

THE WITCH TRIALS OF FINNMARK, NORTHERN NORWAY, DURING THE 17TH CENTURY: EVIDENCE FOR ERGOTISM AS A CONTRIBUTING FACTOR¹

TORBJØRN ALM

Alm, Torbjørn (*Department of botany, Tromsø museum, University of Tromsø, N-9037 Tromsø, Norway*). THE WITCH TRIALS OF FINNMARK, NORTHERN NORWAY DURING THE 17TH CENTURY: EVIDENCE FOR ERGOTISM AS A CONTRIBUTING FACTOR. *Economic Botany* 57(3):08em, 2003. During the 17th century, Finnmark suffered the worst witch trials on record in Norway; at least 137 persons were tried, and about two-thirds were executed. A late 17th century manuscript by district governor H. H. Lilienskiold provides details of 83 trials based on contemporaneous sources. More than half of these provide evidence of a potentially important role of ergotism in triggering persecutions. In 42 trials, it is explicitly stated that witchcraft was "learned" by consuming it, usually in the form of bread or other flour products (17 cases), in milk or beer (23 cases), or a combination (two cases). In the cases involving milk, several witches testified that some kind of black, grain-like objects were found in the drink. Medical symptoms compatible with ergotism were recorded in numerous trials, including gangrene, convulsions, and hallucinations; the latter often explicitly stated to occur after consumption of foodstuffs or drink. The majority of the convicted witches were females of Norwegian ethnic origin, living in coastal communities where imported flour formed part of the diet. The few, largely self-supporting Sámi affected by the witchcraft trials were mainly men, convicted, for example, carrying out traditional shamanic rituals. All flour available in Finnmark during the late 17th century was imported. Rye (*Secale cereale*), which is especially prone to ergot infection, formed a major part of the imported grain.

Key Words: ergotism; *Claviceps purpurea*; witch trials; Norway.

The 17th century witch trials in Finnmark, the northernmost county of Norway, are without parallel in other parts of the country in terms of magnitude and severity (Hagen and Sparboe 1998; Næss 1982). Altogether, the trials of 137 persons are testified by surviving evidence (Hagen and Sparboe 1998), of which two-thirds of the people (92) were sentenced to death or died as a consequence of the persecutions, a large number for a sparsely populated area. The total population of Finnmark in the late 17th century has been estimated at about 3200 to 3800 persons (Utne and Solberg 1938). Witches were burned (85 persons), hanged (three), killed in prison (two) or died of torture (two); only 22 persons were acquitted; the rest received lighter sentences of fines or imprisonment. A slightly greater number of trials (141) is known from the Rogaland district of southwestern Norway

(Mauland 1911; Næss 1982), in a much more populous area.

General discussions of witchcraft in Norway are found in Alver (1971) and Næss (1982). According to the latter author, indictments in Norway were raised on three different counts: diabolism (infrequent, with Finnmark as an exception), malefaction, that is, people accused of using witchcraft to cause harm, and healing with magical formulas and signs. For further discussion of the latter category, see Grambo (1979). A large collection of Norwegian magic formulas is found in Bang (1902).

Although much of the original court material has been lost, available evidence from Finnmark surpasses that of any other area in Norway, both in quantity and quality. This is largely due to the work of Hans Hanssen Lilienskiold, district governor of Finnmark at the end of the 17th century (appointed 1684, dismissed 1701), when the number of prosecutions waned. Having become deeply involved in the plight and poverty of the

¹ Received 18 July 2001; accepted 15 November 2002.

inhabitants, Lilienskiold engaged in assembling data for a description of Finnmark, the final version of which was presented to the Danish-Norwegian king, Fredrik IV, as a large, illustrated, handwritten volume, *Speculum Boreale*. It is now a crucially important source of information on 17th century Finnmark; the text was published by Solberg (1942–1943, 1945). However, an earlier draft manuscript is found in the Royal Library in Copenhagen, which deviates from *Speculum Boreale* in many respects. This draft includes a long chapter (97 pages) on witchcraft, which until recently had been overlooked by all students (Næss 1982; Rutberg 1918; Willumsen 1994, 1997) of the trials in Finnmark.

The full text of Lilienskiold's witchcraft manuscript and some commentaries were printed in Hagen and Sparboe (1998). It provides details of many otherwise unknown witch trials. As district governor, Lilienskiold was in a unique position to make such a compilation, using numerous original documents, of which only a fraction has survived. The witchcraft manuscript is largely an excerpt of court documents, with some comments by Lilienskiold, and offers interesting details concerning the defendants, their alleged witchcraft, confessions and sentences for 83 trials. In these, 85 persons were tried, of which 73 (86%) received death sentences. Although Lilienskiold's record is not complete (Hagen and Sparboe 1998), his account is valuable both in terms of presenting numerous cases in a uniform way and by providing a contemporaneous source. It was written at a time when the witch trials were still ongoing. No death sentences were passed while Lilienskiold was district governor. Still, it is evident from comments in his manuscript that Lilienskiold firmly believed in the reality of witchcraft.

Arguably, the material must be reviewed with caution. The viewpoint reflected in official documents including Lilienskiold's excerpts is obviously that of the authorities. In many cases, the instigating allegations were made by neighbors or acquaintances, who may have had various motives for their accusations. The confessions were often the result of torture and may to some extent have been offered as a means avoiding further maltreatment and pain by supplying the desired information, whether false or true. Still, Lilienskiold's survey of witch trials offers a unique insight that is varied in detail. Contrary to the rest of Norway, the witch trials in Finn-

mark are firmly rooted in a demonological tradition (Hagen and Sparboe 1988; Næss 1982). The confessions abound in details of meetings with the devil, participation in witches' sabbaths, and black magic.

Lilienskiold's manuscript also provides evidence that ergotism or poisoning by sclerotia of the fungus *Claviceps purpurea* (Fr.) Tulasne may have played a substantial role in the witch trials, as also has been inferred for witchcraft prosecutions elsewhere. Carporel (1976) presented circumstantial evidence for an important role of ergotism in the infamous Salem trials of the U.S.A. The role of ergotism in Scottish witch trials has been debated hotly (Boyd 1995; Duncan 1993; Whyte 1994). So far, the argument may have carried greater conviction for workers in natural history than in the social sciences, with Matossian (1989) as a prominent exception. The recent review of witchcraft by Maxwell-Stuart (2000) does not even mention ergotism and its potential role.

This paper reviews the Finnmark witch trials in the light of an ergotism hypothesis, based on the 83 trials presented by Lilienskiold. Citations have been translated from the original Norwegian (or Danish) text, based on the printed version of Hagen and Sparboe (1998). Where deemed necessary, explanatory words have been added in square brackets.

ERGOTISM

Ergotism is caused by grain infected by the fungus *Claviceps purpurea*. If infected, the seed is supplanted by the sclerotia of the fungus, forming a black, oversized grain, known as *Mutterkorn* in German. Ergot is especially common in rye (*Secale cereale* L.), but may infect a whole range of grass (Poaceae) and graminoid (Cyperaceae, Juncaceae) species, both cultivated and wild (Duncan 1993; Németh 1999). In northern Norway, ergot is frequently observed in *Leymus arenarius* (L.) Hochst., syn. *Elymus arenarius* L. (Andersen 1993; Granmo 1993), which is common on sandy seashores.

The sclerotia contain a number of alkaloids (e.g., ergotamine, ergosine, ergocristine, ergocryptine, ergocornine), of which some are highly poisonous, and some also psychoactive (Hofmann 1964; Minghetti and Crespi-Perellino 1999; Rätsch 1998:649; Wasson, Hofmann, and Ruck 1998); different strains or chemoraces may contain different combinations and percentages

of these (Matossian 1989; Pažoutová and Parberry 1999).

Ergot poisoning may take two different forms, convulsive and gangrenous. The first leads to neurological disturbances, convulsions, and may provoke epileptic fits (Caporael 1976:23; Mann 1999; Matossian 1989). Typical symptoms are crawling sensations in the skin and fingers, vertigo, headaches, painful muscular contractions, gastrointestinal troubles, vomiting and diarrhea, and disturbed senses and perception. The mental effects may invoke psychosis, mania, melancholia, or delirium. Other ergot alkaloids are vasoconstrictive, and the resulting narrowing of the blood vessels may lead to gangrene (Mann 1999) and a range of related complications (Rosenkranz, Deutsch, and Erdman 1997).

Although the true nature and cause of ergotism was not known, the sclerotia as such have been known and noted since antiquity. The Assyrians (ca. 600 B.C.) noted a "noxious pustule in the ear of grain," and Persees (ca. 350 B.C.) mentioned "noxious grasses that cause pregnant women to drop the womb and die in childbed" (Mann 1999). A spike of grain with ergot is depicted on an antique Celtic coin (Lengyel 1976; Rätsch 1998).

In Europe, ergotism was endemic during the Middle Ages, and may have contributed to the slow regrowth of the population after the Black Death (Matossian 1989). Such poisoning was known as *ignis sacer*, or "holy fire," and the Catholic church devoted a patron saint, St. Anthony, to those affected. Available descriptions of St. Anthony's ordeals may suggest that he himself suffered from ergotism, causing severe pain and religious visions. The term *ignis sacer* reflected the severe conditions induced by ergotism: burning pains, especially in the limbs, gangrene and eventually the loss of mummified tissues and limbs.

Ergot is highly psychoactive, and may have played an important role in past religious ceremonies (Rätsch 1996, 1998; Schultes, Hofmann, and Rätsch 2001; Wasson, Hofmann, and Ruck 1998). The basic building block of ergot alkaloids is lysergic acid, with D-lysergic acid diethylamide or LSD as a famous synthetic derivative. It was originally synthesized from ergot by Albert Hofmann in 1938, though its psychoactive properties were not discovered until 1943 (Hofmann 1964; Mann 1999; Minghetti and Crespi-Perellino 1999; Wasson, Hofmann, and

Ruck 1998). Some of the ergot alkaloids found in *Claviceps purpurea* have similar psychoactive abilities. Similar alkaloids are found in *Rivea corymbosa* Hall. f., the main component of *ololiuqui*, the magical brew of the Aztecs (Hofmann and Tschertter 1960; Mann 1999:86; Rätsch 1996, 1998:513ff). Apart from its potential role in witchcraft, ergot may have had a bearing on past religious movements, as suggested by Matossian (1989). Packer (1998) found a connection between surges of Jewish mystical movements and periods of ergotism in Europe.

Ergotism is well attested in Norway, but mainly in medieval sources, including some of the sagas. Some rare cases occurred until the late 19th century (Reichborn-Kjennerud 1940; Schübeler 1886). Lethal poisoning of sheep grazing on stands of ergot-infected grass *Leymus arenarius* occurred in the 1990s (Granmo 1993). According to Reichborn-Kjennerud (1940), the convulsive form predominated in Norway and other northern areas, whereas the gangrenous form was more common in Central Europe.

THE FINNMARK WITCHCRAFT TRIALS: EVIDENCE OF ERGOTISM

The 83 Finnmark witchcraft trials included in Lilienskiöld's manuscript are summarized in Table 1. In addition to key court data of year, name of the accused, and sentence, a separate column has been devoted to data on how the defendants claimed or, rather, confessed under pressure to have become witches.

THE ROLE OF GRAIN

A peculiar characteristic of the Finnmark trials is that in numerous cases, witchcraft was not learned in a traditional way, it was *consumed* in food or drink. This is first mentioned in a 1625 trial (No. 17), and repeated over and over again in the trials from 1652 onwards. Some confessions contain statements that are highly evocative of the black, grain-like sclerotia of *Claviceps purpurea*; others refer more generally to flour-based food (bread or porridge) or drinks (milk, beer) that may have contained contaminants. If beer were brewed from malt derived from ergot-infected rye, the resulting drink is likely to have had psychoactive properties (see Rätsch 1996).

Bread or other flour-based products are explicitly blamed in 17 trials (Nos. 17, 27, 37, 38, 39, 41, 43, 45, 46, 49, 52, 57, 59, 60, 66, 69,

TABLE 1. WITCH-TRIALS IN FINNMARK DURING THE 17TH CENTURY LISTED IN LILJENSKIÖLD'S MANUSCRIPT (PERSON NAMES GIVEN IN MODERNISED FORM), AND HOW THE WITCHES HAD LEARNED OR ACQUIRED THEIR CRAFT—AS FAR AS THIS IS INDICATED. SEX (F: FEMALE, M: MALE) AND ETHNIC ORIGIN (N: NORWEGIAN, S: SÁMI) OF THE ACCUSED ARE INDICATED. SENTENCES ARE NOT STATED IN ALL TRIALS REFERRED BY LILJENSKIÖLD, E.G. IN SOME TRIALS WHERE CHILDREN WERE ACCUSED; THESE CASES WERE PASSED ON TO HIGHER AUTHORITIES FOR FINAL JUDGEMENT.

No.	Year	Persons	Way of acquiring witchcraft	Sex	Ethn.	Sentence
1	1610	Anne, Lars Persens' wife (Honningsvåg)	—	F	N	Death
2	1610	Three male Sámi (Porsanger)	—	M	S	Death
3	1612	Lisbeth, Per Torfndsen's wife (Makkaur)	had learned it from a woman	F	N	Death
4	1617	Nils Jonsen Finn	had learned it	M	S	Death
5	1620	Karen Edisdatter	—	F	N	Death
6	1621	Siri Knudsdatter (Vardø)	had learned it	F	N	Death
7	1621	Elsebe Knudsdatter (Kiberg)	—	F	N	Death
8	1621	Mari Jørgensdatter (Kiberg?)	—	F	N	Death
9	1621	Kari Olsdatter (Vardø)	had learned it "from Satan himself"	F	N	Death
10	1621	Marthe Olsdatter (Kiberg)	had learned it (from No. 14)	F	N	Death
11	1621	Guri Olsdatter (Store Ekkerøy)	—	F	N	Death
12	1621	Guri Olsdatter (Lille Ekkerøy)	had learned it (from No. 14)	F	N	Death
13	1621	Ane Larsdatter (Vadsø)	—	F	N	Death
14	1621	Kristi Sørensdatter (Kiberg)	had learned it from an old woman	F	N	Death
15	1621	Lisbet Nilsdatter (Omgang)	had learned it from a female Sámi	F	N	Death
16	1624	Ane Edisdatter (Kiberg)	—	F	N	Death
17	1625	Gunnle Olsdatter (Vardø)	in a piece of bread	F	N	Death
18	1625	Ole Monsen	—	M	N	Fined
19	1626	Karen Monsdatter (Vadsø)	in beer	F	N	Death
20	1627	Kvive Bårsen (Hasvåg)	had learned it from another Sámi	M	S	Death
21	1632	Jetmund's Kari (Vadsø)	—	F	N	Death
22	1632	Synnøve, Anders Nordmøring's wife (Vadsø)	in a drink with some fat	F	N	Death
23	1634	Ingeborg, Ole Monsen's wife (Hamningberg)	had learned it from a Sámi female	F	N	Death
24	1634	Marthe Thomasdatter (Makkaur)	had learned it from No. 23	F	N	Death
25	1634	Sarve Persen (Porsanger)	had learned it from a Sámi female	M	S	Death
26	1634	Marthe, Ole Møring's wife (Makkaur)	—	F	N	Death
27	1634	Kirsten, Rasmus Sivertsen's wife (Vardø)	in butter and bread	F	N	Death
28	1634	Ane Mathisdatter (Ekkerøy)	had learned it from No. 22	F	N	Death
29	1638	Maren, Jon Dass' wife (Vardø)	had learned it from No. 23	F	N	Death
30	1638	Lisbet, Ole Nilsen's wife	had learned it from a Sámi female	F	N	Death
31	1638	Nils Rastesen	had learned it from his father	M	S	Death
32	1638	Solveig Andersdatter	had learned it from her father	F	S	Death

TABLE 1. CONTINUED.

No.	Year	Persons	Way of acquiring witchcraft	Sex	Ethn.	Sentence
33	1638	Sissel Persdatter (Vadsø)	—	F	N	Death
34	1638	Østen's Mari (Vardø)	—	F	N	Death
35	1652	Gannele Amundsdatter (Vadsø)	in beer	F	N	Death
36	1652	Bodil, Axel Andersen's wife (Vadsø)	in a drink	F	N	Death
37	1652	Bårne, sexton Villat's wife (Vadsø)	in flour for a soup	F	N	Death
38	1653	Brite Edisdatter	in a piece of butter and bread	F	N	Death
39	1653	Synnøve Olsdatter	in a piece of bread	F	N	Death
40	1653	Brite Johansdatter (Andersby)	in a drink	F	N	Death
41	1653	Eli Sigvardsdatter (Ekkerøy)	in a piece of bread	F	N	Death
42	1653	Brite Christophersdatter (Ekkerøy)	in milk	F	N	Death
43	1653	Bårne Olsdatter (Syltevik)	in fish and bread	F	N	Death
44	1653	Gjertrud Trondsdatter (Ekkerøy)	in beer	F	N	Death
45	1653	Lisbet Paulsdatter (Kiberg)	in a piece of bread	F	N	Death
46	1653	Ane Persdatter (Kiberg)	in a piece of bread	F	N	Death
47	1653	Marthe Andersdatter (Vardø)	in beer	F	N	Death
48	1653	Karen Jonsdatter (Kiberg)	in a cup of milk and water	F	N	Death
49	1653	Marthe Rasmusdatter	in a piece of bread	F	N	Death
50	1655	Kirsten Olsdatter	had learned it from a woman	F	N	Death
51	1655	Siri Christophersdatter (Senja)	[in grain?]	F	N	Death
52	1655	Mari Thomasdatter (Bergen)	in a piece of bread	F	N	Death
53	1662	Dorethe Larsdatter (Vadsø)	had learned it from a woman	F	N	Death
54	1662	Maren Sigvoldsdatter (Vadsø)	in milk	F	N	Death
55	1662	Ragnhild Klemmetsdatter (Ekkerøy)	[had learned it as a child]	F	N	Death
56	1662	Maren Mogensdatter (Ofoten)	in beer	F	N	Death
57	1662	Marthe Rasmusdatter (Vadsø)	in a piece of bread	F	N	Death
58	1662	Maren Hemmingsdatter (Ekkerøy)	[did not confess]	F	N	Death
59	1663	Siri Olsdatter (Kiberg)	in a mixture of bread and fish	F	N	Death
60	1663	Solveig Nilsdatter (Andersby)	bread, fish and beer	F	N	Death
61	1663	Guri, Laris' wife (Ekkerøy)	in milk	F	N	Death
62	1663	Ingeborg Iversdatter (Vadsø) [a child]	in a plate of milk with something black	F	N	Not stated
63	1663	Maren Olsdatter (Vadsø) [12 years old]	in some beer	F	N	Prison
64	1663	Karen Iversdatter (Vadsø) [8 years old]	in milk	F	N	Not stated
65	1663	Ellen Gunnarsdatter (Vadsø)	—	F	N	Death
66	1663	Karen, sexton Villads' wife (Vadsø)	in a porridge of milk and flour	F	N	Death
67	1663	Margrethe, Størker Olsen's wife	in cheese and milk	F	N	Death
68	1663	Ragnhild Endresdatter (Kiberg)	in milk	F	N	Acquitted

TABLE 1. CONTINUED.

No.	Year	Persons	Way of acquiring witchcraft	Sex	Ethn.	Sentence
69	1663	Sigri Jonsdatter (Vardø)	in salted herring and bread	F	N	Death
70	1663	Gunnhild Olsdatter (Vadsø)	in beer	F	N	Death
71	1663	Barbra, Nils Bastiansen's wife (Vadsø)	in milk with some black grains	F	N	Death
72	1663	Karen Nilsdatter (Vadsø)	in milk	F	N	Not stated
73	1663	Malene Jakobsdatter (Vadsø)	in milk with something black	F	N	Fined
74	1663	Bol Klausdatter (Eggerøy)	in cold milk with something black	F	N	Death
75	1663	Brite Olsdatter (Eggerøy)	in milk with something black	F	N	Death
76	1663	Karen Olsdatter (Eggerøy)	in porridge	F	N	Death
77	1678	Synnøve Johansdatter (Vadsø)	had learned it from a woman	F	N	Death
78	1679	Kirsti, Rasmus Johansen's wife (Vadsø)	—	F	N	Not stated
79	1688	Karen Nilsdatter	—	F	N	Warning
80	1689	Brite Eriksdatter (Sandkjær)	—	F	N	Acquitted
81	1690	Karen Simensdatter	—	F	N	Warning
82	1690	Marthe Nilsdatter (Karigjeld)	—	F	N	Fined
83	1692	Anders Paulsen Finn	had learned it from his mother	M	S	[murdered in prison]

76). Siri Christophersdatter (No. 51), tried and condemned in 1655, confessed that she had passed the art of witchcraft on to Mari Thomasdatter (No. 52) in a piece of flatbread; who was also condemned and confessed to having learned the art "in a piece of bread." Marthe Rasmusdatter from Vadsø (No. 57), tried and condemned in 1662, and Sigri Jonsdatter (No. 69), tried and condemned in 1663, both claimed to have learned witchcraft "in a piece of bread." Kirsten, Rasmus Sivertsen's wife (No. 27), confessed that another Kirsten, Gilbert's wife, "gave her a piece of butter and bread; thereby she at once learned witchcraft . . ." (Hagen and Sparboe 1998).

Karen, the wife of sexton Villads (No. 66), tried and convicted in 1663, had learned witchcraft by eating a porridge containing black objects; the description may sound like ergot-infected grain: "Confesses that Dorthe Larsdatter gave her a porridge of *milk and flour* with fine butter in it, when she was lying in bed after having given birth. This porridge caused her much pain for about 14 days, and during this time Dorthe stayed with her. She noticed something black in the porridge the size of a barley grain. About three weeks later, *Satan* came to her in the shape of a *cat* . . ." (Hagen and Sparboe 1998).

Many others convicted as witches claimed to have learned their craft from other persons, usually other females, but do not explicitly state how they learned it.

In several of the Finnmark court records, the wording may suggest that the witches were well aware of the effect of ergot although it was certainly not recognized as such. A typical case is the trial of Gunnele Olsdatter (No. 17), condemned in 1625: "The previously mentioned Skrepp-Ane gave her a piece of fish to eat. In addition, her daughter also gave her a piece of bread, but just as she was eating it, Ane said: *God give! Now the devil got into you!*, and at once, Gunnele suffered pain, and it was as if something living had entered her. A while later *Satan* came to her outside the door as a black dog." (Hagen and Sparboe 1998).

Many witches claimed to have learned witchcraft from drinks (Nos. 19, 22, 35, 36, 40, 42, 44, 47, 48, 54, 56, 61–64, 67, 68, 70–75), or a combination of drinks and flour-based products (Nos. 60, 66). The drinks mentioned are either milk or beer/ale; in a single case (No. 67) cheese, a milk product, is also noted. The milk

as such was probably harmless (unless the cows had eaten ergot-infected grass, in which case it might have contained ergot alkaloids), but not necessarily the admixture. Ingeborg Iversdatter from Vadsø (No. 62), tried and condemned in 1663, had learned witchcraft in this way: "[She] confessed to have learned [witchcraft] from her mother Maren Sigvoldsdatter, and got it in through a plate of milk. When she had drunk almost all of it, she saw something black at the bottom, which she poured out. The milk drink made her stomach ache." (Hagen and Sparboe 1998).

Malene Jakobsdatter from Vadsø (No. 73) was tried in 1663, but acquitted, rather unexpectedly, when her confession was compared to those of many others who were condemned: "She confessed that Dorthe Larsdatter from Skattøra had learned her witchcraft, which she gave her in some warm *milk* one day as she returned from church, cold and frozen. In the same plate of milk, something black was lying, which Dorthe insisted she should eat, saying: *Just eat it. It won't hurt you.* It is just some crushed *pepper*. But when she had consumed it, a small *grey bird* came to her, like a sparrow, and walked to and fro at her feet, until it finally disappeared from her eyes. Three days later, *Satan* himself came to her . . ." (Hagen and Sparboe 1998).

Barbra (No. 71), the wife of Nils Bastiansen, tried and condemned in 1663, confessed that she had learned witchcraft from milk with some "black seed grains." Bol Klausdatter from Ekkerøy (No. 74), and Brite Olsdatter of Ekkerøy (No. 75), both tried and condemned in 1663, told similar stories; the latter got such pain from consuming it that she had to go to bed.

The case of Gunnhild Olsdatter (No. 70), tried and condemned in 1663, is of special interest. She claimed to have learned witchcraft from a woman in Nordland, who gave her *mungât*, a weak everyday beer. She was also provided with a magical substance: "Confessed to have learned [witchcraft] from a woman in Nordland by a drink of beer that she got. It made her quite bewildered. Later, *Satan* claimed her service, and called himself Morten. This woman, who learned her the art, sent her a substance which looked like blue starch. She was told to put it into the food of the schoolmaster of the woman's children. Instead, she gave it to a dog, which became so mad that it ran into the sea and drowned" (Hagen and Sparboe 1998). The

"blue starch" sounds like crushed ergot, and, if so, it was obviously a potent "magical" remedy, and one that had been consciously prepared, at that.

PHYSICAL SYMPTOMS OF ERGOTISM

Ergotism may lead to a variety of physical symptoms, of which gangrene is the most easily recognized. The Finnmark witch trials suggest that not only the witches were affected; sometimes they were accused of inflicting evil on other people, whose symptoms may also indicate ergotism.

A description strongly evocative of gangrene, probably caused by ergotism, is provided by the trial of Siri Knudsdatter of Vardø (No. 6), condemned in 1621. She confessed to various evil deeds, of which the third (of five) deed is of special interest: "3. *When she and Brite* were fighting, she promised her that her arm would rot away, which happened just afterwards." (Hagen and Sparboe 1998).

Jetmund's Kari from Vadsø (No. 21), convicted and burned in 1632, confessed that she had used her witchcraft to inflict harm on two persons. The symptoms mentioned for both of these could well be explained by ergotism: "1. *She put a spell on Knud Larsen's wife in Vadsø*, calling the evil spirit down on her, whereupon the woman instantly *fainted*, got very ill, and finally died thereof. At the autopsy, her *back* and *thighs* were found to be as blue as *the bottom of a kettle*. 2. Jens Andersen, who had given her maid a cuff on the ear because she had put a heap of rubbish in front of his door, was threatened by her with these words: *That blow shall cost you dearly*. Two days later, he became so mad that they had to tie him for about a month. Later, she took it [the spell] off him, when he admonished her to do so." (Hagen and Sparboe 1998).

After torture, Marthe, Ole Møring's wife (No. 26), condemned in 1634, confessed that she had bewitched several people, of which the fifth case, in particular, may suggest gangrene caused by ergotism: "When Jeremias hit her son below the ear, his arm got so painful that it withered." (Hagen and Sparboe 1998).

In several cases, the court documents suggest that the witches had been bitten by the devil (Nos. 8–11, 64, 68, 73, 75), in the fingers, an arm or a foot. This could also reflect gangrene, perhaps less severe cases.

Several trials offer possible records of the crawling sensations and convulsions caused by ergotism. Gunnele Olsdatter (No. 17), condemned and burned as a witch in 1625, confessed that she had caused evil in two other women and a man. The latter case is most compelling, as she had: "Hurt Ole Hermansen to his health, . . . so that it was as if something living came into him" (Hagen and Sparboe 1998).

Sissel Persdatter from Vadsø (No. 33), tried and convicted in 1638, was accused of similar evil-doing: "On her, Dorthe Svendsdatter blamed her death. As soon as Sissel promised her and her children evil, there was like a living arrow in her waist. She had terrible pains, and two days later she was dead; the same happened to both her children. The son of Gunnell Jetmundsdatter took Sissel's hand the day she returned from the *ting* [council meeting]. At once, something living came into the boy, like a *running dog* around the heart; from this, he suffered terrible pains until he finally died" (Hagen and Sparboe 1998).

Karen Nilsdatter (No. 79), tried in 1688, was accused of killing a boy, whose symptoms could easily have been due to ergotism: ". . . she should have promised evil to a servant boy of Lars Brass, according to the boy's own statement. The boy fell into pains once he returned home and died as a strange sight. He [his body] was motley [even] after death" (cited from Hagen and Sparboe 1998:251; they interpret the original's adjective *spragled* [= motley] as a verb [= twisting], but this seems a rather unlikely feature of a corpse; it might, however, refer to the muscular contractions caused by the convulsive form of ergotism).

Other witches who allegedly caused illness to people included Dorethe Larsdatter (No. 53), tried and condemned in 1662, she had given beer to a man, who died after four days of agony, and Solveig Nilsdatter (No. 60), tried and condemned in 1663, she had allegedly inserted evil in the arm of district governor Orning, "to cause him pain."

PSYCHOLOGICAL SYMPTOMS OF ERGOTISM

Whereas physical evidence may, with some confidence, be interpreted as supporting a hypothesis of ergotism as a factor in the Finnmark witch trials, psychological disturbances are much more problematic to evaluate. They could also have resulted from psychiatric diseases,

though hardly with such frequency in small communities as suggested by the witchcraft trials. In theory, other psychoactive plants may also have played a role, especially if such substances were intentionally added to induce hallucinations. However, none of the classic witchcraft herbs (*Atropa bella-donna* L., *Datura stramonium* L., *Hyoscyamus niger* L., *Mandragora officinarum* L.) grow in the area.

The only plant species explicitly mentioned in the Finnmark witch trials is *græsløff* (*gressløk* in modern Norwegian), Siberian chives (*Allium schoenoprasum* L. ssp. *sibiricum* (L.) Čelak.). It is noted as one of the ingredients in a potion prepared by Karen Monsdatter (No. 19), condemned as a witch in 1626. It was allegedly used to cause harm. Like many other *Allium* species, *A. schoenoprasum* ssp. *sibiricum* has some reputation as a magical remedy, for example, in Finnmark, as an apotropaic to ward off seaserpents (Alm and Furnes 1998; Qvigstad 1928), but it is neither harmful nor psychoactive.

Accidental or intended consumption of ergot-infected grain is a more likely source of mental disturbances. The Finnmark trials repeatedly couple the intake of "magic" in drink or food with psychological symptoms, for example, in the trial of Synnøve (No. 22), Anders Nordmøring's wife, condemned in 1632: "[she confessed] that Guri of Ekkerøy gave her a drink with some fat floating on top, like fish-liver oil. It put her into a queer state of mind" (Hagen and Sparboe 1998).

Bårne, the wife of sexton Villats (No. 37), was tried and convicted in 1652. Her confession suggests the psychoactive influence of flour: "Then she confessed that she had learnt such [witchcraft] of Smeld-Ane by some flour for soup which she had given her. Furthermore, that Ane had a black cat which she was asked to fondle. When she had done this and also eaten some of the flour, her mind became so queer; she had pains, and felt as if she was flying in the air. Thereafter she *tried* the art on a goat kid which she gave a mouthful of bread, and just afterwards it died." (Hagen and Sparboe 1998).

Marthe Rasmusdatter (No. 49), tried and condemned in 1653, became a witch by eating a piece of bread, that seemingly had psychoactive properties: "She confessed to having learnt such [witchcraft] from Sigri of Steinsland, who gave her such knowledge in a piece of bread while she was starving. From this, she immediately be-

TABLE 2. QUANTITIES AND KINDS OF FLOUR (IN BARRELS) DELIVERED TO SOME INHABITANTS OF FINNMARK DURING THE LATE 17TH CENTURY; PERSON NAMES ARE GIVEN IN THE MODERNISED FORM (DATA FROM UTNE AND SOLBERG 1938:251ff).

Recipient, place of living	Size of family/ household (No. of persons)	Year	Rye <i>Secale cereale</i>	Barley <i>Hordeum vulgare</i>	Unspecified
Christen Robertsen, Makkaur	4	1689	1	1	—
Jakob Gjertsen, Makkaur	3	1689	1	0.5	—
Ole Engelbretsen, Makaur	6	1689	1	1	—
Ole Willatsen, Vadsø	3	1689	4	—	1
Anders Villatsen, Vadsø	8	1689	3	—	1
Ole Henriksen, Ingøy	3	1690	1	—	—
Ludvig Paus, Vadsø	17	1688	62	—	2

came so disturbed that she could not help thinking she was in hell." (Hagen and Sparboe 1998).

The trial of Mari Thomasdatter (No. 52), tried and condemned in 1655, provides similar evidence: "She learned at first from Sigri, as noted above, in a piece of bread, which when she had eaten it made the earth [start to] run around with her [i.e., made her dizzy], and at once *the devil* came to them with claws on hands and feet . . ." (Hagen and Sparboe 1998).

The presence of a psychoactive substance in beer is suggested by the confession of Karen Monsdatter (No. 19), who received the death sentence in 1626: "She confessed that Narve-Ane gave her a drink of beer; thereby she got the art that she could fly in the air wherever she wanted . . ." (Hagen and Sparboe 1998).

Brite Eriksdatter of Sandskjær (No. 80), accused in 1689, went crazy the same day as she acquired witchcraft, and had to go to bed. One may also suspect the influence of a psychoactive substance in the case of Karen Edisdatter (No. 5), tried and condemned in 1620, although no food or drink is mentioned in her confession: "When she was a young woman and was herding cattle, a heavy sleep fell upon her on a hill, where a *large, head-less man* came to her, asking if she was sleeping or not, and she answered she did not really know." (Hagen and Sparboe 1998).

GRAIN AND GRASSES IN 17TH CENTURY FINNMARK

Finnmark is situated too far north to allow more than a negligible amount of grain (barley) to be grown. In the 17th century, all grain was imported. The people in Finnmark had access to

two potentially important sources of ergot-infested grain: imported grain and wild grain.

The imported grain, mainly rye, was especially prone to ergot infection. Towards the end of the 17th century, the Danish-Norwegian government appointed two commissions to investigate the trade monopoly of Finnmark and its consequences. The population had made repeated complaints of insufficient and expensive supplies, whereas their major export product, fish, brought low prices. The first (Lindenow) commission was appointed in 1685; a second commission, headed by Henrich Adelader followed only five years later, in 1690 (Utne and Solberg 1938).

In the report of the Lindenow commission, the type of flour provided is usually not specified. However, rye is mentioned in a complaint filed at a court session at Kjelvik, near the North Cape, in October 1685: "While his fellow traders complained that his goods delivered from Bergen this autumn were quite useless and worthless, and a barrel of rye flour did not contain more than 3 ½ *waager* [ca. 65 kilos], although the rye flour was rather good, and they say that it was weighed as soon as it was landed, in the presence of twelve men" (translated from Utne and Solberg 1938).

The report of the Adelader commission is a much more detailed and valuable source in our context. It tried to ascertain the kind and amount of goods people in Finnmark were provided with. In many cases, the type of flour is not stated; where it is, rye invariably forms a predominant part (Table 2). A common man could hardly expect to receive more than one or two barrels of flour per year for a family's provision. Ludvig

Paus, vicar in Vadsø, eastern Finnmark, was obviously much better off. His large household, comprising 11 family members and six servants, acquired 64 barrels of flour in 1688, of which 62 barrels (94%) were rye: at least some of which was intended for sale (Utne and Solberg 1938). In this particular case, the provenance is also stated, as *dantzig rugmel*, rye flour, from Danzig (Gdynia) in present-day Poland. The flour supplied to northern Norway by the trade monopoly may have been of highly variable quality. Kiil (1993) cited a mid-17th century complaint stating that the barrels of rye flour supplied were underweight, and their contents partly "mixed with old peas, barley, malt and sand." In times of need, the lay people of Finnmark are likely to have utilized whatever sources of food were available, including the grain of wild *Leymus arenarius*, which is edible, but frequently infected by ergot (Andersen 1993; Granmo 1993). There is some evidence that the seeds have been used in Norway. Use of the grain of this plant is well documented in Iceland (Guðmundsson 1996), i.e., in an area originally settled by Norse immigrants. In southern Iceland, *Leymus* was still utilized a century ago. Ergot-infected seeds were recognized as dangerous and were removed during the winnowing process (Guðmundsson 1996).

It may be significant that *Leymus arenarius* occurs in particularly large stands on the sandy beaches of the Varanger peninsula, within the area of Finnmark most heavily affected by the witch trials. Lilienskiöld's *Speculum Boreale* contains a chapter on useful plants in Finnmark and *Leymus arenarius* is mentioned among these, in a brief passage advocating the possibility of cereal cultivation in the county's interior fjord areas. Lilienskiöld does not mention any use of *Leymus*, except the suggestion given by its vernacular name: "*Wilt-Korn* [wild grain], occurs only in dry, sandy places at the shore with a strong, erect stem, so hard that it almost survives the winter. In shape and size, it looks like the spike of a rye, and serves as fodder for the birds" (translated from Solberg 1942–43).

On the other hand, Lilienskiöld fails to mention several plant species that were certainly used in folk tradition, as is evident from other contemporaneous sources, and he did not include some well-known useful species that were mentioned elsewhere in *Speculum Boreale*. In ethnobotanical terms, his manuscript is an inter-

esting but not comprehensive source. Only 11 species are mentioned; many more are depicted in the accompanying figures, without explanation, not even a legend. The inclusion of *Leymus* may suggest that it was, after all, considered of some importance.

A mid-18th century manuscript by Knud Leem (Dahl 1906) contains similar information on *vildt Korn*, wild grain, probably based on Lilienskiöld. Leem, however, wrote at the time (1760s) when the Finnmark trade monopoly had been eased (lifted 1789). Cheap flour was available from rapidly increasing trade with Russian vessels that offered grain and other commodities in exchange for fish.

Two additional vernacular names from eastern Finnmark were recorded by Chr. Weldingh in the 1760s (Dahl 1893), *Wild Havre*, wild oats, and *Søe-Havre*, sea oats. Again, both of these suggest that *Leymus* was perceived as a kind of grain. The official Norwegian name for *Leymus arenarius* is *strandrug*, strand rye; which has been used as a folk name for the species at scattered locations along the coast (Høeg 1974).

Positive evidence for the use of the seeds of *Leymus* in times of need is provided by a 19th century record from Alta, western Finnmark by W. Christy (1837), an Englishman who visited the area in 1836: "Almost close to the Fiord was abundance of *Elymus arenarius* the seeds of which, as Mr. Norager informed us, are sometimes gathered and eaten in times of scarcity." Thus, even in the 19th century, *Leymus* was sometimes resorted to as a source of flour and potentially contaminated by ergot.

OTHER EVIDENCE

Some evidence for ergotism as a contributing factor in the Finnmark witch trials may be gained from the age, sex, and ethnicity of those affected. The ethnic origin of the accused is not always clear, though the witches of Sámi origin are usually (but perhaps not always) indicated by the old Norwegian term "Finn."

The vast majority of those accused of witchcraft in the trials referred by Lilienskiöld was of Norwegian ethnic origin (76 of 85 persons). Of these, almost all were females (75 of 76). There is some evidence that females may be more susceptible to ergotism than males (Caporael 1976), which may to some extent explain why such a large proportion of the witches were female, though social structure may have also played a

role. Some were children, who are known to be especially vulnerable to ergotism (Matossian 1989), for example, Ingeborg Iversdatter (No. 63), Maren Olsdatter (No. 64), and Karen Iversdatter (No. 65), all accused of witchcraft in 1663. The latter were 12 and 8 years old, respectively, in these cases, even the authorities found the accusations hard to believe. Again, all three were females of Norwegian ethnic origin.

Contrary to this, eight of the nine persons clearly indicated as of Sámi ethnic origin were males. This is easily understood when reviewing the court data, for although they were also accused of witchcraft, their crime was adhering to their old beliefs and religion, using shamanic drums (see discussion in Hagen 2002). Though they sometimes practiced magic, for example, to make wind, their confessions do not mention meetings with the devil and other acts fitting into a demonological context though it was certainly interpreted as such by the authorities.

The fact that almost all witches were of Norwegian ethnic origin is compatible with their way of making a living, largely based on fishing, supported by some small-scale agriculture, with the meager income used to buy imported goods, such as flour. The Sámi were largely self-supporting; having little or no need to buy imported flour, they were much less prone to be affected by ergotism.

DISCUSSION

As mentioned in the introduction, Caporael (1976) advocated the potential role of ergotism in triggering the Salem witchcraft trials; an interpretation strongly supported by Matossian (1989). Woolf (2000), in a recent review, found the evidence unlikely to explain the events unfolding there. As for Europe, Caporael (1976) noted that the Lorraine district of France suffered severe outbreaks of both witchcraft persecutions and ergotism from medieval times until the 17th century. In Germany, the Saxon clergy was still discussing whether convulsive ergotism was a disease or demonic possession during the 1700s. Matossian (1989:70ff) found a strong statistical correlation of climate, rye prices, and the number of witchcraft trials (ergotism cases) in Europe. The possible role of ergotism in Scottish witchcraft trials has been recently advocated by Duncan (1993) and Boyd (1995), whereas Whyte (1994) found it unlikely

that ergotism played any substantial role in Scotland.

Much of the evidence from the Salem, Massachusetts, U.S.A., and European witch trials remains circumstantial; it does not provide a direct connection between rye-based and ergot-infected foodstuffs, ergotism, and the consequences, in terms of physical illness, mental disturbances, sudden death, and inferred witchcraft. The flour-based witch cake that may have triggered the Salem trials is a possible exception (Caporael 1976). Supposedly a means of ascertaining whether witchcraft was present—when fed to a dog, it died—and thus set the witch-hunt in motion. Evidence for ergotism as such is provided by some English witch trials (MacFarlane 1970; Matossian 1989); in one of these, a person's thigh "did rot off"—a tell-tale evidence of gangrene, with ergot as the likely cause. Otherwise, there is no direct coupling of ergot-infected grain and witchcraft in the above cases. The Finnmark witch trials come close to demonstrating this connection. Numerous witches claimed to have learned witchcraft by consuming it, either in the form of bread or other flour-based products (17 trials), in drinks, usually milk or beer (23 trials), or a combination of these (two trials). The beer may have been brewed on ergot-infected rye-based malt, whereas the milk is repeatedly reported to have contained some sort of added "black grains" (five trials). In Norwegian folk tradition, it is well known that beer brewed from grain contaminated by seeds of *Lolium temulentum* L. or a similarly contaminated porridge may have dangerous properties (Høeg 1974), the most likely cause being ergot infection (Wasson, Hofman, and Ruck 1998:43–44; see also discussion in Alm 2003).

Symptoms of ergotism, gangrene, are clearly indicated in several Finnmark trials. Some symptoms, for example, gastrointestinal troubles, may be under-represented in the court records, simply because they were not necessarily interpreted as evidence of witchcraft, as suggested for the Salem trials (Matossian 1989). Still, stomach pain was mentioned repeatedly in the Finnmark witch trials.

Keeping the psychoactive aspect of ergot in mind, it is not surprising that consumption may have led to hallucinations. Repeated claims of having met the devil or attending the witches' sabbath, for example, may not reflect more than fantasies at a time when witchcraft and witch

hunts were considered realities, not least by the clergy and other authorities. The actual effect of psychoactive drugs will obviously depend to some effect on the circumstances, education, and general knowledge, that is, the cultural context of those affected (Matossian 1989).

Whether or not the inclusion of ergot in milk drinks was accidental or a conscious act, is much more difficult to evaluate. Some of the court statements may suggest that at least some of the Finnmark witches were well aware of the effects of ergot and used it to cause harm. In numerous trials, the confessions include a statement that the witch, once she had learned witchcraft, tried it by giving it in the form of bread, to some kind of animal, usually a cow, a sheep, a goat, or even sometimes a dog, and once a cat, invariably the animal died, sometimes after displaying strange behavior.

It seems more likely that most cases were, at least originally, the result of accidental ergot poisoning. Both witches and people who were not accused of anything were affected. In the latter case, the mysterious symptoms may have given rise to suspicions and allegations of being harmed by witchcraft. In Norway, ergot may have played a role in trials outside Finnmark. Lohndal (1993) provided notes on a witch trial in southernmost Norway during the 1660s, in which an alleged victim of witchcraft complained of a strange disease. It made him feel "as if he was lying in ant-mound," an excellent description of the tingling sensations or formication caused by ergotism.

The growth of ergot depends on weather conditions. Thus, the proportion of infested grain is strongly variable, negligible in some years and high in others. If ergotism in Finnmark derived largely from imported rye, it is not possible to establish a connection between local climate and the scale of infection. The rye supplied from Central Europe may have come from different areas and could possibly be several years old when it finally arrived at the northern extremity of Europe, or at least not always have derived from a single year's harvest. Nonetheless, the witch trials in Finnmark are characterized by strong surges of persecutions, occurring in 1621 (10 trials), 1632–1638 (12 trials), 1652–1655 (18 trials) and 1662–1663 (24 trials). This could possibly reflect years of heavy ergot infection in the source areas. Barger (1931) reported three outbreaks of ergotism in Germany during the

latter half of the 17th century, in 1672, 1675 and 1695. Haeser (1882) noted many further outbreaks, occurring in Germany (1600, 1648–1649, 1672, 1675, 1686, 1687, 1693, 1699), France (1630, 1650, 1664, 1670, 1674–1676, 1694), Italy (1690), and Switzerland (1650, 1674, 1676); even this long list does not exclude the possibility of ergot infection in other years, as well. The French outbreak of 1630 is also noted by Barger (1931) and Duncan (1993); it occurred just prior to a major wave of witch prosecutions in Finnmark (1632–1638, 14 trials). The witch trials of Rogaland, southwestern Norway, reached their peak (26 trials) within the same decade (Næss 1982).

If seeds of the local *Leymus arenarius* were utilized, the rate of infection may have differed according to variations in local climate. According to Russian data, ergot infection of rye is favored by cold winters and wet springs (Matossian 1989). In the cool and damp climate of northern Norway, the growth of ergot may be favored by warm summers; ergot infection of *Leymus* was unusually high in 2001 and 2002, both warmer-than-average summers (Alm unpublished; herbarium specimens in TROM). Climatic data from ongoing dendrological studies in northern Norway (Dr. A. Kirchhefer pers. comm.) suggested that the 17th century climate was generally cool, but it may be noted that the Finnmark trials occurred in or just after average or warmer-than-average years.

By their repeated insistence that witchcraft was learned by ingesting bread, beer, and milk with "black grains," the Finnmark witch trials provide a crucial link between suspect and potentially ergot-infected foodstuffs and the consequence, alleged witchcraft and prosecutions. Although ergot is likely to have played an important role in triggering the trials, the resulting prosecutions are hardly conceivable without clerical and juridical authorities eager to interpret ergotism as witchcraft and evil at work. Those affected were mostly people of low social rank. They were doubly unfortunate in being both the ones most likely to buy and consume foodstuffs of dubious quality including ergot-infected rye, and they were least able to defend themselves. In a strictly puritan, Protestant setting, it does not seem unlikely that the psychoactive abilities of some ergot alkaloids may have triggered visions of diabolic encounters, and thereby have contributed to instigating the

witch-hunt. If so, *Claviceps purpurea* was the true culprit of the witch trials, which can thus hardly be blamed on neither the victims nor the authorities, none of which possessed sufficient mycological knowledge to know with what they were dealing.

ACKNOWLEDGMENTS

Thanks are due to Dr. Andreas Kirchhefer, Institute of Biology and Geology, University of Tromsø, Norway, for providing information on 17th century climatic data based on his dendrochronological studies, and to the reviewers of the draft of this article.

LITERATURE CITED

- Alm, T.** 2003. Ales, beer and other Viking beverages—some notes based on Norwegian ethnobotany. Yearbook of the Heather Society 2003:37–44.
- Alm, T., and A. Furnes.** 1998. Tradisjonell bruk av sibirgraslauk (*Allium schoenoprasum* ssp. *sibiricum*) i Nord-Norge. Blyttia 56(2):96–101.
- Alver, B. G.** 1971. Heksetro og trolldom. En studie i norsk heksevesen. Universitetsforlaget, Oslo, Norway.
- Andersen, I. L.** 1993. Mjølauke—en vanlig sopp på gras i Nord-Norge. SFFL faginfo 1993(3):125–131.
- Bang, A. C.** 1902. Norske Hexeformularer og magiske Opskrifter. Videnskabs-selskabets Skrifter. II. Historisk-filosofisk Klasse 1901(1):i–xxxii, 1–762.
- Barger, G.** 1931. Ergot and ergotism: a monograph. Gurney and Jackson, Edinburgh, Scotland.
- Boyd, W. E.** 1995. Four and twenty blackbirds ... more on ergotism, rye and witchcraft in Scotland. Area 26:77–78.
- Caporael, L. R.** 1976. Ergotism: the Satan loosed in Salem? Science 192(4234, 2 April):21–26.
- Christy, W.** 1837. Notes of a voyage to Alten, Hammerfest, etc. Entomological Magazine 4:462–483.
- Dahl, O.** 1893. Biskop Gunnerus' virksomhed fornemmelig som botaniker tilligemed en oversigt over botanikens tilstand i Danmark og Norge indtil hans død. II. Johan Ernst Gunnerus. Tillæg I: C. Gunnerus' visitatsreiser i Nordland og Finmarken og der indsamlede planter. D. Planter indsendte til Gunnerus fra Stadsbygden, Aafjorden, Nordland og Finmarken. Det kongelige norske videnskabers selskabs skrifter 1892(2):1–61.
- . 1906. Biskop Gunnerus' virksomhed fornemmelig som botaniker tilligemed en oversigt over botanikens tilstand i Danmark og Norge indtil hans død. III. Johan Ernst Gunnerus. Tillæg II: Uddrag af Gunnerus' brevveksling, særlig til belysning af hans videnskabelige sysler. Hefte 8. G. Breve angaaende Seminarium lapponicum, dettes adjunker og Gunnerus' assistance ved prof. Knud Leems videnskabelige arbejder. Det kongelige norske videnskabers selskabs skrifter 1906(4):1–102.
- Duncan, K.** 1993. Was ergotism responsible for the Scottish witch-hunts. Area 25(1):30–36.
- Grambo, R.** 1979. Norske trollformler og magiske ritualer. Universitetsforlaget, Oslo, Norway.
- Granmo, A.** 1993. Fruktifiserende meldrye (*Claviceps purpurea*) i Nord-Norge. Polarflokken 17(2): 439–445.
- Guðmundsson, G.** 1996. Gathering and processing of lyme-grass (*Elymus arenarius* L.) in Iceland: an ethnohistorical account. Vegetation History and Archaeobotany 5(1–2):13–23.
- Haeser, H.** 1882. Lehrbuch der Geschichte der Medicin und der epidemischen Krankheiten. Vol. 3. Geschichte der epidemischen Krankheiten. 3rd ed. Gustav Fischer Verlag, Jena, Germany.
- Hagen, R.** 2002. Harmløs dissenter eller djevlsk trollmann? Trolldomsprosessen mot samenes Andres Poulson i 1692. Historisk tidsskrift (Oslo) 81:319–346.
- Hagen, R., and P. E. Sparboe,** eds. 1998. Hans H. Lilienskiöld. Trolldom og ugudelighet i 1600-tallets Finnmark. Ravnetrykk 18:1–312.
- Høeg, O. A.** 1974. Planter og tradisjon. Floraen i levende tale og tradisjon i Norge 1925–1973. Universitetsforlaget, Oslo, Bergen, and Tromsø, Norway.
- Hofmann, A.** 1964. Die Mutterkornalkaloide. Ferdinand Enke Verlag, Stuttgart, Germany.
- Hofmann, A., and H. Tschertter.** 1960. Isolierung von Lysergsäure—Alkaloiden aus der mexikanischen Zauberdroge Ololuiqui (*Rivea corymbosa* (L.) Hall. f.). Experientia 16:414–416.
- Kiil, A.** 1993. Da bøndene seilte. Messel Forlag, Oslo, Norway.
- Lengyel, L.** 1976. Das geheime Wissen der Kelten. Bauer, Freiburg, Germany.
- Lohndal, A.** 1993. Kirsten Snabbe—ein kvinnelagnad på 1600-talet. Årsskrift Agder historielag 69:18–27.
- MacFarlane, A.** 1970. Witchcraft in Tudor and Stuart England. Routledge & Kegan Paul, London, England.
- Mann, J.** 1999. Murder, magic and medicine. Revised ed. Oxford University Press, Oxford, England, and New York, NY.
- Matossian, M. K.** 1989. Poisons of the past: molds, epidemics, and history. Yale University Press, New Haven, CT.
- Mauland, T.** 1911. Trolldom. Cappelen, Kristiania, Norway.
- Maxwell-Stuart, P. G.** 2000. Witchcraft. A history. Brimscombe Port, Stroud, Gloucestershire, England, and Tempus Publishing, Charleston, SC.
- Minghetti, A., and N. Crespi-Perellino.** 1999. The history of ergot. Pages 1–24 in V. Křen and L. Cvak, eds., Ergot. The genus *Claviceps*. Harwood Academic Publishers, Amsterdam, The Netherlands.
- Næss, H. E.** 1982. Trolldomsprosessen i Norge på

- 1500–1600-tallet. Universitetsforlaget, Oslo, Norway.
- Németh, E.** 1999. Parasitic production of ergot alkaloids. Pages 303–319 in V. Křen and L. Cvak, eds., *Ergot: the genus *Claviceps**. Harwood Academic Publishers, Amsterdam, The Netherlands.
- Packer, S.** 1998. Jewish mystical movements and the European ergot epidemics. *Israel Journal of Psychiatric Related Science* 35(3):227–239.
- Pažoutová, S., and D. P. Parberry.** 1999. The taxonomy and phylogeny of *Claviceps*. Pages 57–77 in V. Křen and L. Cvak, eds., *Ergot. The genus *Claviceps**. Harwood Academic Publishers, Amsterdam, The Netherlands.
- Qvigstad, J.** 1928. Lappiske eventyr og sagn. II. Lappiske eventyr og sagn fra Troms og Finnmark. Instituttet for sammenlignende kulturforskning, ser. B, skrifter 10:1–736.
- Rätsch, C.** 1996. *Urbock. Bier jenseits von Hopfen und Malt*. AT Verlag, Aarau, Germany.
- . 1998. *Enzyklopädie der psychoaktiven Pflanzen*. AT Verlag, Aarau, Germany.
- Reichborn-Kjennerud, I.** 1940. Vår gamle trolldomsmedisin. III. Skrifter utgitt av Det norske videnskabs-akademi Oslo. II. Historisk-filosofisk klasse 1940(1):1–221.
- Rosenkranz, S., H. J. Deutsch, and E. Erdmann.** 1997. "Saint Anthony's fire": Ergotamin-induzierte Gefäßspasmen als Ursache akuter ischämischer Syndrome. *Deutsche medizinische Wochenschrift* 122(14):450–454.
- Rutberg, H.** 1918. Häxprocesser i norska Finnmarken. *De svenska landsmålen och svensk folkliv* 16(4): 3–110.
- Schübel, F. C.** 1886. *Viridarium norvegicum. Norges Væxtrige*. Vol. 1. Universitetsprogram, Christiania, Norway.
- Schultes, R. E., A. Hofmann, and C. Rätsch.** 2001. *Plants of the gods: their sacred, healing, and hallucinogenic powers*. Revised edition. Healing Arts Press, Rochester, New York.
- Solberg, O. ed.** 1942–1943. Finnmark omkring 1700. Vol. 2. Lilienskiolds Speculum boreale. Nordnorske samlinger 4:51–327, 36 pl.
- . ed. 1945. Finnmark omkring 1700. Vol. 2. Lilienskiolds Speculum boreale. Nordnorske samlinger 7:1–365.
- Utne, M. B., and O. Solberg, eds.** 1938. Finnmark omkring 1700. Aktstykker og oversikter. Første bind. Nordnorske samlinger 1:i–viii, 1–343.
- Wasson, R. G., A. Hofmann, and C. A. P. Ruck.** 1998. *The road to Eleusis: unveiling the secrets of the mysteries*. Hermes Press, Los Angeles, CA.
- Whyte, I. D.** 1994. Ergotism and witchcraft in Scotland. *Area* 26(1):89–90.
- Willumsen, L. H.** 1994. *Trollkvinne i nord i historiske kilder og skjønnlitteratur*. Tromsø, Norway.
- . 1997. Witches of the high north: the Finnmark witchcraft trials in the seventeenth century. *Scandinavian Journal of History* 22(3):199–221.
- Woolf, A.** 2000. Witchcraft or mycotoxin? The Salem witch trials. *Journal of Toxicology—Clinical Toxicology* 38(4):457–460.