

Maria Lodovica Gullino



# Spores

Tulips with Fever, Rusty Coffee,  
Rotten Apples, Sad Oranges, Crazy Basil.  
Plant Diseases that Changed the World  
as Well as My Life


 Springer

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Tulips with Fever, Rusty Coffee, Rotten Apples, Sad Oranges, Crazy Basil. Plant Diseases that Changed the World as Well as My Life

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Drawings by Carlotta Bianco

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*To my father Gino and uncle Piero*

*Pater ipse colendi  
haud facilem esse viam voluit,  
primusque per artem  
movit agros, curis acuens mortalia corda  
nec torpere gravi passus sua regna veterno.  
Ante iovem nulli subigebant arva coloni;  
ne signare quidem aut partiri limite campum  
fas erat; in medium quaerabant, ipsaque tellus  
Omnia liberius nullo poscente ferebat.*

*The Father himself hardly willed  
that agriculture would be easy  
when he called forth the field with his art,  
whetting human minds with worries,  
not letting his kingdom slip into full-blown  
laziness.  
Before Jove took power, no settlers broke the  
fields with their plows;  
it was impitous then to mark the land and  
divide it with boundaries;  
people sought land in common, and Earth  
herself  
gave everything more freely when no one  
made demands.*

*Virgil, Georgics, I, 121–128.*

## Foreword by Francesco Profumo

University professors are often considered isolated in their ivory tower, avoiding to “get their hands dirty”. It is certainly not the case of the author of *Spores*, who is a passionate researcher, is very close to the territory, and has always sought to combine basic and applied research to respond to stakeholders’ requests.

Researchers do not always feel the need to disseminate their results. In this volume, which is the new, international edition of a previous book, published in 2014, Maria Lodovica Gullino goes further, trying to tell the fascinating story of some plant diseases that have deeply affected the economy of countries throughout the world. I, therefore, greatly appreciated the reason that prompted the author to present the discipline she is dealing with in a lighter form, trying to explain to a wider public the social role of plant pathology and the impact that some plant diseases had on our history.

The availability of food for the whole planet and the beauty of the landscape that surrounds us rely on plant health. This is what Maria Lodovica Gullino reminds us with *Spores*, leading us—with an accessible language—on a long journey to discover plant diseases of the past and more recent ones, highlighting the social and economic consequences they had and might still have in the future.

The recent Covid-19 pandemic showed us the importance of environment and plant health. This new version of *Spores* has indeed included the new, interesting vision of circular health.

I also enjoyed the personal cut of this book, reporting author’s life experiences, which gives the reader a very lively cross-section of the world of research with its laboratory and field trials and the portrait of colleagues from all over the world.

My hope is that *Spores* may bring young people to discover the fascinating world of scientific research and convince all of them of the importance of investing resources in plant health. Investing in plant health means investing in planet health, thus in our own future.

Francesco Profumo  
President of Fondazione Compagnia di San Paolo  
and former Italian Minister of Education, University and Research  
Turin, Italy



# Acknowledgements

For this 2021 English edition, I must thank my Italian publisher and friend Daniela Piazza who encouraged me to write *Spore* in 2014. Thanks to my American friends who suggested me to consider an English edition. Thanks to Stefania Antro for her careful translation. Thanks to my colleagues and friends and to the many people who, completely unknowingly, are part of this book. Thanks also to the many plant pathogens that made my life and work so interesting.

# Introduction

## Why This Book

Plant diseases caused, in the past, significant economic losses, deaths, famine, wars, and migration. Some of them marked the history of entire countries. One example among many: the sudden development of potato late blight in Ireland in 1845–49.

Today plant diseases are still the cause of deaths, often silent, in developing countries, and relevant economic losses in the industrialized ones.

This book, written with much passion in its Italian version in 2014, does not want to be a Plant pathology text. On the contrary, it wants to describe, in simple words, often enriched by my personal experience, various plant diseases that, in different times and countries, cause severe losses and damages. This English 2021 version is not just the translation of the first edition, but an updated version, with a much more international perspective.

Plant diseases did cause not only significant economic losses but, often, also relevant social effects. Just consider that one and half million people in mid-1800 left Ireland, moving to the United States and Canada as a consequence of the Irish famine caused by late blight of potato, which destroyed a crop that was fundamental to their diet.

Besides the so-called “historical plant diseases”, in the process of writing this book, I wanted, by letting take my hand, carried away by my past, to describe also some diseases that though not causing famine or billions of losses, because of their peculiarity, might be of interest for the readers.

One-hundred-seventy years after the development of late blight of potato in Ireland, despite the astonishing results obtained in biology, in general, and in plant pathology, in particular, plant diseases can still cause enormous economic losses in industrialized countries and deaths and famine in third countries. Diseases not only affect agricultural crops, but also ornamental plants and forests. In this case, the damage is most aesthetic than economic and can lead to profound changes in the landscape. Without mentioning the risk represented by the fall of trees, which, by happening in open public spaces, can cause damages to people and things.

Moreover, some pathogens, because of their nature or their way of spreading, can cause anxiety and fear.

This book has the aim of describing, though in a quite light way, the social role of plant diseases, letting the reader know the topical importance of the discipline that studies them, plant pathology, as well as the role of plant pathologists in our society.

Thus, this book has not been conceived and written for experts, but for a broader audience, willing to learn more about plant health and to understand the reasons why so many people, in the past and nowadays, choose to be plant pathologists. This is because plants produce most of the food that we consume, which we expect to be healthy and safe, and also because plants make the world beautiful. By reading this book, the readers will understand why plant pathologists are happy and humble people, very conscious of the social importance of their daily work.

The title “Spores” is evocative of the reproduction means of fungi. Spores are small, light structures, often moving fast. The chapters of this book will be short and concise. Like spores! Plant pathologists reading this book should forgive the fact that, sometimes, also pathogens such as viruses and phytoplasmas, not producing spores, are described. Moreover, sometimes I dwell upon some curiosities which, at first reading, seem to have little to do with spores!

At the end of the book, a glossary will help readers when wording becomes too complex.

The first part of the book (Ancient spores) describes quite a few historical famines, together with some episodes that will help understanding how some plant diseases did affect human history. This part of the book will also cover diseases that contributed to modify the landscape in many countries.

The second part of the book (The spores of my life) tells, in a much more personal style, about more recent plant diseases, sometimes very peculiar, which have been the object of my work or that have been important during my working life. Very contemporary plant diseases! This part of the book also includes many characters: researchers, students, people I met in different parts of the world, during my work and my many travels. And also people who in some way have been related to my work. Why so many real people in this book? My intent is to give the readers a cross-section, very much lived, of the world of research. This part of the book also deals with plant protection. Because, at the end, plant pathologists study plant diseases with the final aim of curing them, exactly as a medical doctor. As a plant pathologist, I would describe myself as a plant doctor, doing research my entire life in order to prevent plant diseases and to manage pathogens with methods having a very low environmental impact. As a plant doctor, I always tried to adopt strategies and products “alternative” to the most traditional chemical ones. Whenever possible, of course.

The third part of the book deals with Scary spores: those pathogens that suddenly emerge, in different parts of the world, causing economic losses and destroying, in our century, entire crops. Such plant pathogens do not cause anymore famine, at least in industrialized countries. However, they make us feel helpless and generate fear. This part of the book also talks about pathogens used to destroy coca

crops, and about pathogens that might be used against our crops, in a biological warfare. This section of the book also aims to tell readers how plant pathogens are and must still be considered a danger.

The book ends with a look into the future. What is going to happen in the future? A glance inspired by research, but also using some imagination. The recent Covid pandemics did shuffle the cards in any field, including our discipline. What did we learn from it? Probably it is too early to say. However, the first impression, also on the wave aroused by the International Year of Plant Health, celebrated in 2020, the very same year of the Covid pandemics, is that the focus in the future should indeed be more on plant health than on plant diseases.

With the full awareness that sometimes stories are repeated. Thanks to God, maybe... If not, what would plant pathologists be needed for?

## Something Very Personal

“You are a plant pathologist? So weird! I never met one before!” Yes! I’m a plant pathologist! Once, every time I was questioned about my job, I did answer with a generic “I’m a researcher”. Later on, I started better specifying my research field. But it was only a few years ago that I discovered how fascinating was to my interlocutor to meet with a plant pathologist. At the beginning I was really surprised, since there are so many plant pathologists worldwide. At least 50,000 of them belong to the International Society for Plant Pathology (ISPP) that I had the honour to lead from 2008 to 2013. We are the plant doctors! And we are an army!

Why did I choose this job? Actually, maybe it’s this job that chose me.

As a daughter of agricultural entrepreneurs, I was born and grew up in the tiny and beautiful town of Saluzzo, in northern Italy. In the late spring, every year we left our house located downtown, to move to the countryside, and we spent the summertime in the so-called “Ciabòt” (a dialect word meaning a small farm), until the beginning of school. There was only one mile as the crow flies between the two houses, but what a difference! A whole other life. I can really say I grew up in the green, between meadows and orchards. My father, a graduate in Agricultural science, as well as my mother, was a very innovative entrepreneur and my first mentor. He passed on to me his passion for agriculture. An agriculture very much environmentally sound, though oriented to productivity, by taking advantage of the most advanced technologies. In the late 50s-early 60s, I learned from my father how to introduce the most advanced technologies making the better and safer use of them. The agriculture that I learned since then is very much sensitive to consumer’s health, grower’s safety and environment’s protection.

I still remember with emotion, after more than 50 years, my father's recommendations to farm workers on how they had to be careful handling pesticides.

In my second grade school, when I was a seven-year old, in the first compositions that we had to write, I was already mentioning pesticides (DDT, particularly),

of which I knew, thanks to my father, the technical name (dichloro-diphenyl-trichloro-ethane) and its mode of action.

The deep knowledge—always sustained by continuous reading of scientific articles—that my father had about plant pathogens and their epidemiology, pesticides, their mechanisms of action and their positive and negative characteristics, did strongly influence my future choices, although I did not probably realize it. Peach trees were the passion and the proud of my father. Harvest time was eagerly awaited. All the photos of my childhood include peach trees and/or peaches. In fact, as my mother used to say, my father photographed peaches with me in the background.

What my father, and me as a consequence, feared most at the time, were the storms (or worse the hail) and, among plant diseases, brown rot of peach and apple scab. Even today a thunder is enough to bring me back to the nightmare of a hail storm, which can destroy the work of a year in a few seconds.

I learnt very early from my father almost everything about the main pathogens of fruit crops. He used to show me the symptoms on fruits and leaves, describing the environmental conditions that favoured the development of such diseases, explaining the strategies he would adopt to manage them. I was very impressed by the attention he paid in choosing the most appropriate and effective technical means, always with attention to their environmental impact. Not so common in the late 50s-early 60s.

On summer evenings dad used to drive me and my younger brother to enjoy ice-cream downtown. Later, going back to the Ciabòt, in the dark, he would drive slowly, with the dazzling lights on, around the perimeter of the orchards. Depending on how many *Cydia molesta*, a dangerous peach moth, were crashing into the windshield, my father would decide whether or not to spray the orchards with an insecticide the day after. Here is, simplifying to the maximum, what we now call the concept of “threshold”, the level of infestation beyond which it is necessary to adopt control measures.

I miss so much the long chats with uncle Piero, a great researcher who was studying the breast cancer at the highest levels in Bethesda (Maryland, USA). On his summer trips to Saluzzo, his hometown, this seemingly aloof and very serious uncle devoted much time to the curious brat I was. He would enchant me with his stories that highlighted beauty and secrets of the scientific research, instilling in my mind a keen interest for an unknown world that slowly, year after year, became more and more accessible. Therefore, I heard earlier talking about research and its evaluation, about the impact factor (an index that reflects the importance and influence of scientific publications), etc.

When I was five years old, I did not know how to read or write, since I refused to attend the kindergarten, but I was already subscribed to the English version of the National Geographic Society. “Start looking at the photos!” used to say uncle Piero.

Perhaps unconsciously my father and my uncle were raising a plant pathologist.

Influenced by uncle Piero, dreaming of America and eager to go beyond the photos of National Geographic, I accepted with great enthusiasm the proposal of my father to seriously study English since the second grade, with the help of Miss

Sue Chapman, who stayed in our house for more than one year. To her infinite patience I owe not only the fast and easy learning of English, but also my early love for this language that, as I understood later at the beginning of my professional life, would represent for me a formidable tool of work.

Since I was a child I wanted to be a researcher, following the example of uncle Piero, but once at the University, the paternal imprinting prevailed and the passion for botany, along with some fortuitous encounters, directed me towards plant pathology. That's why I am a plant pathologist.

The long summers I spent at the Ciabòt brought me closer not only to nature but also, and I would say especially, to agriculture and farmers.

Having understood since childhood how serious could be the damage caused by insects and plant pathogens, and how, despite being very hard, the farmers' work could be lived with passion, stimulated me to engage in agricultural research, which I intended not as an end in itself, but as a mean to provide some practical solutions.

I do not hide my passion for agriculture. In my many trips around the world, I have always been drawn to countryside and farmsteads, and I consider farmers—passionate, curious and fulfilled workers—the best part of the productive sector.

Today, after more than 45 years of research, I feel the same enthusiasm of the beginning, consider myself a lucky person, love my work and could never imagine to carry out a different profession.

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## About the Author



**Maria Lodovica Gullino** Born in Saluzzo, of which she is very proud, Maria Lodovica Gullino since the late 1970s with great concreteness and passion has been carrying out research on plant diseases at the University of Torino, where she is a full-time Professor in Plant Pathology and Vice-Rector for the valorization of human and cultural resources.

Daughter of agricultural entrepreneurs and an entrepreneur herself, she lived and worked for long periods abroad. When she is not travelling, she lives in Torino, where she directs the Centre of Competence for the innovation in the agro-environmental field, which she established at the University of Torino in 2002. For work, she has travelled the world far and wide, leaving each time with a suitcase half empty and then full of stones—precious or not—and coloured fabrics at the return.

As a journalist, she loves to read and write. After more than 1000 scientific papers and books, including the series “Plant Pathology in the twenty-first Century” (Springer, 2009–2021), she wanted to try her hand at a lighter writing. She started with “Spore” (Daniela Piazza Editore, 2014), followed by a children’s book in 2015, “Caccia all’alieno” (Alien hunt), on alien pathogens threatening fruit and vegetable crops, and in 2016 “Valigie: cervelli in viaggio” (Suitcases: brains on the move), edited by the same publisher. In 2018, she wrote “Angelo, il Dottore dei Fiori” (Dr Flower), the story of Professor Angelo Garibaldi, researcher and co-founder of Agroinnova, illustrated by Gabriele Peddes and published by Edagricole, Business

Media. Adapted also for the theatre, this book has offered the opportunity to make even the youngest ones aware of the fascination of research on plant diseases. For the International Year of Plant Health, in 2020, she wrote another book for children, entitled “Healthy plants, healthy planet” (FAO), translated into several languages.

# Ancient Spores



This first section of the book, going through a period of several millennia, starting from the first plant diseases mentioned in the Bible, describes some serious diseases of the past that have truly marked the fate of certain countries. The history of those diseases reminds us of the fragility of our production system, and of the crucial role that agriculture plays in every age and society. Moreover, some episodes in particular offer clear proof—if ever there was need—of how history repeats itself. The coffin ships that in nineteenth century carried to North America the Irish immigrants escaping the famine caused by potato late blight in their country resemble the makeshift vessels leaving nowadays the African continent along the Mediterranean route. Now as then, famine and starvation force entire populations to migrate.

The Tulip Mania—which I will discuss more later—that happened in Holland in the distant sixteenth century, doesn't remind us of more recent financial bubbles?

As history teaches us, plant pathogens have no boundaries and no mercy. They affect indifferently rich and poor countries, important and small plants. Thanks to their spores, they travel from one country to another, at a speed that has changed according to the development of transport. And when pathogens affect ornamental plants that beautify our environment, the damage is mostly aesthetic, rather than economic, but still very important.

The past also teaches us that pathogens can become real weapons, used to starve the enemy, in the so-called biological warfare. As we will see, several countries have owned for years laboratories equipped to produce pathogenic spores of important crops: war spores.

Here then is a series of historical spores, described in short—and hopefully easy-reading—chapters.

# Plant Diseases in the Holy and Classical Texts and in the Art



Plant diseases are as old as the plants themselves. Fossils present signs of various pests and severe famines, due to drought, locust invasions and fungal diseases, as reported by several ancient writings.

The first information about plant diseases date back to Assyrian-Babylonian, Egyptian and Jewish writings and figures.

Famines attributed to rust attacks on cereals are mentioned in the first book of the Bible (*Genesis*, 42, 1–5). This disease was well known in the past. Its typical symptoms on cereals—rust-colored pustules—together with the associated remarkable yield losses, made it so popular that Romans thought it was the work of divinity (see box page 5). Moreover, in some passages, diseases likely ascribable to coals, capable of destroying seeds, are reported around 750 B.C.

Among the Greek authors, it was Hesiod the first to deal with agriculture. In his poem *Ἔργα καὶ Ημέραι* (*Works and Days*) (7th century B.C.), he gives practical advice for the cultivation of fields and suggests the days of the month more suitable for performing certain activities. However, it is with the works of Aristotle and Theophrastus that we have much more precise information on plant diseases. The latter, in particular, author of the two most important texts of Botany of the past *Historiae plantarum* and *De causis plantarum* (*Enquiry into Plants* and *On the Causes of Plants*), speaks of propagation of plants by means of seeds and grafting and of the effect of environmental conditions on plants, and refers to the cereal rusts, also providing basic information on their biology and epidemiology. The Greek writer (371–287 B.C.), in fact—who for the two volumes mentioned above is rightly deemed the “father of botany”—reports in his writings a correlation between the severity of rust attacks and the location of the most affected fields. Although he did not know the causes of this disease, Theophrastus observed, for example, that cereals were more frequently affected by rust than vegetables. Already in 470 B.C., moreover, the Greek philosopher Democritus provided some interesting indications to protect the wheat from rust, advising the use of fumigations.

Later on, various Latin authors, including Cato, Varro, Virgil, Columella and Pliny the Elder, often cited in their writings some fearsome plant diseases able to

cause severe famines. Speaking of Latin writers, it is interesting to note the different conception of agriculture of two great poets, Virgil and Lucretius. For the singer of the Augustan era, the adversities of nature, which men have to overcome, are a gimmick of Jupiter to prompt human ingenuity. In Lucretius, however, it is the sign that nature was not created by divine agency for the good of mankind, since “it is marked by such serious flaws” (“*tanta stat praedita culpa*”, *De rerum natura*, v. 199), although the philosopher himself believes that through work, man has come out of the wild state. In the *Georgics* there is an interesting description of rust, which devours the stems of wheat (see box page 6). And we can find cereal rust cited again by Pliny the Elder.

Despite the observations of these authors, often based on scientific ground, for a long time plant diseases were considered as magic or sidereal phenomena attributed to supernatural forces. It was general belief among farmers that plant diseases were in some way a consequence of divine punishments.

Severe famines due to fungal diseases also occurred in the following centuries, generally triggered by violent epidemics of wheat rust or other cereal rusts that caused serious yield losses followed by reduced stocks, raids and disturbances. A more recent example is the plague of 1629–1631, described by Alessandro Manzoni in the novel *The Betrothed*.

The invention of compound microscope in 1590 and its improvement by Anton van Leeuwenhoek in 1683 allowed the first observations on parasitic microorganisms. It was initially botanists who made interesting contributions to plant pathology: after all, what is plant pathology if not the study of sick plants?

Some Italian scientists, such as Pier Antonio Micheli, Giovanni Targioni Tozzetti (see box page 7) and Felice Fontana, greatly contributed to plant pathology foundation as an independent discipline. The first experimental proofs of the parasite relationship between plant and pathogen were carried out by Prevost in 1807 on common bunt of wheat (see page 266), while the understanding of the biological cycle of rusts, by Antoine De Bary in 1865, marked the birth of modern plant pathology.

Born within botany, plant pathology was acknowledged in the last century as a scientific discipline in its own. Advances made in plant sciences, microbiology, biochemistry and biotechnologies have strongly influenced this discipline. At the same time, plant pathology has contributed to the development of many other disciplines.

Also numerous works of art have given, in their own way, a contribution to plant pathology. Plant pathologists always stand out from “normal” people because of the special regard they have for pathogens and plant diseases: it is mainly the infected plants or those with symptoms or strange signs to catch their attention. Even when faced with a picture, for example in front of a still life, a plant pathologist will look for any signs of illness—starting with the magnificent tulips, as much mottled as infected by viruses, portrayed by Flemish and Dutch painters in 1500–1600. Rembrandt and Vermeer lived through the years of the Tulip Mania (sort of collective madness unleashed by these fashionable flowers that led to a real speculative bubble—see page 39), and many of the major Dutch artists of the time chose the



infected tulips as subject for their paintings. Famous, among others, is the artwork by the German painter Jacob Marrell (1614–1681), active in Utrecht, which portrayed tulips affected by Tulip Breaking Virus.

*The Great Hunger* (1962) by Cecil Woodman-Smith describes the Great Irish Famine brought in 1840s by the late blight of potato, and so do several paintings of Flemish artists. Among the most famous artwork on this subject, stands out *The Angelus* (1857), initially titled *Prayer for the Potato Crop*, by Jean-Francois Millet, actually displayed in Paris at Musée d’Orsay.

Another very famous work, *The Beggars* (1962), by Pieter Bruegel the Elder, that we can admire at Musée du Louvre in Paris, would portray people whose legs would have been impaired by ergotism (see page 9), a very common disease in those days in Europe.

Going to depth

### Prayers to the goddess Rubigo to protect cereals from rust

Plant diseases, the cause of famine, have always been feared and for a long time they were considered a divine punishment. In a certain sense it was believed that God or some deity, by influencing the climatic conditions, favoured the appearance of devastating epidemics.

In the treatise *Naturalis Historia*, Pliny the Elder (23–79 A.D.) and Ovid (43 B.C.–18 A.D.), in the fourth book of *Fasti*, mention the liturgical celebrations (the famous *Rubigalia*) held in Rome during the month of April to appease the wrath of the goddess *Rubigo*, personification of wheat rust.

The ceremony, very well described by Ovid, consisted of a procession of people dressed in white who brought red animals (dogs, cows, foxes) to sacrifice as a gift to the goddess, in a forest outside Rome. The origin of these religious ceremonies, practiced for more than 1,700 years, is traced back to the punishment inflicted, with the appearance of cereal rusts, after it had been set on fire with cruelty to a fox. The symbols associated with these ceremonies often presented the reddish and black colours, typical of rust spores, and represented cows, foxes, red dogs etc.

Moreover, in some countries propitiatory processions are still celebrated to obtain good harvests.



Going to depth

### The wheat rust at the time of Virgil

Below is how Virgil described wheat rust.

*Prima Ceres ferro mortalis vertere terram  
instituit, cum iam glandes atque arbuta sacrae  
deficerent silvae et victum Dodona negaret.  
Mox et frumentis labor additus, ut mala culmos  
esset robigo segnisque horreret in arvis  
carduus; intereunt segetes, subit aspera silva,  
lappaeque tribolique, interque nitentia culta  
infelix lolium et steriles dominantur avenae.*

*Virgil, Georgics, II, 147–159*

Ceres first taught men to plough the earth with iron, when the oaks and strawberry trees of the sacred grove failed, and Dodona denied them food.

Soon the crops began to suffer and the stalks were badly blighted, and useless thistles flourish in the fields: the harvest is lost and a savage growth springs up, goose-grass and star-thistles, and, amongst the bright corn, wretched darnel and barren oats proliferate.





### **Magic practices and family matters**

The father of modern phytopathology, the Florentine Giovanni Targioni Tozzetti, in his work *Alimurgia* also describes—not without irony and sarcasm—the magic practices that were used by farmers to fight the diseases of plants, such as burning live scorpions or the left horn of a cow. Giovanni Targioni Tozzetti had a son, Ottaviano, who was a physician and a botanist, professor at the University of Pisa. His nephew, Antonio, was a physician, famous for his findings in the field of chemistry, and Director of the “Garden of Simple”, now the Botanical Garden of the University of Florence. Antonio married the noblewoman Fanny Ronchivecchi who animated a literary circle in Florence, in via Ghibellina, and who inspired Giacomo Leopardi the *Aspasia Cycle*.

# Poisons of the Past: A Very Fascinating Hypothesis



The importance and sad fame of *Claviceps purpurea*, a fungus that attacks rye, are linked to the disastrous consequences for human and animal health caused by the presence of its sclerotia in the flours and fodder. Since ancient times this fungus has been the cause of very serious epidemics of a disease known in the Middle Ages as sacred fire or fire of St. Anthony, now as ergotism (term deriving from French *ergot* = spur, with which in France is indicated the sclerotium produced by the pathogen), responsible for hundreds of thousands of human and animal deaths.

Those who consume food prepared with rye flour contaminated with sclerotia of *Claviceps purpurea* may encounter two main forms of ergotism, probably due to a different ergotoxin content in the contaminated sclerotia as well as to a different amount of ingested ergotoxins: a convulsive form and a gangrenous one.

The first causes very complex pathological manifestations, of nervous type: hallucinations, convulsions, sensation of epidermal burns, abortions, reduced fertility. The second, on the contrary, has a generally acute trend, causing swellings and strong skin rashes of the limbs, which at first assume a purplish-red colour, tending to black, and then going into gangrene due to arrest of the blood circulation, until they become stumps destined to detach from the body of the sick person.

The complexity and variability of the phytopathological picture, its unpredictability together with the total ignorance of its origin, justify the sense of mystery and the superstitions that in the past accompanied ergotism.

The first news of widespread manifestations of ergotism come from France and date back to the end of the 6th century A.D. The disease then reappeared in 857 in France, along the Rhine Valley, causing thousands of victims. Since then, various other intoxications followed: outbreaks of ergotism are reported in 1042, 1066, 1089, 1094.

The foundation of the religious order of St Anthony by Pope Urban II in 1095, for the care of the sick, was one of the few measures at that time feasible to alleviate the consequences of the disease. The monks of St. Antony order used to raise pigs, with whose fat they soothed and cured the wounds of those who, afflicted by skin