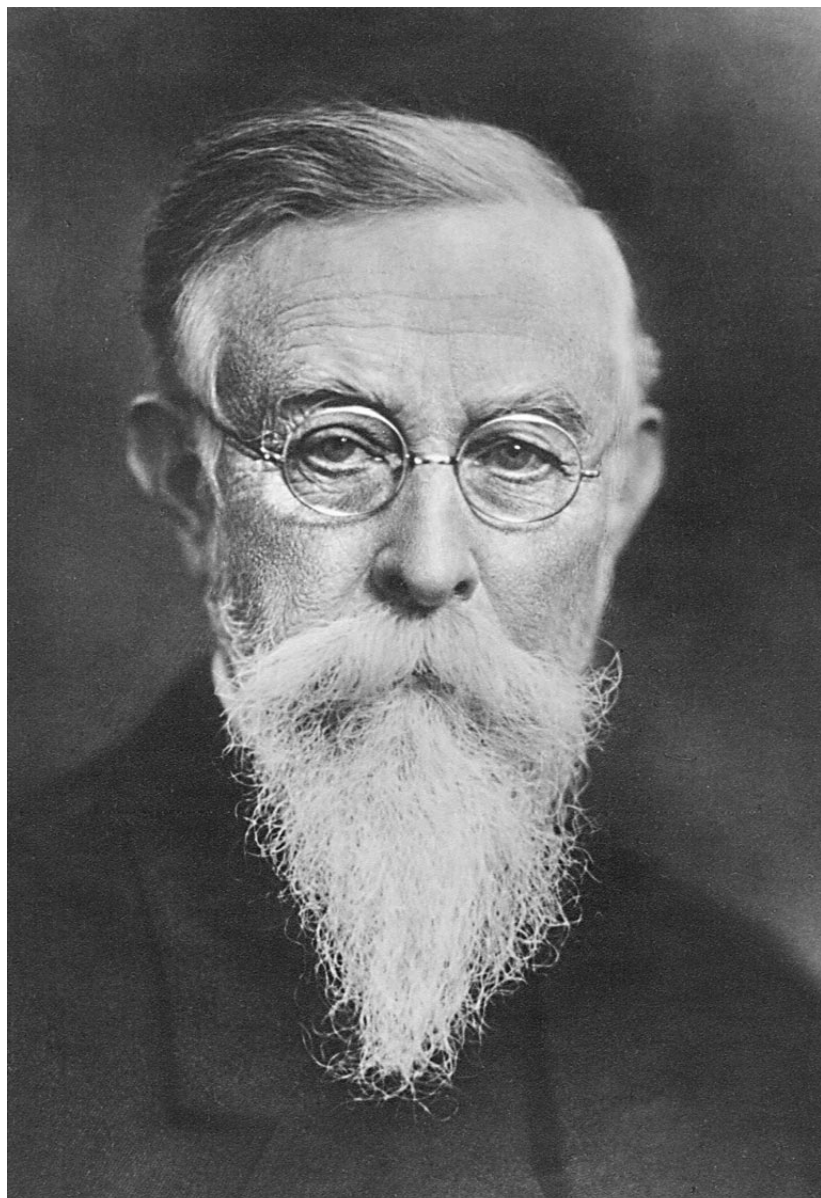




CARL FREIHERR VON TUBEUF

CARL FREIHERR VON TUBEUF: Pioneer in Biological Control of Plant Diseases

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■ **Abstract** Carl von Tubeuf, a founder of plant pathology in Europe, pioneered biological control of a major plant disease and introduced the term “biological control” to plant pathology. His book on plant diseases was one of the first to be published in English. He was proficient in many areas, and his interests included plant diseases, mycology, forest insects, white pine blister rust, the mistletoes, plant protection laws, and nature conservation.

INTRODUCTION

Biological control, especially in its abbreviated form, biocontrol, is a frequent topic in plant pathology literature, and it is appropriate to profile and recognize Prof. Dr. Carl Freiherr von Tubeuf who pioneered biological control of a major plant disease and introduced the term to plant pathology. Although early forest pathologists (4, 7, 9) were aware of this work, none of the texts on biological control nor any of the numerous reviews on this topic mentions Tubeuf’s pioneering contributions.

Tubeuf published on biological control of forest insects as early as 1893 (8), and in 1901 published on the systematics of *Tuberculina maxima* Rostr., “a parasite of Weymouth pine (*Pinus strobus* L.) blister rust” (15). In 1914 he published *Biological Control of Fungus Diseases of Plants*, the first application of the term biological control to plant diseases (20). Expectations exceeded results, and subsequent workers did not share Tubeuf’s enthusiasm of *Tuberculina* for blister rust control (4, 5, 7).

Biological control of plant diseases was a minor part of Tubeuf’s total contribution to plant pathology, and to plant sciences as a whole. He was a founder of plant pathology in Europe and over his career published on a wide range of topics in forest botany, dendrology, plant pathology, and mycology (8). He was also a

qualified zoologist and published on birds, snakes, insects, and mites, including discovering and naming several new species of gall mites of conifers. His 1895 textbook on plant diseases (12) was translated into English in 1897 (13) by a former student, William G. Smith, who stated that “no such book as this exists in the English language.” Most early American texts cited Tubeuf’s book as a contribution to plant pathology.

Tubeuf had a long association with Robert Hartig, a founder of forest pathology. He was Hartig’s student, assistant, son-in-law, associate, and successor. Tubeuf was also a teacher, researcher, administrator, founder and editor of scientific journals, photographer and artist, champion of nature conservation, and advocate of plant protection laws.

Two obituaries detail Tubeuf’s professional achievements. His successor at Munich, Ernst Münch, emphasized Tubeuf’s contributions to plant pathology and forest botany (8) while L. Fabricius stressed Tubeuf’s work in dendrology (3). This review draws heavily from these two sources. These obituaries differ in the spelling of Tubeuf’s first name. Münch used the Latin version “Carl” whereas Fabricius used the German form “Karl” as the name appears in two of Tubeuf’s major publications (12, 27). Tubeuf always used Carl but signed his publications variously as Carl Freiherr von Tubeuf, C. Freiherr von Tubeuf, C.F. von Tubeuf, von Tubeuf, v. Tubeuf, or simply as Tubeuf.

Carl Freiherr von Tubeuf was born on January 20, 1862 (Fabricius erred in giving the date as February 20, 1862), in Amorbach in Bavaria, as the grandson of one of the barons from the Barony of Tubeuf in Normandy who migrated to Germany before the French Revolution. His father, Anton Freiherr von Tubeuf, was director of the Prince Leiningen crown lands. Carl von Tubeuf earned a diploma at the classical grammar school in Munich in 1881, then studied forestry at the Aschaffenburg Forestry Institute from 1881 to 1883, and at Munich University from 1883 to 1885. Tubeuf completed his doctoral dissertation on “*Cucurbitaria laburni* on *Cytisus laburnum*” in 1886 and then worked for several months in the Bavarian Forest Superintendent’s office at Freising. However, Hartig had so stimulated Tubeuf’s botanical and phytopathological interests that he devoted himself entirely to botany and related subjects. He returned as assistant to Hartig but shortly took a temporary position as a substitute lecturer in forest botany at Karlsruhe Polytechnical University. In 1887 he again became Hartig’s assistant at the Forest Research Institute. While there he also became a private lecturer (Privatdozent) at the University of Munich and the Munich Polytechnical University. During this time he published his well-known textbook.

In autumn of 1898, Tubeuf went to Berlin as Imperial Advisor and member of the Imperial Board of Health to establish a Government Institute of Biology and in 1901, succeeded Albert Frank as Head of the Biological Division for Agriculture and Forestry in Berlin-Dahlem. Robert Hartig died that year and on April 1, 1902, Tubeuf was appointed his successor as Professor of Plant Anatomy, Physiology, and Pathology on the state faculty of the University of Munich, a position he held for 31 years. During his tenure, he was active in the University Senate and

Dean's office and, as Head of the Botany Division, was a permanent member of the Bavarian Forestry Research Institute.

Tubeuf wrote many publications on a wide range of topics. Fabricius (3) states that Tubeuf wrote over 300 publications not counting book reviews and short communications. Münch (8) provides a list of about 150 of Tubeuf's publications but omits many important ones including "Spread of blister rust with the purchase of Weymouth pine" (16) and "Biological control of blister rust of Weymouth pine" (29).

In 1892, Tubeuf founded "Forstlich-Naturwissenschaftliche Zeitschrift" (Forest Science Journal) and in 1898, founded and edited "Praktischen Blätter für Pflanzenschutz" (Practical Journal for Plant Protection). After he returned to Munich he and a colleague founded "Naturwissenschaftliche Zeitschrift für Land- und Forstwirtschaft" (Scientific Journal for Agriculture and Forestry) in 1903. This last named journal did not draw sufficient agricultural contributions and was discontinued in 1920. Lack of cooperation between professions is reflected by Tubeuf's comment in 1914 (20) that "regrettably, botanists and zoologists rarely work together," a situation that still exists today. Tubeuf also founded and edited "Blätter für Naturschutz" (Journal for Nature Conservation) as part of his activities with the Alliance for Nature Conservation in Bavaria.

In 1925, Tubeuf succeeded Paul Sorauer as editor of "Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz" (Journal of Plant Diseases and Plant Protection) and served until 1936, several years after his retirement. Tubeuf published mostly in journals under his control, which allowed him to publish short articles of local interest and to avoid critical comments of editors and reviewers. He could also publish on controversial topics without considering opposing views, as well as apply pressure to public authorities in areas such as plant protection legislation. Tubeuf could criticize those who opposed his views in articles with titles such as "Playing with fire: A warning against Herrn. Dr. H. Freiherr Geyr von Schwepenburg" (31) and "Consequences of Wappes' obstruction against the control of blister rust of Weymouth pine" (33).

Although Tubeuf is associated primarily with forest pathology, he has contributed to other agricultural areas, and one of his major accomplishments was development of a smut-resistant wheat variety. His many drawings and photographs of diseased agricultural plants reflect the wide range of crop plants that he studied. This was at a time when plant pathology was not yet a well-recognized discipline and Tubeuf was generally considered to be a botanist, as his many interests and writings indicate. However, one of his first publications was his 1889 "Habilitationsschrift" or habilitation paper entitled "Contributions to the knowledge of tree diseases." A habilitation paper was a work intended to qualify as a teacher in German universities at the time, and still is required for many faculties.

Among his other early major works were several small books such as "*Seeds, Fruit, and Seedlings of German Native or Introduced Forest Plantation Plants*" in 1891 and "*The Conifers with Special Regard to Middle Europe Winter-Hardy Species*" in 1897, also published in Russian. Tubeuf richly illustrated these with

drawings and photographs. The first had 100 illustrations and the second had 179. Tubeuf put high value on good, technically accurate illustrations and acquired many photographic skills. His general textbook (12) contained 330 drawings and photographs and his monumental 832-page monograph on mistletoes (27) had 180 illustrations, most of which were made by Tubeuf. All of his publications were enhanced with photographs and his four publications in 1916–1919 dealing with his 1913 trip to America contain over 100 photographs.

Not only was Tubeuf a skilled black and white photographer, he also pioneered use of the Lumière 3-color process in photomicrography. In 1911, he published a colored photomicrograph showing masses of bacteria among parenchyma cells in a bacterial gall on stone pine (18).

TUBEUF'S TEACHING

Tubeuf's biographers (3, 8) emphasized his research but he was also an innovative and dedicated, if demanding, teacher. A story told to the second author in the 1970s by Tubeuf's last assistant demonstrates how rigid Professor Tubeuf could be. In order to enhance the quality of projected slides the room had to be darkened and, so that there would be no disturbance after the lecture began, the assistant was instructed to lock the lecture room door immediately after Tubeuf entered the room and started the lecture.

Tubeuf was strongly influenced by Hartig and concentrated on practical aspects of his science rather than the philosophical. Tubeuf utilized field studies, as Hartig had, and as early as 1890, during time as Hartig's assistant and as a private lecturer, described the "Botanical excursions with forest science students of Munich University" (10). Some years later he wrote a small booklet describing these field trips for use as a teaching aid and a guide for students to prepare reports of the field trips (21). Establishment of field facilities such as those at Grafrath for teaching and research further demonstrates Tubeuf's emphasis on practical elements.

Tubeuf used illustrations liberally in his teaching and there still exists at the Institute of Forest Botany, which was moved from Munich to nearby Freising in 1992, a large collection of 9×12 cm glass slides, many of them hand colored, of pathology, dendrology, mycology, and other subjects. In 1893, Tubeuf described the use of the "magic lantern" for demonstration (11). From 1906 to 1910, he also prepared colored wall charts about plant diseases and wood-destroying fungi. In addition to the glass slides there are hundreds of large glass negatives from Tubeuf's photographic collection. The former Munich specimen collection, including valuable original material from Hartig's research, was enlarged by Tubeuf and considered unequalled at the time (8).

BIOLOGICAL CONTROL

Tubeuf attempted biological control of pine caterpillars with the fungus *Isaria* as early as 1892, and *Empusa* (now *Entomophthora*) in 1893; in 1897, he wrote of successful control of a caterpillar epidemic with the latter fungus (8). His 1901

paper on *Tuberculina maxima* (15) did not directly concern biological control of plant diseases but his 1914 paper (20) using this fungus dealt directly with this topic. The following excerpts are free translations of portions of that paper. They illustrate Tubeuf's introduction of this "new method of disease control."

"... the first proposal to use smaller animal parasites to fight against insects originated from Theodor Hartig in 1827.... The method by which natural enemies control insects is known today under the name biological control."

"Although the lower parasites of the plant kingdom, the bacteria and fungi, by their very fast reproduction, would seem to be especially suited to the control of insects, noteworthy results have not been attained. The number of official trials is remarkably small and although they were very welcome, regrettably botanists and zoologists rarely work together. Also my earlier trials in 1892 on the control of the caterpillar [*Lymantria monacha* L.] with the fungus *Isaria* gave very good results in the laboratory but failed in the field...."

"The insects damaging to agriculture and forestry are now controllable by 3 groups of natural enemies but in the case of plant pathogenic bacteria and fungi natural enemies are almost completely absent. Therefore, it seemed to me especially important to test biological control with one of the few cases in which one of the most dangerous fungal plant parasites seems to succumb to another parasitic fungus. It concerns the control of the rightly feared blister rust of Weymouth pine, which yearly kills not only thousands of young white pines, but also attacks older trees and may cause their death...."

"It has already long been known that a lilac-colored fungus sometimes lives as a parasite in the yellow aecia of *Peridermium strobi*...."

"When I was sent blister rust diseased Weymouth pine plants the previous summer I also obtained the lilac-colored parasite and I welcomed the opportunity to use the blister rust diseased *Pinus lambertiana* at Grafrath for an experiment. Several of its aecial pustules were dusted with conidia of *Tuberculina maxima* on 24 May 1913."

"After my return from a long trip [Tubeuf visited America from July to the end of October 1913] I immediately examined the Grafrath experiment and on 6 November found that all of the blister rust pustules were covered with a lilac-colored powder, already appearing in the distance to make an extremely noteworthy impression...."

"It would be enough if we could only apply the new biological control by this single disease, but it will not be until further studies prove if this is possible in other cases. We find in the case of many fungi with rapid conidial dispersal that, in spite of the presence of parasites, there is no decrease of disease. For example, it is an entirely different situation in the Erysiphaceae with its *Cicinnobolus*, because, in the case of *Peridermium strobi* the fungus is carried on the overwintering mycelium and prevents aecial formation the next year."

Tubeuf acknowledged that the relationship of *Tuberculina* mycelium with either the blister rust fungus or diseased pine tissues was not clear and, in the summer of 1914, he persuaded Eckley Lechmere to work in his laboratory and attempt to elucidate this relationship. Lechmere published his results in 1914 (5) and reported that “when the blister rust migrated upon the Weymouth pine, it was followed by the parasite, which could, however, attack only the aecia and spermogonia without spreading freely through the tissue of the host plant and destroy the mycelium there. For that reason, *Tuberculina* cannot be employed as a ‘biological control agent’.”

Despite the negative finding by Lechmere, Tubeuf continued to consider *Tuberculina* a means of biological control of white pine blister rust and in 1930 published a paper extolling this use (29). Tubeuf said, “. . . under this title [viz., “Biological Control”] I earlier described my experiments to control blister rust of white pine by means of a parasite (*Tuberculina maxima*) living in its aecial sori. Through yearlong tests I demonstrated that this parasitic fungus could be introduced into a region where pine suffers heavily from rust, become easily spread by wind, and through infection with it successfully heal aecial sori on stems or branches of white pine.”

Although Lechmere’s conclusions did not agree with his own, Tubeuf apparently thought highly of Lechmere and wrote a tribute about Lechmere’s premature and ironic death (32). The following paragraph summarizes Tubeuf’s Lechmere “Nachruf” (obituary).

Eckley Lechmere, a young Englishman doing botanical studies in France in 1914, went to Munich to do a histological study of the interaction of *Tuberculina* with *Cronartium ribicola* J.C. Fischer. Lechmere was fluent in French and English and soon became proficient in German. Shortly after Lechmere published his results, World War I began and, despite warnings from the British Consul, he lingered in Germany until he was interned with other British subjects. Tubeuf arranged for Lechmere’s release to serve as his assistant but Lechmere chose to remain interned with his countrymen where he organized and taught courses in botany using teaching material provided by Tubeuf. After the war, Lechmere returned to England where his sister waited, but tragically died in the influenza pandemic of 1918–19.

WHITE PINE BLISTER RUST

American pathologists and foresters knew Tubeuf through his early work on white pine blister rust. He and fellow German Heinrich Klebahn together contributed 100 years of studies on this disease. American blister rust leaders such as Perley Spaulding drew heavily on Tubeuf’s observations and experience in formulating blister rust control measures in the United States. As early as 1897 (14), Tubeuf called attention to the fact that commercial nurseries were spreading the disease

throughout Germany and began calling for government control of the forest tree nursery trade. Many years and many publications later, Germany finally enacted a general plant protection law in 1930, due largely to Tubeuf's persistent urging. Tubeuf's warnings likely were influential in the passage of the 1912 Plant Quarantine Act in the United States.

In his 1897 publication subtitled "The Danger of Spreading Bark Blister Rust of Weymouth Pine" (14), Tubeuf noted that "the fact that the fungus spreads especially on young plants in nurseries is easy to explain because *Ribes* species are cultivated there at the same time, which serve the fungus as alternate host plants and makes possible its rapid spread." He continued this campaign in 1904 (16) by stating his opinion that "If the blister rust of Weymouth pine ever becomes more widespread, then the ones who sell rust-diseased plants from their nurseries, the ones who tolerate the well-known distribution of diseased plants without trying to prevent it, and the ones who buy and import diseased plants bear the blame. I continue to try not to fall into one of these categories."

Tubeuf's involvement with white pine blister rust ran the gamut from danger of spread to the need to separate pines from the alternate hosts, to the utilization of resistant pine species such as *Pinus peuce* Griseb., as well as resistant *Ribes* varieties, e.g., "rote Holländische." American blister rust pathologists cited Tubeuf more than any other European authority on white pine blister rust, including Klebahn, primarily because he concentrated on the disease and its control. His 1901 colored wall chart, "Der Blasenrost der Weymouthkiefer," prepared while he was with the Biological Division of the Imperial Board of Health, was used by the USDA Bureau of Plant Industry to train its inspectors and others. Tubeuf summarized his 49-year involvement (1887–1936) with a detailed review of his work on white pine blister rust in one of his final publications (32).

PLANT PROTECTION LAWS

Tubeuf's early warning (14) of the spread of blister rust in Germany and Europe was largely ignored but he continued to push for a general law that would regulate the sale of plants that might spread plant pests. Tubeuf was persistent but additional warnings in 1904 (16, 17) and 1911 (19) had little effect. Although Germany had individual laws directed at specific pests, there was no law such as the 1912 Plant Quarantine Act of the United States, primarily because of opposition by the nursery trade, abetted in some cases by foresters and horticulturists.

Tubeuf appears to have lost interest in this topic, or at least was quiet about it, until 1928 when he resumed his crusade (28) with the following statement, "Until now only laws against individual pests were enacted . . . There exists, however, a need for a broader government plant protection law, in which structure the special laws would fit. Had we such a law for a decade, it is very likely that the terrible elm disease from Holland [Dutch elm disease] would not have been introduced to us . . . And had the United States of America such a law it might not have

imported the destructive blister rust disease.” Finally, in 1930, Germany enacted a general plant protection law regulating the importation of conifer plants and their parts (30).

MISTLETOE

Tubeuf’s favorite subject was the parasitic phanerogams, especially the mistletoes, which he studied over the longest time of his career (3, 8). These studies produced over 50 publications that covered a wide range of topics including general biology, infection trials, different forms, reproduction, cultivation, function of berry color and berry mucilage, distribution and spread, and host range. His observations were combined into his “*Monographie der Mistel*” in 1923 (27), which also included lengthy sections on mistletoe ethnology, and use in medicine and commerce and was extensively illustrated with photographs by the author. One short chapter relating to European mistletoe in North America under the title “Does *Viscum album* occur in America?” reads as follows,

“While its absence from America was pronounced with uncertainty by German authors,¹ George Engelmann, who treated the Loranthaceae in Sereno Watson’s *Flora of California* in 1880, says with all certainty: ‘Only two genera are represented in the United States,’ namely *Phoradendron* and *Arceuthobium*. According to this and other authors, and according to my own observations in various parts of the United States [referring to his 1913 trip], America is actually free of *Viscum album*. Indeed, a provision should even exist which prohibits importation of European mistletoes. That was very conceivable, since, as we have pointed out in another place, the American *Phorodendron*² and *Arceuthobium*³ species already cause very serious damage. However, to me it has not been confirmed in America. The mistletoes (see illustration in chapter 14, “Damage”), are used in America in the same way for Christmas as our mistletoe in Europe.”

Tubeuf was wrong about *Viscum album* not being in North America. *V. album* was later documented in California, where it had been present for many years but misidentified as *Phoradendron flavescens* (6). Apparently Luther Burbank, the famous horticulturist, established *Viscum album* at his experimental farm near Sebastopol about 1900, probably for commercial purposes. This parasitic plant did not spread rapidly and when discovered in 1966 was found only in a 16-square mile area around the original site. Although Tubeuf did visit California in 1913,

¹For example, P. Magnus in the Report of the Botanical Society of Brandenburg Province, 1875.

²Recent revised monograph of the species-rich genus *Phoradendron* by Trelease.

³Tubeuf CF. The species of the genus *Arceuthobium* with special regard to its biology and practical importance. With 50 illustrations in *Naturw. Z. Forst-Landw.* 1919, pp. 167–275.

his observations were restricted mostly to forests and it is unlikely that he visited the Sebastopol area.

TUBEUF IN AMERICA

In his "*Monographie der Mistel*," Tubeuf alluded to his observations of mistletoe "in various parts of the United States," referring to a 1913 trip described in four publications (23–26). He did not give his itinerary in detail but a general route can be deduced from the few dates and locations in his reports, as well as from the photo captions. The following excerpts give a general idea of the sites visited, with some dates included and names of some participants in different sections of the tour. Tubeuf did not present the events in chronological, or even geographical, sequence but scattered details over the four publications. For example, he does not tell about his arrival in New York until after describing his activities at Lincoln, Nebraska. We have attempted to put the events in chronological order to the extent possible.

Tubeuf begins with his enthusiastic acceptance of an invitation: "Since I was invited in May 1913 by American botanists to participate in a phytogeographic excursion through the United States, I gladly seized the opportunity to not only realize a youthful dream, but also to satisfy my interest in North American forests and forest trees. ..." (23).

Tubeuf arrived in New York on July 30, 1913, met his colleagues and only an hour after arrival visited the New York City Aquarium and, in the afternoon, the New York Botanical Garden. That night the group traveled by train to Niagara Falls and the following night to Chicago to visit forested areas on the southern end of Lake Michigan, where Tubeuf photographed many of the native forest trees but apparently not *Pinus strobus*, one of his major interests in Germany.

The group was in Omaha, Nebraska, on August 8 and in Lincoln on August 9, where the mycologists C.E. and E.A. Bessey were guides at the University of Nebraska. Tubeuf commented on the "noteworthy plant pathological collection," one of the few references to plant pathology made in the first three articles describing his trip (23–25). He described the surrounding prairie and commented on the hot weather and that he missed the "enjoyable sea breezes of the splendid 'Crown Princess Cecile'," the ship that brought him to America.

The group did not stay long in Lincoln for they were at Akron in northeastern Colorado on August 10, "in the middle of the high treeless prairie." From Akron they traveled in automobiles "furnished by friendly farmers" to Yuma to visit the Colorado Dry Land Experiment Station. From Akron they traveled, again by train, to Colorado Springs where they stayed with the botanists Frederick and Edith Clements, at their "comfortable summer home at Minnehaha-on-Ruxton." Minnehaha was a location on an excursion railroad to Pikes Peak and Ruxton the name of a stream. Tubeuf does not say when they arrived but on August 17, they visited the nearby "Fremont Forest Experiment Station," which no longer exists. This is the last date Tubeuf gives until September 28, when he was at El Tovar, a railroad station on the south rim of the Grand Canyon north of Flagstaff, Arizona.

Meanwhile he described his journey over the Rocky Mountains to visit several Forest Service sites, including one at Boulder Peak (near Tolland at the summit) and another near Idle Wild (sic) on the west side of the Continental Divide.

Tubeuf continued in a fourth paper with a different title (26) and gives very few dates but does refer to some geographical locations and his route can be deduced from these. He talks of the various dwarf mistletoes observed and photographed at Mt. Rainier in Washington State; at Prospect, between Medford and Crater Lake in Oregon; at Carmel on Monterey Bay, California; at El Portal at the entrance to Yosemite Park; and finally Mt. Lemmon, Arizona, in addition to his earlier mention of El Tovar.

Tubeuf also gave a short presentation to a botanical society in Washington, D.C., but this likely came at the end of his trip. No dates are given but we can assume that he left for Germany about the end of October since he was checking his biological control experiment on November 6, “after my return from a long trip.”

NATURE CONSERVATION

In the introduction to his travels in America, Tubeuf demonstrated his concern about the conservation of natural resources with the following observation, “One can still see today what once was and which remains to be preserved, to create a picture of the earlier grandeur of nature However, one can also recognize that changes in forests rapidly take place, and that the passenger pigeons, bears, buffalo, and Indians are in large part exterminated” (23).

Shortly before leaving for America, Tubeuf became the first chairman of the Bund Naturschutz in Bayern (Alliance for Nature Conservation in Bavaria), whose goals in 1913 were “to protect the natural monuments in Bavaria, provide means of preventing damage, explaining the importance of nature conservation, and call for funds for nature conservation” (1). Tubeuf expressed his views in surprisingly modern terms: “Many responsible people have the opinion that ‘nature’ is chaotic, so we have to be the countermovement, the opposition, against alignment [of roads and rivers], against clearing [of vegetation], and against drainage [of wetlands]. Many technologists still believe that these massive alterations mean order and not clearcuts, because their minds are as monotonous as potato fields and as silly as the new roadways.” This statement was ahead of its time in light of current arguments about clearcutting of forests, vegetation management, drainage of wetlands, highway construction, stream alignment, and other environmental concerns. Tubeuf also combined his interests in the mistletoes with his concern for nature conservation by proposing that *Viscum album* should be protected from commercial exploitation by law (22).

Tubeuf had considerable success, although most came after his death. In 1916 Tubeuf fought a proposal to carve a gigantic lion into the rock wall of the Königssee as a war memorial and proposed putting a 20,500-hectare area around Königssee under nature conservation. This came about in 1921 and the area became Berchtesgaden National Park in 1978.

TUBEUF'S PERSONAL LIFE

Little information is available about Tubeuf's personal and family life except what Münch (8) and Fabricius (3) have given. We know that he married Robert Hartig's only daughter, Edith, and that they had four children, three daughters and a son. Apparently the son followed the Hartig tradition and became a forester. Of the daughters, at least one, Elisabeth, assisted her father in his scientific work and was involved in the preparation of his *Monographie der Mistel*, and that work is dedicated to her. She also contributed to other publications such as "Conifer seeds as food" (35).

Tubeuf's biographers (3, 8) emphasized his dedication to his work and that he was always active, diligent, and full of energy. He expected the same from his students and subordinates, a trait not always appreciated, nor was everyone able, or willing, to meet his high standards.

Fate delivered a cruel blow in 1933 when an affliction required amputation of a leg (3, 8) but with prosthesis and crutches, he could still carry on his work and publications. However, two years later he broke the other leg and was confined to a wheelchair. In 1936, he published his final treatise (32) and his farewell (34) as editor of *Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz*, a position he had held since 1925. 1936 also marked the golden anniversary of his doctoral dissertation.

Although Tubeuf published almost exclusively in his own journals, he belonged to several German and foreign scientific societies (3, 34). He was also Private Administrative Advisor to the Bavarian Government. The fungus family Tubeufiaceae Barr (Pleosporales) and the type genus *Tubeufia* Penz. et Sacc. are named in his honor and reflect his mycological contributions (2).

Dr. Carl Freiherr von Tubeuf died in Munich on February 8, 1941, at the beginning of his eightieth year. He continued to write up to the time of his death but left many unpublished works (3).

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