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## Was ergotism responsible for the Scottish witch-hunts?

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**Summary** *This paper tests the hypothesis that ergotism may have played a role in the Scottish witch-hunts. It is concluded that ergotism was not likely to have been involved because there is no documentary evidence of ergot poisoning in Scotland during the witch-hunts. Furthermore, in order to develop ergotism, contaminated rye or wheat must be digested by individuals. Since there is no evidence that rye or wheat was part of the diet of the 16th–17th century Scots, ergotism is unlikely to have been responsible for the witch crazes.*

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‘In no country did the witch-cult flourish more rankly, in no country did the belief persist more lately, and in no country did the persecution of sorcery rage fiercer and the first blaze brighter than in Scotland’ (Summers 1927). During the three great periods of Scottish witchcraft persecutions, 1590–97, 1640–44 and 1660–63, over four thousand individuals were tried and subsequently executed (Black 1958). Innumerable causal factors including the Reformation and the Counter Reformation (Summers 1927); the religious zeal of the clergy; the use of judicial torture (Black 1958); the rise of the modern state and the development of capitalism (Middlefort 1972); the great social and intellectual upheaval of the period (McFarlane 1970) and the hatred of women have all been put forward to account for the mass hysteria and slaughter of the Scottish witch-hunts.

More recently, Caporeal (1976) presented a circumstantial case that linked ergotism or ergot alkaloid poisoning and the Salem witch trials of 1692. Ergot is usually caused by the fungus *Claviceps purpurea*, but can be caused by other fungi of the genus *Claviceps*. The fungus grows on 1000 host plants which belong to *Gramineae*, the grass family. This embraces 620 genera which supply humans with forage and cereal crops (van Rensburg and Altenkirk 1979). Despite this, ergot is most commonly found in rye (Barger 1931; van Rensburg and Altenkirk 1979; Marasas and Nelson 1987). This is because rye, unlike other cereals such as wheat, oats, and barley, depends largely on cross-fertilisation and thus opens its glumes in order to receive pollen from other plants. This opening greatly increases the risk of infection by ergot (Hayes 1988). Wheat, oats, and barley are, therefore, rarely attacked. As a result, the distribution of ergot is very closely associated with rye cultivation (Barger 1931).

Sclerotia of the fungus replace the individual grains of the host plant (Webster 1985). These sclerotia contain a large number of powerful pharmacological agents, the ergot alkaloids (Aellig 1978). If contaminated rye is utilised in the baking of rye-bread, those consuming the loaves might suffer from ergotism (Caporeal 1976).

Two types of ergot poisoning may result from the ingestion of contaminated rye: convulsive and gangrenous ergotism. Convulsive ergotism is characterised by epileptiform convulsions; spasms of the fingers, toes, face, vocal chords, oesophagus and diaphragm; violent retching and diarrhoea; ravenous hunger; crawling and tingling sensations underneath the skin; pronounced anaesthesia of the skin; paralysis

of the lower limbs; delirium; imbecility and a loss of speech (Aellig 1978). Gangrenous ergotism will not be discussed here, as it is as convulsive ergotism which was implicated in the Salem witch trials.

In December of 1691, eight girls were affected with unknown 'distempers'; their behaviour was characterised by disorderly speech, odd postures and convulsive fits. After no explanation could be provided for the illnesses, accusations of witchcraft were made by the girls. Witches were accused of choking, pinching, pricking with pins and biting the afflicted; in fact, the actions of the witches were probably the symptoms of the disease.

In summary, Caporael (1976) presented a circumstantial case which proposed that the physical manifestations of the afflicted girls which stimulated the witch-hunts (in which twenty individuals were executed, two died in prison, and one hundred and fifty were imprisoned), resulted from ergotism. Psychological and social factors then gave meaning to the symptoms. Caporael (1976) further postulated that ergotism might be implicated in other witch trials.

As a result of Caporael's work, Parry (1978) speculated about a relationship between the Scottish witch-hunts, 'difficult weather' and ergotism. Moreover, Matossian (1989) suggested the significance of the correspondence of witch persecution and rye-growing areas in Scotland. An appealing case may be made for Parry's speculation because the development, spread and germination of ergot spores is favoured by cool, wet conditions. These tend to prolong the flowering period of cereals and grasses, and so increase the chance of infection (Hayes 1988). Furthermore, the extent to which infection occurs is largely determined by the weather during the flowering period (The Scottish Agricultural Colleges 1982). In Britain, when the incidence is high, there is an apparent correlation of high relative humidity and low maximum temperature in June (Webster 1985). The Scottish witch-hunts of the 1590s and the 1640s coincided with the 'especially difficult weather of the periods 1591-98 and 1647-59'. Both periods were characterised by a run of particularly cool, wet summers, ideal conditions for the development of ergot.

Although the occurrence of outbreaks of ergotism is largely influenced by climatic conditions (Marasas and Nelson 1987), it is important to stress that a number of other factors also play a role. These include cultivation techniques, harvesting methods, grain selection, and storage conditions (Hayes 1988).

In light of the above, this paper aims to test the hypothesis that ergotism may have played a role in the Scottish witch-hunts. The approach is to establish first if any disease which might correspond to ergotism occurred at the time of the witch-hunt and secondly if rye or wheat was consumed at the time of the three Scottish witchcraft persecutions.

### **Ergotism in Scotland**

It is difficult to determine the date of outbreaks of past ergotism. One reason is the problem of determining the aetiology of various illnesses described in the writings of the physicians of the 16th and 17th centuries (Duncan 1992). This is because it is impossible to be certain of equivalents in modern medical terminology (Flinn *et al* 1977) and it can never be known if the disease was described in fanciful terms. On account of these problems, there is much disagreement over the definition of an ergot outbreak. For example, Creighton *et al* (1891-4) believed that the first undoubtable instance of ergotism in Britain occurred in 1762 in England. Matossian (1989), however, believes that Creighton failed to diagnose most of the past ergotism epidemics.

Matossian suggests that the earliest detailed account of ergot was by an English physician in 1603. She further suggests that, by the middle of the 17th century, English physicians were making associations between diet and central nervous system disorders. Barger (1931) in contrast, suggested that ergot was hardly known in England, because of its limited distribution, until it was described in 19th century medical literature.

Bearing in mind the lack of agreement regarding what was an ergot outbreak, there are grounds for suggesting that ergot was not present at the time of the Scottish witch-hunts. Ergot was known for centuries under a plethora of names in continental Europe (Table 1) because of its extensive distribution in time and space (Table 2) (Barger 1931). In contrast, there is only one word in English for ergot; there is no word for ergot in Scots. Moreover, there is no evidence for ergot poisoning in Scotland. Therefore, it would appear unlikely that ergotism occurred at the time of the Scottish witch-hunts.

It is possible that ergotism could have occurred earlier, since the primary sources relevant to health care in 17th century Scotland can never be complete. Therefore, an investigation of Scottish diet was undertaken in order to determine if rye or wheat, the cereals chiefly responsible for ergot poisoning, were consumed at the time of the Scottish witch-hunts. Unfortunately, little information exists on early Scottish diet, but it is possible to examine archaeological and historical sources in an attempt to reconstruct Scottish diet.

Archaeological sites provide information on cereal remains. These sites do not necessarily provide a record of diet because crops may have been grown for purposes other than human consumption. Boyd (1988) presented a catalogue of charred and waterlogged cereal remains from archaeological sites in Scotland. The catalogue which is 'moderately complete up to 1986' lists the following sites: 6 Neolithic; 48 Bronze Age; 22 Iron Age; 8 Roman; 11 Dark Age, Viking, and Pictish; 9 Medieval and Post Medieval; and 2 unknown age. The distribution of excavated sites providing botanical evidence is 'uneven and, to a degree, geographically constrained'. Despite this fact, the catalogue is useful to those researching in the field of Scottish environmental archaeology (Boyd 1988).

Boyd (1988) has suggested that rye occurred only as a 'fringe' cereal, possibly having been cultivated on the eastern seaboard during the Medieval period. Archaeological data would therefore suggest that rye was not cultivated in Scotland at the time of the witch hunts. Wheat, on the other hand, appears to have been grown in the Medieval and Post Medieval periods (Boyd 1988).

Since the archaeological evidence is sparse and unevenly distributed in space and time, historical third-order sources had to be consulted. These include the Old Statistical Account of Scotland (OSA). Although the OSA was compiled in the 1790s and the witch trials occurred throughout the 16th and 17th centuries, the OSA is thought to give a fairly accurate picture of Scottish diet, as Scottish diet had changed relatively little in the previous two hundred years. The Lowland diet began to be described as based almost exclusively on grain, and especially oats, as early as the 1590s. Moreover the Highland diet, from the 16th century onwards, was described as based on animal products and increasingly on oatmeal (Gibson and Smout 1989). Therefore, the OSA provides glimpses into the diet of the historical Highlanders and Lowlanders.

The Lowlanders subsisted on oats, bere and barley. From the 17th century onwards, all accounts of Lowland diet stress the primacy of oatmeal and ale (Gibson and Smout 1989; OSA II, III, V, VII, IX, X). The Reverend James Anderson of Abernethy Parish reported that the 'staple provision among the labouring class is here, as in almost all of

Table 1 Names for Ergot

German	French	Italian	Latin	English
Rockenmutter	ergot	grano allogliato	Calcar	Ergot
Mutterkorn	argot	grano cornuto	Clavus	
Kornmutter	blé	grano sprone	Clavus secalinus	
Kornmuhme	bled cornu	grano speronato	Clavus siliginis	
Roggenmuhme	chambucle	segala allogliata	Grana secalis degenerata	
Meelmutter	mane	segala cornuta	Secalis mater	
Mütterlein	ébrun	sperone di gallo	Orga	
Rockenmütterle	bled avorté	chioda segalino	Secale cornutum	
Mutterkornlein	bled ergoté		Secale luxurians	
Stiefmutterkorn	bled farouche		Spermoedia clavus	
Kornvater	bleds fourchus		Spacelia segetum	
Kornmänner	bled hàve			
Hasenbrod	bled rachitique			
Krähenkorn	faux siegle			
Rezroggen	seigle cornu			
Rezkorn	seigle corrompu			
Hahnenbrod	seigle a l'éperon			
Martinskorn	seigle ivre			
Wolfzähne	seigle noir			
Kornzaphen				
Hahnensporn				
Horn				
Vogelsporn				

Source: Barger 1931

Table 2 Known outbreaks of Ergot in Europe

France	Germany	Sweden, Norway and Finland	Russia
945 Paris	857 Xanten	1746–7	1722
994 Metz, Burgundy	1484 Meissen	1755–6	1824
1041 Verdun	1581 Lunenburg	1765	1832
1085 Lorraine	1587 Silesia	1783	1863
1089 Lorraine, Orleans	1592 Silesia	1836–71	1881
1092 Tournai	1596 Hersen		1889–91
1093 Vienne	1672 Westphalia		
1094 Limoges, Nivelles	1675 Vogtland, Westphalia		
1109 Orleans, Chartres	1695 Hasz		
1128 Soissons, Chartres	1702 Freiberg, Hanover		
1129 Arras, Cambrai	1717 Holstein, Annalberg		
1200 Vienne	1722 Prignitz, Pommerania		
1235 Aquitaine	1736 Silesia, Bohemia		
1630 Sologne	1741 Holstein, Stendal		
1676 Sologne	1754 Potsdam		
1709 Sologne	1770 Fulda, Duisburg, Hasz, Celle		
1747 Sologne	1770 Hamburg, Rostock, Holstein, Verden		
1749 Lille	1831 Niederlainsitz		
1755 Sologne	1855 Brunswick, Hersen		
1764 Arras	1856 Brunswick		
1770 Maine, Sologne	1879 Hersen		
1777 Sologne			
1820 Allien			

Source: Barger 1931

Scotland, oatmeal'. Porridge, browse, sowans and oatcakes were the daily fare and formed the mainstay of every meal (Fenton 1976). Meat was scarcely consumed in the common household (OSA III, V, VII, IX) and bere or barley formed the drink crop (Fenton 1976). An orphan's diet from Hutcheson's Hospital, Glasgow, in 1649, showed that 82 per cent of the nutrients came from oatbread, 5 per cent from meat and 8 per cent from fish. The average diet (based on eight known diets between 1639–1743) included 19.7 ounces of meal and 2.1 pints of ale per day (Gibson and Smout 1989).

Despite the dependence on oats and barley in the Lowlands, animal products remained important in the Highlands (OSA XVIII, XX). For example, Breadalbane, in 1594, produce 28 bolls of bere, 710 stones of cheese, and 50 stones of butter; thus, only 15 per cent of the caloric intake came from grain (Houston *et al* 1989). Martin Martin (1695) reported that the Highlanders subsisted on a diet of butter, cheese, milk and oatmeal.

Bread made of flour was not eaten in Scotland, as wheat was a cash crop for sale and not for home consumption (Fenton 1976; OSA V, VII, IX). Parry (1978) has suggested that wheat may have been grown only for rent. The Reverend James Anderson, parish of Abernyste, reported that, 'wheat flower is daily coming more into use' (in the 1790s), and a proprietor in the parish of Longferry reported, 'the consumption of wheaten

bread has increased much within these few years'. Peas, on the other hand, were always consumed as a bread crop; it was common to mix bere-meal with about 1/3 pease-meal to produce pease-meal bread (Fenton 1976).

Therefore, neither rye nor wheat, according to written sources, appears to have been consumed in Scotland during the witch-hunts. Both crops, however, were extensively cultivated and consumed in England throughout historical times (Franklin 1953).

## Conclusions

It is concluded that ergotism is most unlikely to have played a role in the Scottish witch-hunts. This is because there is no documentary evidence of ergot poisoning in Scotland. Furthermore, in order to develop ergotism, contaminated rye or wheat must be ingested. Since there is no evidence that rye or wheat was part of the diet of the 16th–17th century Scots, ergotism is unlikely to have been responsible for the witch-hunts of that time.

It is possible, however, that other fungal infections might have been involved. Some fungal infections, like modern LSD, can cause hallucinations, often in a very distorted form. The sufferer may perceive others to be acting in an evil manner. On the basis of present evidence, the assumption that ergotism was specifically responsible for the Scottish witch-hunts must be considered to be most improbable.

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