devrimizin Bilim Üretimine Katkıları, https://www.klimik.org.tr/wp-content/uploads/2013/03/FezaGunergun1.pdf (Access on 17.09.024).

[65] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 41-50.

[66] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 13.

On June 30, 1948, the Ankara Higher Agricultural Institute was closed, and the Faculty of Forestry was affiliated with Istanbul University, while the faculties of Veterinary Medicine, Agriculture, Agricultural Arts, and Natural Sciences were transferred to Ankara University.[67] Between 1948 and 1949, the phytopathology courses at the Institute were delivered by Dr. Mediha Özkan, Gassner's assistant. However, since she had not yet completed her doctoral studies, the courses were subsequently undertaken by Bekir Alkan for five years. In 1953, Alkan played a pivotal role in the establishment of the Plant Protection Department, which encompassed major disciplines such as Phytopathology, Entomology, and Herbology in Turkey. He invited Prof. Dr. Kurtz Lohwag, a distinguished expert in phytopathology from the Hochschule für Bodenkultur in Vienna, to the Ankara Higher Agricultural Institute. Prof. Lohwag, specializing in forest phytopathology, delivered his lectures with translations provided by Alkan. Although he returned to Vienna after one year, he conducted summer school courses on forest phytopathology at Istanbul University's Faculty of Forestry between 1957 and 1959. Moreover, Lohwag contributed to the development of phytopathology in Turkey by mentoring İbrahim Karaca, one of the assistants at the Higher Agricultural Institute.[68]

Between 1957 and 1959, due to Karaca's military service, phytopathology courses were taught by Prof. Dr. William Winfield Ray from the University of Nebraska. Assoc. Dr. Zeliha Güneş and Dr. Abdullah Gürcan assisted Ray during this period. Karaca resumed teaching in 1959; however, he was stationed in Erzurum during 1961-1962 due to administrative duties at Atatürk University and later transferred to Ege University. During this time, Selahattin İren and Abdullah Gürcan made significant contributions to the field of phytopathology. İren worked with Prof. Dr. E. Stakman in Minnesota, became a professor in 1971, and retired in 1988, while Gürcan became a professor in 1976 and retired in 1992. Following their retirements, virology specialist Erdi Gürseller became prominent in the field. In the 1970s, phytopathology education was offered at the Faculties of Agriculture of Ankara, Ege, Atatürk, and Çukurova Universities. The Department of Plant Health at Ege University, established in 1955, began offering courses during the 1956-1957 academic year, with İbrahim Karaca serving as the head of the Phytopathology Division. Subsequently, a discipline in Herbology was also established. Additionally, Necati Kaşkoloğlu, the Director of the Agricultural Control Institute, taught at Ege University for 11 years until 1970. While the department at Ege University followed the American educational model, the corresponding department at Ankara University adhered to the German model. However, with the enactment of the 1981 Higher Education Law, the Ankara model was adopted nationwide. The Faculty of Agriculture at Çukurova University, on the other hand, was established in 1969 under the deanship of İ. Akif Kansu as an affiliate of Ankara University. In 1980, the Department of Plant Protection began its academic activities with 11 students. The faculty contributed to phytopathology through its research on viral diseases and established the Subtropical Fruits Research and Application Center. Prof. Dr. Ahmet Çınar played a significant role in advancing academic developments in phytopathology.[69]

Atatürk University in Erzurum was established in 1970 with Law No. 6990. In 1958, the Department of Field Crops and the Department of Horticulture were organized under a single department called Phytotechnology. On March 21, 1968, with the decision of the Ministry of National Education numbered 6318, the Department of Plant Protection was established under the chairmanship of Nematology specialist Prof. Dr. Hasan Ş. Yüksel. The department began admitting students in 1979. Alongside Yüksel, Herbologist Prof. Dr. Zeki Özer and Entomologist Hikmet Özbek were also involved in the department. Atatürk University Department of Plant Protection is lagging behind the others in terms of educational infrastructure. This situation was caused by the geographical location of the city, lack of laboratories, climate room and course

[67] Sevtap Kadıoğlu, "Ankara Yüksek Ziraat Enstitüsünde Mülteci Bilim Adamları," *Osmanlı Bilimi Araştırmaları, Atilla Bir Armağanı* 9, 1-2 (2008): 186.

[68] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 41-59.

[69] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 50-55;61-63;70-71,

equipment. In addition to universities and agricultural research institutes, research in phytopathology and entomology was also conducted at the Sugar Institute affiliated with the Turkish Sugar Factories Inc. and the Biology branch of the Maltepe Tobacco Institute under the Ministry of Customs and Monopoly. In 1961, the Plant Protection Museum was established within the General Directorate of Agricultural Fight and Agricultural Quarantine in Ankara.[70] By the 1990s, Ege University Faculty of Agriculture stood out academically, while Çukurova University Faculty of Agriculture excelled in physical infrastructure. The Plant Protection Departments at four universities in Turkey are on par with their European counterparts in terms of providing resources and infrastructure for Agricultural Research Institutes. However, in areas such as scientific incentives, work discipline, academic competition, teaching materials, machinery, and equipment, European institutions maintain a significant advantage.[71]

Development Process of Phytopathology in the Turkish Ministry of Agriculture

Directorates of agricultural pest control were established within the Ministry of Agriculture in 1924. In the 1930s, 30% of the agricultural products produced in Turkey suffered yield losses due to diseases and pests.[72] In the 1930s, there were three agricultural pest control stations in Turkey, located in Ankara, Adana, and İzmir. In fact, during this period, there were plans to bring scientists from Germany to conduct research on plant diseases.[73] However, these stations did not fully possess a comprehensive inventory of plant diseases and pests in Turkey. Between 1948 and 1978, Agricultural Pest Control Research Institutes were established in Istanbul, Samsun, Diyarbakır, and Erzincan. The enactment of the Agricultural Pest Control and Quarantine Law No. 6968 in 1957 led to the establishment of the Directorate General of Agricultural Pest Control and Quarantine, which operated until 1984, following German and Dutch models. The opening of the Halkalı Agricultural School in 1892, along with the establishment of agricultural pest control institutes in Bornova (Izmir) and Adana, represented significant milestones in the institutionalization of phytopathology. During the 1960s, the Directorate General of Agricultural Pest Control established laboratories dedicated to phytopathology, bacteriology, and entomology.[74]

The period from the enactment of the relevant law in 1957 to the restructuring of the Ministry of Agriculture in 1984 under the perspective of neoliberal policies, phytopathology was at its peak, when plant protection became important for farmers and the use of pesticides became widespread. In fact, in 1970, the Turkish Phytopathology Society was established in Izmir by a group of academics from the Faculty of Agriculture at Ege University, led by Prof. Dr. İbrahim Karaca, along with experts from the Bornova Agricultural Pest Control Institute. Since 1971, the society has been publishing the *Turkish Journal of Phytopathology*. Ege University has collaborated with the Ministry of Agriculture for professional development courses, as well as with the Bornova Agricultural Pest Control Institute and the Nazilli Cotton Research Institute. In addition to the society, the journal, and academic activities, the Departments of Plant Protection at Ankara University, Ege University, Atatürk University in Erzurum, and Çukurova University have contributed to the advancement of phytopathology. However, following 1984, phytopathology research shifted towards desk-based projects under the influence of neoliberal policies. In the 1980s, some plant protection institutes were affiliated with agricultural research institutes, and phytopathology studies continued within these institutions. Addition-

[70] Alkan, *Türkiye Ziraatında Bitki Korumanın Kısa Tarihçesi Ekonomik Önemi, Organizasyonları ve Sorunları*, 32-35.

[71] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 73-81.

[72] Kuntay, *Fitopatoloji*, 8.

[73] Dr. Schwarz and Dr. Scheibe can be counted among these examples. BCA 30-18-1-2/ 22 -52 - 6 As scientists came to the country, efforts were also made to follow developments abroad. For instance, it was planned for Ali Rıza and Süreyya Bey to attend a congress in the Netherlands concerning developments in plant diseases and entomology. BCA 30-10-0-0/ 229 -539 – 2.

[74] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 84-89; 1-3, 64; 97-103.

ally, the Plant Quarantine and Fumigation Directorate were established in port cities such as Istanbul, Izmir, Samsun, Antalya, Mersin, and Iskenderun for the examination of imports and exports, while the Quarantine Chief Technician Office was established in Edirne and Ankara.[75] The legal basis for this is the plant protection and quarantine agreements signed by the Republic of Turkey with the countries it trades. For example, an agreement, signed between the Government of the Republic of Turkey and the Government of Israel in Tel Aviv on September 16, 2003, envisages cooperation between the two countries in the field of plant protection, facilitating trade in plant products and taking measures for plant health.[76] A similar agreement was signed between the Government of the Republic of Turkey and the Kingdom of Morocco on March 30, 2005, in Rabat. This international agreement was also approved by the Grand National Assembly of Turkey on October 24, 2007.[77] In fact, on March 28, 2011, the Republic of Turkey and the Republic of Argentina signed an agreement on cooperation in the field of plant protection in Ankara.[78]

Conclusion

The invention of the microscope in the 17th century marked a significant turning point in the scientific development of phytopathology; however, the history of plant diseases dates back long before humanity appeared on the historical stage. The knowledge and experiences of diverse societies—from ancient Greece and Rome to the civilizations of India, China, Egypt, and Mesopotamia—contributed to its development up until the 17th century. The invention of the microscope, along with the potato blight seen in Northern Europe in the mid-19th century and the army's need for food and supplies during World War I, highlighted the importance of agricultural productivity and healthy food. This situation demonstrates that the field of phytopathology directly influences politics, society, the economy, the financial system, and trade.

Since the 19th century, Botany, Chemistry, Medicine and Veterinary Medicine have been influential in the development of Phytopathology. Scientific advances and research in phytopathology have been intertwined with social and economic issues and the process of institutionalization. The first scientific studies in phytopathology started in Europe with the invention of the microscope. However, after the severe war economy caused by the First World War in Europe, the studies in the field of Phytopathology shifted mainly to the United States of America. In the USA, Phytopathology has been systematically continued with the support of the Ministry of Agriculture, universities and the American Phytopathological Society for scientific studies, publications and congresses.

However, when the story of phytopathology in Turkey is examined, it is possible to see the traces of Ottoman modernization. First and foremost, it is evident that during the establishment of both the Ministry of Agriculture and agricultural schools in the 19th century, the focus was on responding to the conditions of the time rather than on planning, sustainability, institutionalism, and production economy. This is evidenced by the closure of the Ministry of Agriculture in 1846, which was then affiliated with the Ministry of Commerce, as well as the establishment of the Veterinary School in response to the cattle plague, despite plans to open an agricultural school. A non-scientific approach that prioritizes short-term commercial gains over efficiency in the production economy can be observed. It is known that the first documents in the field of Phytopathology in the Ottoman Empire were about phylloxera seen in vineyards in 1875. However, the introduction of phytopathology into the education system was thanks to Ali Rıza Erten, who taught at the

[75] Karaca, *Türkiye'de Fitopatoloji Tarihi*, 1-3, 64; 97-103.

[76] TBMM Türkiye Cumhuriyeti Hükümeti ile İsrail Devleti Hükümeti Arasında Bitki Koruma ve Karantina Alanında Anlaşmanın Onaylanmasının Uygun Bulunduğuna Dair Kanun Tasarısı ve Dışişleri Komisyonu Raporu (1/739) https://www5.tbmm.gov.tr/tutanaklar/TUTANAK/TBMM/d22/c054/tbmm22054108ss0442.pdf (Access on 19 Eylül 2024).

[77] Grand National Assembly of Turkey, Journal of Minutes, Term. 23, Vol. 3, 24 October 2007, 175- 176, 205; *Official Journal* 2 November 2007.

[78] *Official Journal 2,* 19 January 2011.

Halkalı Agricultural School after 1912. As a matter of fact, Erten is the founder of Phytopathology in Turkey. While Ottoman agricultural education and bureaucratic organization were influenced by France, the Republic adopted the German model, both through its inquisitive education system and the influence of experts from Germany in the 1940s. While the Halkalı Agricultural School was prominent in agricultural education during the Ottoman period, the Ankara Higher Agricultural Institute stood out until the mid-1940s. In the 1950s, due to Turkey's alignment with the Western Bloc during the Cold War and the development of Phytopathology in the United States, Turkish Phytopathology specialists also emerged who obtained their doctorates in the U.S. after studying in Europe. Since the mid-1950s, scientific studies have been carried out in the Phytopathology Departments of the Plant Protection Departments of the Faculties of Agriculture established at Ege University, Erzurum Atatürk University and Çukurova University, as well as Ankara University.

Following the proclamation of the Republic, various laws were enacted, and agricultural research institutes were established to address the production losses in agriculture caused by pests, harmful animals, and locusts. These institutions collaborated with universities on scientific research and publications while also engaging in educational and outreach activities targeted at farmers. This illustrates that Phytopathology in Turkey evolved through both educational initiatives and the bureaucratic framework of the Ministry of Agriculture.

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