

Ergot of Rye

Introduction

Ergot of Rye is a plant disease that is caused by the fungus *Claviceps purpurea*. The so-called **ergot** that replaces the grain of the rye is a dark, purplish **sclerotium** (Figs. 1a-b), from which the sexual stage (Fig. 2a-b), of the lifecycle will form after over wintering. The sexual stage consists of stroma in which the asci and ascospores are produced. Although the ergot is far different in appearance than the true grain, its occurrence was so common that it was thought to be part of the rye plant, until the 1850's, when the true nature of the ergot was understood. Although the common name indicates that this fungus is a disease of rye, it also can infect several other grains, with rye being the most common host for this species. It is the ergot stage of the fungus that contains a storehouse of various compounds that have been useful as pharmaceutical drugs as well as mycotoxins that can be fatal when consumed. The proportion of the compounds produced will vary within the species. Thus, the victim that has lived through ergot poisoning once may experience different symptoms if they were unfortunate enough to consume ergot for a second time. This species was also the original source from which LSD was first isolated. It is believed that symptoms of ergotism have been recorded since the middle ages and possibly even as far back as ancient Greece.



Figure 1a: Ergot (sclerotia) on rye. Ergot replaces grain of rye. Until 1850's the ergot was thought to be part of the plant.

Figure 1b: Ergot (sclerotia). The ergot is the over wintering stage and is also the part of the life cycle containing the alkaloids.



Figure 2a: Ergot (Sclerotium) producing stroma after overwintering. The stroma contains the asci and ascospores.

There are approximately 35 species of *Claviceps*, with most occurring on grasses. All species form the sclerotium that is described above, and will form the same types of compounds. Although some research has been carried out in these other species, the bulk of our knowledge and most of our research has been concerned with Ergot of Rye.

Today, we will go over the consequences of consumption of the ergot stage of *Claviceps purpurea* and describe some of the impact that it has had.

Symptoms Caused By Consumption of Ergot of Rye

Poisoning attributed to Ergot of Rye is referred to as **ergotism**. Although this fungus is recognized as one species, there are two sets of symptoms that can be found in cases where serious poisoning as occurred: **convulsive** and **gangrenous ergotism**.

Convulsive ergotism is characterized by nervous dysfunction, where the victim is twisting and contorting their body in pain, trembling and shaking, and wryneck, a more or less fixed twisting of the neck, which seems to simulate convulsions or fits. In some cases, this is accompanied by muscle spasms, confusions, delusions and hallucinations, as well as a number of other symptoms.

In gangrenous ergotism, the victim may lose parts of their extremities, such as toes, fingers, ear lobes or in more serious cases, arms and legs may be lost. This type of ergotism causes gangrene to occur by constricting the blood vessels leading to the extremities. Because of the decrease in blood flow, infections occur in the extremities, accompanied by burning pain. Once gangrene has occurred, the fingers, toes, etc. become mummified, and will eventually fall off as a result of infection. If the infected extremities are not removed, infection can spread further up the extremity that has been infected. Gangrenous ergotism is common in grazing, farm animals.

Today, we will cover some examples of gangrenous and convulsive ergotism and the impact that it has had in different places and times.

Discovering The Cause of Ergotism

The Cultivation of *Secale cereale* (Rye) and the Origin of Ergotism

The occurrence of *Claviceps purpurea* must have begun with the cultivation of rye since it was far more common on that host than in other grains. Rye was a weed grain and occurred wherever wheat was cultivated. Often it became the dominant plant when wheat fields were abandoned. Thus, in a way, where ever civilization became established, rye would follow it there. However, it was not cultivated for food until sometime, in the early Middle Ages (around the 5th. Century), in what is now eastern Europe and western Russia. It was in the Rhine Valley, in 857 A.D., that the first major outbreak of gangrenous ergotism was documented. It was at this time that the symptoms (but not the knowledge of what caused the symptoms) from consumption of ergot was called **Holy Fire**. "**Fire**" because of the burning sensations, in the extremities, that were experienced by the victims of gangrenous ergotism, and "**Holy**" because of the belief that this was a punishment from God. The victims' toes, fingers, arms and legs

often became blackened as a result of gangrene, and would eventually die from the infections in these extremities. In addition, the victims often suffered from convulsive ergotism, as well, from the psychoactive properties that may occur in the ergo. Numerous epidemics of ergotism followed, with thousands dying as a result of the continual consumption of infected rye, with the most susceptible victims often being children.

In 1039, an outbreak of ergotism occurred in France. During this outbreak, however, a hospital was erected in order to care for the victims of ergotism, by Gaston de la Valloire. De la Valloire dedicated this hospital to St. Anthony, and through this gesture Holy Fire came to be called **St. Anthony's Fire**. Monks would eventually start the order of St. Anthony and over 370 hospitals would be built for those ailing from Holy Fire, in the name of St. Anthony. Each hospital was symbolically painted red to inform the illiterate that aid was available to help alleviate their pain. Those who came often did find relief from ergotism. This was probably due to the absence of rye bread from the victims' diet during their care in the hospital. However, those inflicted by ergotism, and healed, were likely to be inflicted again since the cause of this strange disease was unknown.

Although there is no doubt that ergotism occurred in the Middle Ages, medicine was at a very primitive state at this time, and some of the symptoms that we associate with ergotism can be due to other illnesses. Thus, the outbreaks of ergotism couldn't always be confirmed. However, it seems rather certain that by the 8th. and 9th. centuries, in the kingdom of the Franks, ergotism was present and would continue to be present in this area for the next eight hundred years. From the year 900 AD, when records evidently became common in what is now France and Germany, to around 1300 AD, there were severe epidemics of ergotism over large areas every five to ten years.

What is now France being the center of many of these severe epidemics because rye was the staple crop of the poor, and the cool, wet climate was conducive for the development of ergot. Ergot infection of rye was more likely during these wet periods because the rye flower remained opened longer, which provided more opportunity for the fungus to infect the flower. The regular rye grain and the hard, purplish black, grain-like ergot produced by the fungus were harvested and ground together during milling. The flour produced was then contaminated with the toxic alkaloids of the fungus. In 944 AD, in southern France, 40,000 people died of ergotism. Because the cause was unknown, no cure was available (you don't have to know the cause of a disease to cure it, but it sure helps; also knowing the cause of a disease does not mean an immediate cure will be found). Until people realized that the consumption of ergot was the cause of the disease, there was no rational way by which treatment could proceed.

It was not until 1670 that a French physician, Dr. Thuillier, put forth the concept that it was not an infectious disease, but one was due to the consumption of rye infected with ergot that was responsible for the outbreaks of St. Anthony's Fire.

Thuillier's Discovery of the Cause of Ergotism

Dr. Thuillier was all too familiar with the symptoms of ergotism for he had seen hundreds of such victims. From treating such victims, he had formulated some generalities concerning Holy Fire. He recognized that it was far different from infectious diseases with which he was familiar. Unlike those diseases, ergotism was not common in urban areas, where the population density was great and conditions were unsanitary, but rather in rural areas among the poor. It also did not seem to be contagious since it might strike only one member of a family and not the others, or if an entire family

has the malady, their immediate neighbors may not become sick. Some victims were even known to be living in isolation for months, yet still contracted this dreaded disease. Children and feeble people were more susceptible than others and nursing mothers might see the symptoms in their babies. However, the strangest feature of this disease that Thuillier observed was that it appeared money could buy one's freedom from St. Anthony's Fire since the rich did not seem to contract the disease. Thus, Dr. Thuillier believed the disease was not infectious and that the symptoms that arose must have something to do with the victim's environment. Some causes could be immediately eliminated. It seemed unlikely that the fresh country air and sunshine could be responsible for the disease, and the country and city folks all drank from the same source of water could not be the cause. Thus, he thought diet was the key to the disease.

On his visits to his patients, in the country, he noted the food that was set out on the tables. There was usually pork or beans, but the main staple and what always seemed to be present was a loaf of rye bread, which always seemed to be prominently displayed in the center of the table. A few families began eating potatoes by this time and Thuillier initially believed that this was the possible cause of this disease, but at this time it had not yet become popular enough to be a standard fare in family meals and St. Anthony's Fire had been known hundreds of years prior to the introduction of the potato to Europe. As farmers brought their goods to market, Thuillier also noted that the city dwellers consumed rich beef, poultry, truffles and white bread. All the information that he required to solve the puzzle of St. Anthony's Fire was there and Thuillier must have had it for quite some time before all the pieces of the puzzle would fall into place. The answer came one day while he was walking through the country as he had done on so many occasions before. Passing through fields of rye infected with ergot, Thuillier suddenly realized that he had walked by this answer countless numbers of times. The ergot or what the French farmers called cockspurs, were well known, but have never been considered harmful. Thuillier also knew of these structures from his readings. He knew that they had been used by alchemists in their potions to hasten child birth. However, he also realized that even medicine must be carefully measured out in their dosage for too much of a good medicine could just as well be a poison. He then looked into his records and found that in years when ergot infection was high, the "Fire" raged and thousands died. Although he was convinced that this was the answer, the evidence at hand was still not conclusive and Thuillier could not convince the farmers that this was the cause of this dreaded disease. It would be another two hundred years before Ergot was demonstrated to be a fungus that was causing gangrenous and convulsive ergotism.

In 1853, Louis Tulasne, an early mycologist and illustrator, worked out the life cycle for the Ergot of Rye. In his examination of the development of the Rye flower, he concluded that the ergot was a fungus that was growing on the inconspicuous flower of the Rye and that the fungus, and not the Rye itself, was the culprit. The sclerotium or ergot that grows on the Rye is an overwintering stage and not met for consumption by either man or animals. In fact, we now know today that the ergot, as is true of many other fungi and plants, has evolved with numerous alkaloids as protection against such events occurring. Once the ergot stage has survived the winter, it will germinate to form mushroom-like structures that will produce the sexual spore stage, during the spring. This spore stage will be ejected from the fruit bodies by the fungus and dispersed by wind to the Rye flower where a new infection will begin. However, the probability that a spore will happen to come to rest on a Rye flower is very remote, but only a few infections are necessary for the lifecycle to continue. Once the infection does occur, a new, *asexual* spore stage is now produced, which is far more effective in infecting the Rye flowers. This is called the *Spacelia* stage, which produces its spores in a "honey dew" exudates that will attract flies and beetles. As they visit each flower, looking for more honey, they carry the ergot spores from Rye

flower to Rye flower, causing new infections with each visit, throughout the spring and summer months. When winter approaches, sclerotia are formed that will allow them to survive until the following spring.

Historical Events In Which Ergotism Was Involved

The plague of Holy Fire (gangrenous ergotism) was also responsible for some of the geographical boundary of Europe today. France suffered many waves of ergotism throughout its history beginning around the eighth and ninth century and continuing for the next 800 years. During the one hundred years between 800-900 A.D., The Holy Roman Empire, which was formed by Pope Leo III, was one of those areas affected by Holy Fire. This was a part of Europe that was populated by the Franks and during this period thousands of peasants ate bread made from the infected grain and thousands died as a result of Holy Fire. At the same time, from Scandinavia, a race of people, the Northmen (Vikings) invaded the Holy Roman Empire. With their superior size and fighting ability, and of course the fact that a large population of the Franks had just suffered from ergot poisoning, they easily defeated the Franks who lived along the coastal regions. Before this time, the Vikings had already settled permanently on the northwest coast of France and had already exerted pressure on the Holy Roman Empire with their numerous raids. Because of the constant successful raids in this area, Charles the Third was forced to abdicate the throne of the Holy Roman Empire by 887 and this led to the split of the Holy Roman Empire into two kingdoms. The kingdom of the West Franks became France and the kingdom of the East Franks became Germany. Through it all the Northmen were unaffected by the ergotism because Rye was not their staple food. By 911, the Northmen's hold on the northwest coast of France was complete, and the king of France ceded to them what would become Normandy. The people that settled Normandy adopted the French religion, language and culture, and would eventually become assimilated by France. Today, Normandy is a part of France, but its recognition as a region is still recognized.

Without question the Northmen were warriors of superior size and fighting skill, but it is impossible to say how successful their invasion, against the Franks, would have been if the wave of ergotism had not occurred at this same time. However, it is difficult to imagine that with much of the Frank population sick with ergotism that they were able to put up much of a fight regardless of the fighting prowess of the invading army.

Ergotism and the Bubonic Plague

In order to understand the disease, let us first go over its life history. The bacterium, *Yersinia pestis*, is the actual pathogenic agent that causes the Bubonic Plague. However, it does not directly infect humans, most commonly, *Xenopsylla cheopis*, a species of flea that specifically infects rats is the carrier of the disease. *Pulex irritans*, a flea that typically infects human can carry also carry the disease, but this is uncommon. The disease cycle begins when the bacterium enters the stomach of a flea that has bitten an infected rat and dined on its blood. If the rat host dies of the disease or for some other reason, the flea will have to find another host. If the flea should bite a human and sucks its blood, it regurgitates blood and plague bacilli into the bite site thereby infecting its human host. It was believed that during the High Middle Ages, the 1100s-1200s, Europe was in a period of relatively good health and population growth. However, this ended between 1348-1350, when a major epidemic of the Bubonic Plague struck. It is estimated that 1/3 of Europe's population died as a result of the plague. Although the death toll on this occasion was high, a depression in the population of Europe lasted until 1490. This puzzled historians since even with such a high number of deaths, population recovery should have occurred by the next generation, unless other factors were involved. Necrosis, bleeding and an ulcerous swollen

throat, symptoms of damage to cells in the bone marrow were observed in many victims. These symptoms indicated widespread damage to the human immune system.

Matossian (1988) believed that while deaths could ultimately be attributed to Bubonic Plague, the consumption of grains infected with T-2 or related mycotoxins compromised the immune system and increased the likelihood of death in human *and* rats. Because of the increase in death of rats, the fleas carrying the disease would require a new host, which in heavily populated area, often was a human host. This led to a higher death rate than might have normally occurred. She also presented evidence, based on what seemed to be selectivity of the disease, based on age and wealth, grain storage and environmental moisture.

- The age groups that were most impacted by the plague were children 5-14 years and youths 15-24 years. The latter groups had mortality rates that were three times normal during the plague while the children between 1 to 4 years had a mortality rate of less than average. Matossian believed that age, activity and diet played a major role in the mortality rate. The youngest children during this period tended to be on a diet of porridge, which would normally be boiled long enough to break down the mycotoxin. Those in the age groups with the high mortality rate, because of their growth spurts and activity, consumed more calories per unit body weight than other age groups and therefore consumed more mycotoxin. The poor also had a greater mortality rate than the rich. This can probably be attributed to the ability of the latter groups ability to move away from areas of plague and to be more selective in their diet. The poor were often forced to consume substandard food that more than likely were contaminated with mold during the plague.
- The highest incidents of plague occurred in areas where there were large surpluses of grain stored. The large surpluses of grain attracted large populations of rats who were the vector transmitting the plague.
- There also appeared to be a strong correlation between the occurrence of plague and the amount of rain, humidity and flooding. Areas of Europe where such conditions prevailed were hit hardest with the plague. For example, England had a very wet summer, during 1348, where the mortality was high. However, neighboring Scotland that same year and the plague did not spread widely there, until the wet summer of 1350. Areas that were cold, *but* dried, such as Iceland, northern Norway and Sweden, Finland, and large areas of Russia and the Balkans escaped the the plague, entirely. Thus, the plague did not find its way throughout Europe, but was rather restricted in its distribution. Matossian cites Graham Twigg (1936) as a historian who believed that the plague was only present in Mediterranean ports and a few cities where there was a dense human and rat population.

Due to the cold and wet years that occurred in 1348-50, in certain areas of Europe, grain crops, which were the staple for Europe at this time, were thought to have been contaminated with T-2 or related toxins that damaged the immune systems of both rats and humans. The damage to the immune systems of both rats and human is believed to be one the contributing factors that led to the high mortality during the Bubonic Plague. However, other causes of depressed immune systems, other than fungal in origin, may also have occurred at this time.

When the greatest mortality due to the Bubonic Plague had passed, areas that were hard hit with the plague did not recover. This puzzled historians, although there were still some incidents of famine and diseases, after the plague, generally there was not a lack of food nor a great deal of disease since the populations in many areas had been drastically reduced by the plague. However, there was still a

population depression even a generation after the plague, and longer. Populations in many areas had still not reached levels that were present before the plague. After the plague, the winters were unusually cold. This affected the diet of the poor more than the wealthy. In those years where the winters were cooler, Rye would be more likely to survive than wheat. This made it more likely that Rye would be consumed, and while the Rye survived the cold temperatures, the plants were traumatized and were more susceptible to infections by Ergot. Evidence that Ergot poisoning was occurring was based on reports of nervous system disorders. In summer of 1355, there was an epidemic of "madness" in England. People believed that they saw demons. In 1374, a wet year, marked by a lack of food, there was an outbreak of hallucinations, convulsions and compulsive dancing in the Rhineland. Some people imagined they were drowning in a stream of blood. In addition to nervous system disorders such as those described above, Ergot poisoning is also known to reduce fertility and cause spontaneous abortions. With the greater consumption of Rye, coupled with consumption of grains infected with T-2 and related mycotoxin that is believed to have shortened the consumer's life span by compromising their immune system, were possibly the reason for the population depression during this period of time. It would not be until almost the 15th. Century that an upward trend in population would begin.

Ergotism and Witchcraft

In victims where convulsive ergotism has occurred, during the Dark Ages, what can the uninfected people around them be thinking? It has recently been postulated that such victims of ergotism were often thought to be witches. In talking about witches and witchcraft, just how would one go about deciding that someone is a witch? One thing to keep in mind is that these incidents that we will be talking about happened centuries ago. So, you may think the criteria kind of silly when you hear them. If you saw someone with the symptoms of ergotism, and you didn't know about ergotism, you may guess that the individual having a muscle spasm, tremors and writhing had some type of physical problem, such as epilepsy, or maybe even be on drugs, especially if they were hallucinating. Most people wouldn't think that witchcraft was involved. However, you now know that even during the last century the cause of diseases was still not known. Even today, there are people that not only believe in witchcraft, but even practice witchcraft. It seems that people have always been willing to believe in fanciful explanation for a given phenomenon rather than an a simple one. So when there were large number of people that came down with the symptoms of ergotism, it was concluded that they must have been the victims of witchcraft. It was especially true for convulsive ergotism since some people would claim to hear the devil speaking to them and were thought to be possessed. Matossian (1988) linked the occurrence of ergotism with periods where there were high incidents of people persecuted for being witches. Emphasis was placed on the Salem Witch Trial, in Massachusetts, in 1692, where there was a sudden rise in the number of people accused of being witches, but earlier examples were taken from Europe, as well.

How did Matossian arrive at the conclusion that the bewitched individuals were victims of ergotism rather than something else? There are many symptoms that are attributed to ergotism and while together they may be rather unique, there are other diseases, or physical afflictions that may also have some of these symptoms. However, Matossian did not rely on just one indicator (the symptoms) to determine that ergotism was responsible for witchcraft hysteria, but looked at several other parameters as well. She looked at where these incidents occurred, the temperature, rainfall, the crops grown in that area and who was affected.

In looking at the geography of *where* witch trials occurred in Europe, Matossian found that a large proportion of the trials were concentrated in the alpine regions of France and central Europe where Rye

was usually grown as the staple. Also, it was in these areas that the best source of "primary" records were kept. In Swabia, in southwestern Germany, they even kept annual records as to the number of trials. Other records such as the price of Rye would give an indicator as to how much Rye was available in a given year and more contemporary research compiling the widths of annual rings of trees in given localities gave an indication as to approximately what the spring and summer temperature may have been. For example, in years where there were a large number of witch trials, there were usually high Rye prices, indicating that it was a poor growing year for Rye and people may not be as selective in what they consumed. Trials were also more common during years when the spring and summer months were usually cooler, and even more so if the climate was colder and wetter than the norm. Cooler temperatures would be more favorable for ergot formation on Rye and even more Ergot would form if the rainfall was greater.

How did the witch hunt begin? Once victims of ergotism began exhibiting symptoms of alkaloid poisoning of Ergot, people began to look for the "witch or witches" that caused this sickness and misery to occur. In Salem, Massachusetts, the witch hunt began, on January 20, 1692 when three pre-teen girls began to exhibit symptoms of what Matossian interpreted as convulsive ergotism. This would, of course, have been interpreted as acts of strange behavior on the part of the people of Salem. They began blasphemous screaming, had convulsive seizures, were in a trance-like states. They were taken immediately to a doctor, but after about a month, since a physical answer to for the behaviors of the girls could not be found, the doctor concluded that the girls had been bewitched. Soon other girls were found to "contract" this disease. Even though people were ignorant as to the cause of disease, they knew that disease was commonly contagious and that everybody that came in contact with people with disease often got it as well. However, since ergotism was not a disease, it didn't have the same characteristics as other diseases previously encountered. If this were a typical disease, more people would have showed these symptoms, but it seemed restricted to the girls at this time. It appeared that a "selective force" was causing ergotism. In order to determine who had bewitched them, a **witch cake** was baked with the infected girl's urine. Consumption of such a cake would reveal to the girls who had bewitched them. After consuming the cake, pressure was placed on the girls to reveal the names of the witches, which they did. They named three women: Tituba, Reverend Samuel Parris' Carib Indian slave, Sarah Good and Sarah Osborne. The Reverend Samuel Parris was the minister in the town of Salem. Of the three women, Tituba was the only one to confess to being a witch. The two Sarahs maintained their innocence throughout. Sarah Good would be hanged for witchcraft and Sarah Osborne would die in prison. During her confession, Tituba testified that there was a conspiracy led by witches that was occurring in Salem and from there the witch hunt was on. Soon more people came forward to tell stories of how they were somehow harmed by witches and of the visions that they had seen. This led to accusing more people of witchcraft. As the end of the year neared, 20 people accused of being witches were executed. Who would be the most likely people, in a community, to be blamed?

The people that were accused of witchcraft were likely the ones that were trying to help the unfortunate victims. They were usually the doctors, or herbalists, a person who uses plants for medicinal purposes. So these were not the professions to be in during times of witch hysteria. These particular people were selected as the "witches" because, as healers, they had what seemed to be magical powers over the human body when they cured their patients of what ailed them. And the healers were in some cases able to heal symptoms that were associated with ergotism. For example, mistletoe was effective against some kinds of convulsions and spasms. However, during these bouts of ergotism, their accusers reasoned that if someone could cure illness, they also had the power to cause it as well. Which is why they weren't accused of causing bubonic plague and other diseases for which they did not have a cure. Doctors today actually don't have it that different. If you become sick or just say you became sick while a

doctor is treating you, you can probably blame the doctor. This situation in which the healer is accused of being a witch is very much analogous to the doctor being sued for malpractice.

However, there are also some records where there did not seem to be any correlation between witchcraft and ergotism. What explanation can be offered for these cases. One explanation of which we cannot be certain is that the symptoms described on records were real. It seems very likely that at least some of the accused people were framed for practicing witchcraft as a means of getting even with somebody. However, these types of events can sometimes be separated. For example, young children and adolescents were frequently the victims and it seemed unlikely that they trying to "get even" with a neighbor. Another explanation was that during bad times when many people became sick and ill, witchcraft persecution would also be prevalent. Witchcraft in this case was used since something or somebody had to be blamed for what occurred.

Claviceps purpurea, or Ergot of Rye has possibly had more impact on the world, past and present than any other species of fungus. We have only touched on some of the events that this fungus has had.

A 20th. Century Outbreaks

Even in the 20th. Century, there have been occasions where outbreaks of ergotism, due to consumption of contaminated Rye. Ergotism occurred in 1926-27 in Russia, with 10,000 reported cases, in England in 1927, with 200 cases, among central European Jewish immigrants and the last known example occurred on August 12, 1951. On that day, Jean Vieu, a medical doctor in the little town of Pont-St. Esprit, in Provence, France, was the first to discover the outbreak while puzzling over two cases of patients who complained of intense pain in the lower abdomen. At first Dr. Vieu believed these cases to be acute appendicitis, but the symptoms that his patients exhibited were not those of this particular ailment. Instead, some of these symptoms included low body temperatures and cold fingertips. Even stranger were the wild babbling and hallucinations. By August 13th., Dr. Vieu had a third patient with these symptoms. His concern of these patients led him to meet with two other colleagues and together, the three doctors had twenty patients with the symptoms just described.

By August 14th., the town's hospital was now filled with more patients with the same symptoms and 70 homes were required as emergency wards. When possible, victims were tied to their beds, those that escaped were running mad and frantic through the streets. All available strait jackets were rushed to the town to restrain the victims of this sickness. If there were any town's people of Pont-St.-Esprit that were not terrified by this time, they became so when they learned of a demented, eleven-year-old boy, who had tried to strangle his own mother. Paranoia soon spread throughout the town, rumors soon spread that this wave of dementia was due to a mass poisoning that had been carried out by the local authorities.

Meanwhile, the doctors, were working diligently to discover the cause of this dementia. That this was caused by some sort of food poisoning, they were certain. However, what had all these people consumed? The doctors searched the houses of the afflicted and found only one common food item. All the victims had consumed wheat bread from the same baker. Samples of the bread were taken and sent to Marseilles. When the results from the analysis of the bread samples were completed, tests indicated that it contained approximately twenty alkaloid poisons, and that they had all apparently come from the same source. The origin of the alkaloids was identified as those belonging to the fungus causing ergot of the rye plant.

It would be four more weeks before the whole story concerning the contamination of the bread would unfold. Beyond the Auvergne Mountains, where wheat is grown, an unethical farmer had apparently sold contaminated rye grain to a miller who had mixed it with wheat and grounded it into flour. The miller then shipped the flour to Pont-St.-Esprit, to the baker who was also collaborating with the farmer and miller. It was their greed that was responsible for over two hundred cases of alkaloid poisoning, thirty-two cases of insanity and four deaths.

Because of quality control of diseased crops, outbreaks of ergotism was virtually unknown by this time, and because the bread was wheat rather than rye, it took longer to diagnose the food poisoning to be ergot. However, once determined, the contaminated bread and flour were avoided and the problem soon went away, but imagine now if the source of these symptoms were unknown as was the case before the Middle Ages. Let us look at some examples of ergotism under such conditions and the impacts that they had during this time.

The Present Impact of Ergot

Through careful screening out of the ergot stage, ergotism is now rare. To clean Rye seeds, a floatation method has been devised. A solution of approximately 30% potassium chloride is poured over the Rye seeds and stirred. The ergot stage is buoyant and will float to the top and can be skimmed off and the seeds planted. To minimize the amount of ergot formation, after Rye has been harvested, the field is deeply ploughed so that the ergot will not germinate. A different crop can then be rotated the following year that is not susceptible to ergot, which will break the cycle of any ergot that may have survived the previous year's ploughing. Unfortunately, there has never been a variety of Rye that has been developed that is resistant to ergot.

Current Uses of Ergot

There are medicinal products that have been extracted from Ergot. Some of the more common examples include **ergotamine**, which is prescribed for various causes of headaches, including migraines. **Ergonovine** is used to control postpartum hemorrhage and cause contraction of the uterus. The knowledge that the ergot could be used for the latter was known since the 17th. Century when midwives prepared extracts of ergots for this purpose. In 1935, Albert Hofmann was able to synthesize ergonovine in the lab, at Sandoz Laboratories. The most well-known is LSD, which was originally prescribed for psychiatric disorders, but was eventually made illegal due to abuse.

Source:

<http://www.botany.hawaii.edu/faculty/wong/BOT135/LECT12.HTM>