On
Ergot of Rye
by
Henry E. Langford
When I decided upon taking Ergot of Rye as a subject for my thesis, it was not with the supposition that I should be able to add any new matter to the present literature of the subject, but with the hope of giving a clear, but necessarily concise, account of what is known about Ergot of Rye up to the present time, as regards its Botanical Characters, History, Chemical Composition, Physiological, Toxicological, Therapeutical effects, and to add the results of my own somewhat limited experience with this substance when given internally during labour, also the results of any experiments which I might have the opportunity of making upon the subject whilst I am writing any thesis.

In the first place, I shall give the Botanical Characters of the Common Rye, Secale cereale. This plant belongs to the Natural Order Graminaceae. It is a herbaceous plant, with a round, hollow, jointed stem, narrow alternate leaves, a split sheath, and a ligule at its summit. Spikelets two-flowered. Flowers sessile, solitary, with the linear rudiment of a third terminal
one. Glumes two, herbaceous, keeled, nearly opposite, smooth or arnued. Palea two, herbaceous; the lower one arnued at the point, keeled, unequal, 
sided, broadest and thickest on the outer side; the upper shorter and bicarinate. Stamina three, 
Ovulam pyriform, keen. Stigmate two, nearly 
scaly, terminal, feathery, with long simple, 
finely-toothed hairs. Scales two entire, ciliate, 
Carpospermum hairy at the point, loose.
The habitat of this plant is the Caspian-Caucasian 
desert, but it is cultivated in various parts of Europe.
The Egypt of Egypt does not appear to have been 
known to the ancients. But the disease, 
produced by it is supposed to be referred 
unto the following passage from the works 
of Siebert: "1809 A pestilential year, especially 
in the western parts of Sarum, where many 
persons became Grituell, in consequence of 
their inward. Grits being consumed by St. Anthony's fire. Their limbs were rotten 
and became black like coal. They either 
perished, miserably, or deprived of their 
Grituell hands and feet, were reserved for 
a more miserable & life. Wherever among
grapiles were afflicted with contraction of the bones. We are, however, certain that it has been extensively known during the last two centuries, described as chiefly affecting ree, and recognized by various names, according to the languages in which it may have been expressed.

The first botanist writer who notices ergot is Linseius. It seems to have been employed by women to promote labour from long before its properties were known to the profession. Camerarius in 1683 mentions that it was a popular remedy in Germany for accelerating parturition. In Italy and France also it appears to have been long in use. By its physical properties the ergot of rye is easily recognised. It consists of angular sometimes rounded bodies, from the third of an inch to an inch and a half in length, retaining the longitudinal depression of the sound grain, with a side at the extremities curved like the spine of a cock whence the name. It is of a violet brown colour externally, sometimes whitish, yellow internally,
In the entire state the colour is very faint, but when powdered it has a heavy, musty, somewhat animal smell; the taste is acid and disagreeable; it is firm and friable, breaking with a clear transverse fracture. Ergot of rye, attracts moisture if exposed to the air, swells and become amorphous, and is attacked by a small insect, a species of acorns (Acorns Ergota, Pereira) which is about one fourth the size of the cheese acute. This animal devours the interior and leaves the grain a mere husk no longer fit for medicinal purposes: it should therefore be kept in well-stoppered bottles.

As it is important to distinguish between a good and a bad specimen, it may be observed, that if the ergot be clean and smooth upon the surface, and growing, of a deep purple colour — neither totally black nor light brown, having a soft strong colour, breaking cleanly, exhibiting a pink blush internally, unpunctured by insects, turning with a clear gritty flame, and being of less specific gravity than water, its activity may be trusted.
The chemical properties of Ergot of Rye appear to have been well investigated. When moderately heated, it becomes light coloured, loses its natural smell, and acquires the colour of roasted wheat, at the same time greatly diminishing in activity. Flour, which contains as much as one third of ergot, rises without difficulty when made into paste, though when baked, the bread is dry and brittle. When ergot alone is made into bread, it does not ferment, remains soft, or heavy, and crumbles when handled. When ergot is boiled in water, it forms, if the preparation be concentrated, a deep brown-coloured solution, having the colour of ergot, and embodying its active principle. Continued boiling weakens the medicinal activity of the solution, and will, if sufficiently continued, render it inert.

The cuticle does not peel off by maceration nor can boiling, however protracted, separate it; but its colour is transferred to the interior of the pruina, giving it a deep-red tinge. The solution obtained by
boiling exhibits a white pellicle upon its surface when cool, which is the oil of ergot altered by heat and moisture, and in this condition looks like common fatty matter. An infusion of ergot is thus affected by reagents. Ammoniac paper indicates the presence of a free acid. Caustic potash renders it a fawn colour in a few minutes; phosphorus succeeds, which terminates in a light brown precipitate. Caustic ammonia gives a bulky precipitate of a light pink colour. Lime water, a light blue deposit. Carbonate of soda, and potash, no immediate effect, but in a few minutes there is a deposit of a faint pink colour. The strong acids afford a yellowish flaky coagulum. Potash darkens its colour merely. Phosphate, and acetate of lead, give a dirty violet precipitate. Infusion of pulp gives a brown coagulum, which dissolves on being agitated. Alcohol removes the active principle of ergot, with a little of its coloring matter. Water rendered alkaline forms a supernacceous solution containing most of the coloring matter; therefore, water either
June or alkaline, is the best solvent of the coloring matter. This coloring matter is capable of being procured as a dye.

Ergot of Rye has been analysed by several chemists. According to the analysis of Wiggers, which is one of the most recent, and is supposed to be the most accurate, it contains the following constituents:

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A thick white oil</td>
<td>35.806</td>
</tr>
<tr>
<td>White fatty matter</td>
<td>1.0456</td>
</tr>
<tr>
<td>Cerne</td>
<td>0.7578</td>
</tr>
<tr>
<td>Tannin</td>
<td>4.01.262</td>
</tr>
<tr>
<td>Ergotine</td>
<td>1.2466</td>
</tr>
<tr>
<td>Bromazone</td>
<td>7.7645</td>
</tr>
<tr>
<td>Sapone</td>
<td>1.3530</td>
</tr>
<tr>
<td>Gum extractive and coloring matter</td>
<td>2.3250</td>
</tr>
<tr>
<td>Vegetable albumin</td>
<td>1.4600</td>
</tr>
<tr>
<td>Phosphoric acid and phosphate of potash</td>
<td>1.4221</td>
</tr>
<tr>
<td>Phosphate of lime and trace of iron</td>
<td>1.2962</td>
</tr>
<tr>
<td>Silica</td>
<td>0.1394</td>
</tr>
</tbody>
</table>

Wiggers supposed the ergotine to be the active principle of the ergot, but it cannot be, as it is insoluble in water.

Dr. Wright, an earlier experimenter on the
The drug is believed to act by properties depending on the fixed oil. The following is its analysis:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thick White Oil</td>
<td>31.50 g</td>
</tr>
<tr>
<td>Cinnarome</td>
<td>5.50 g</td>
</tr>
<tr>
<td>Peracide</td>
<td>9.50 g</td>
</tr>
<tr>
<td>Glutin</td>
<td>7.50 g</td>
</tr>
<tr>
<td>Fungin</td>
<td>11.40 g</td>
</tr>
<tr>
<td>Colouring Matter</td>
<td>3.50 g</td>
</tr>
<tr>
<td>Fecula</td>
<td>26.60 g</td>
</tr>
<tr>
<td>Salts</td>
<td>3.10 g</td>
</tr>
<tr>
<td>Loss</td>
<td>3.50 g</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100.00</td>
</tr>
</tbody>
</table>

Dr. Dompier, at a later period, examined with great care the chemical, toxicological, and therapeutical properties of the drug. He found it to contain two very distinct active principles. The one, a soft reddish-brown extract, very soluble in water, which he has named *epinol*, and in which the medicinal and anti-hemorrhagic properties of the drug depend, and the other a colourless oil, very soluble in ether and which alone is the poisonous principle.
The Natural History of Egypt of Oge is at present very imperfectly understood. Numerous attempts have been made to account for the formation of this substance, and much difference of opinion exists as to what it really is.

The Spur attacks rye chiefly in damp seasons and in moist clay soils, particularly those recently reclaimed from waste lands in the neighbourhood of forests. Of all the places where the Spur has been hitherto observed, none combines these conditions so perfectly, and none has been so infected with the disease as the district of Soissons, situated between the rivers Seine and Cher in France. The Spur does not seem to propagate itself by contamination. Fontana has alleged that one variety of it may spread from plant to plant over a field, and even that he has transmitted it by contact from one ear to another. But his opinion and statement of facts are completely at variance with a set of very careful experiments made by Hertvig, a German Physician, who found
that even when the ear while in flower was
surronded for lecture days with the powder of spurred rye, the healthiness of the future
grain was not in the slightest degree affected.
The same results have been obtained by
Dr. Wiggers. It had been conceived by some
that nothing else is required for its production
but moisture combined with warmth,
and that under these circumstances the grain
is formed simply by a diseased process from
the juices of the plant. By others, such as
Tulip, Fontana, and Bleek, it has been held
to be a diseased formation, arising in
consequence of the spore man being guarrished
when young by an insect.
The latest and best authorities agree that
it is a peculiar species of fungus (Thermodes
classus of Fries and Lindley, Exotetica arbor
tifacens of Quekett and Perina), which is
produced under certain circumstances as
yet not fully ascertainable, on plants be-
longing to the natural families Graminaceae,
Euphorbias, and Palmaeae, but on some so
frequently as on Triticum cereale or common rye.
I shall now say a few words regarding the pathological effects of the Ergot of Rye.
At different times doubts have been entertained whether the poisonous effects attributed to ergot did not really arise from some other cause. But, independently of the connection which has been frequently traced between the Ergot and the disease, imparted to it in the human subject, the question has been not completely at rest by the experiments which have been tried on animals with the object of settling the question. These experiments have proved that spurred rye is an active poison of a very peculiar kind. It has been found to be injurious and even fatal to all animals which are fed for a sufficient length of time with a moderate proportion of it, unless they escape its action by vomiting; that dogs and cats suffer only slight symptoms of distress at poisoning, in consequence of eluding and throwing it by vomiting; but that swine, poultry or are sooner or later killed by it; and that the symptoms it causes in beasts and birds are in the first instance...
siddhes, bilious jaundice, and finally, and afterwards diarrhoea, suppuring tumours, scurvy, gangrene throughout the body, and sometimes dropping off of the toes.

As to its effects on man it has been found by express experiment, that in a simple dose, two drachms for example, it excites pyrexia, headache, flushed face, pain and spasm in the stomach, nausea, and vomiting, colic, purging, and a state of weakness and weight in the limbs. But the poisonous effects of opium have been principally observed in a peculiar disease which has at various times occurred epidemically in various parts of the Continent, and which arises from the spurned dry being ground up with the sound grain, and used for food for a length of time in the form of bread.

The poisonous symptoms produced differ much in different epidemics, and even in different cases of the same epidemic. Two distinct sets of symptoms have been noticed; the one constituting a nervous disease, which is characterized by violent spasmodic convulsions, the other being a depraved state of the
constitution, which ends in dry gangrene,
and it does not appear that the two affec-
tions are apt to be blended together in the
same case.
The convulsive form of the choleræ, the
Convulsive Exposition of the French writers,
has been described by Fiske, a German
Physician, as it occurred in the North of
Germany in 1790-1. In its most acute form,
it commenced suddenly with chillsness of skin,
reddness, and loss of sensibility, followed
soon by dreadful cramps and convulsion
of the whole body, rious toxicaæuous, yellow-
ness of the countenance, excessive thirst, excu-
erating pains in the limbs and chest, small,
almost imperceptible, pulse; and such case,
usually proved fatal, in twenty-four or forty-
eight hours. In the milder cases the convul-
sions came on in spasms, were preceded
for some days by weakness and weight of
the limbs, and a strange feeling of insects
drawling over the legs, arms, arms, and face;
in the intervals between the fits the appetite
was voracious, the Julee natural, the excretion,
regular, and the disease either terminates in recovery, with scattered suppurations, cutaneous eruptions, miscarriage or death, or it proved, in the end fatal, amidst prolonged sufferings and convulsions.

This form of the disease has also been well described by Dr. Wegner of Schlosten from his experience of an epidemic which prevailed in the neighbourhood of that place, in the year 1831 and 1832. The usual symptoms were, at first periodic symptoms, afterward an unsteady sense of contraction in the hands and feet, and at length violent and permanent contraction of the flexor muscles of the arms, legs, feet, and hands, fingers and toes, with frequent attacks of a sense of burning or creeping in the skin. Every case was cured by emetics, caustics, and frequent small doses of arsenic, provided it was taken in reasonable time, and the mealaosome food was completely withdrawn.

The other form of disease, which has been named Gangrenous Eruption by the French writers, has been minutely described by various
author. In the most severe form as it appeared in Switzerland in 1709 and 1716, it commenced, according to Lamp, a physician of Lucern, with general weakness, weakness, and a feeling as of insects creeping over the skin; when these symptoms had lasted some days or weeks, the extremities became cold, white, stiff, swollen, and at length so insensible that deep incisions were not felt. These excruciating pains in the limbs superimposed along with fever, headache, and sometimes bleeding at the nose, finally the affected parts, and in the first instance the fingers and arms, afterwards the toes and legs, shrivelled, dried up, and dropped off at the joints. A healthy granulating surface succeeded; but the powers of life were frequently exhausted before that stage was reached. The appetite, as in the convulsive form of the disease, continued voracious throughout. In milder cases as it prevailed at different times in France, Warsaw and sometimes attended the precursory symptoms, and the pungent affection was attended with Clark Viscitation.
Dr. Wright made experiments upon dogs, by giving moderate doses of ergot in their food, and continuing its administration for some time, but the results of his experiments certainly do not agree with what was observed in the irregularities on the Continent. He observed a cachetic state of the body, indicated by extreme muscular wasting and weakness, loss of appetite, frequent pulse, fever of the secretions, congestion of the alimentary mucous membrane, excessive contraction of the pupil and enlargement of the liver, enlargement of the absorbed glands, tubercular depositions in the lungs, and new formation of callos at the ends of fractured bones.

The physiological action of this Ergot of Pey, has illustrated, in a series of experiments performed by Dr. Wright upon the lower animals. In these experiments he injected solutions of ergot of different strengths into the arteries and veins. The following is an account of one of these numerous experiments. Three straights of ergot were boiled in as many ounces of water, evaporated to one ounce and a half,
And when injected, the liquid was slowly injected into the right jugular vein of a terrier dog, weighing fourteen pounds. Its introduction was almost immediately followed by heavy and laboured breathing, with increased action of the heart. Its beats amounting to about 100 in a minute. The jugular was dilated at first, but soon contracted again. In two minutes he cried out widely, and violent convulsions of the whole frame succeeded at intervals. Five more minutes passed over, his breathing continued to be heavy and laboured, the action of the heart being quick and violent. He was perfectly motionless, the eye was fixed and intangible to the touch. Feeling indeed was quite gone. Squeezing made in different parts of the body furnished no indications of suffering. In twenty minutes the head began to fall, respiration diminished in frequency until it became unobservable, and in this state he continued without any alteration, until two hours and a quarter from the first injection, when life became wholly extinct.
Upon post-mortem examination of the animals experimented upon by Dr. Wright the only morbid appearance were, dark blood in the left ventricle, and slight congestion of the lungs. From these experiments Dr. Wright drew the following conclusion. 1. That solutions of capot injected into the arteries and veins affect chiefly the brain and nervous system.

2. Both may be influenced, together, coma more or less perfect and paralysis appearing at once, or the spinal cord may be first affected, paralytic immediately resulting, and the brain participate subsequently, the coma-tose period being much delayed.

3. Its effects differ according to the strength of the solution employed. In a concentrated form it appears to paralyze the system instantly, no resistance to its effects being discernable. A weaker preparation causes for a time great excitement, the nervous energy is roused, but this is eventually under the influence of the poison. A much diluted solution, on the contrary, produces at first no apparent effect, but seems by a very propar
sive sedative action, to deprive the system of its energy and so to exhaust it of life. Its effects are produced more quickly when introduced by the arteries than by the veins. The brain then appears to be first affected, and the spinal cord subsequently; and in some instances stupor to a considerable extent may prevail, and yet the sensibility of the extremities be little impaired. Dr. Wright also varied his experiments by introducing a large simple dose of the ergot into the stomach or rectum of the animal, and from these experiments he inferred that ergot is capable of exciting a local irritation upon the parts with which it comes in contact, determining when in the stomach, cramps, vomiting, and hiccup; when in the rectum, tenesmus; and by sympathy, typing and giddiness. It appears from some of Dr. Wright's experiments that a small quantity of alcohol has the effect of temporarily removing the effects of acute injection of ergot injected into the blood vessels of a dog.
As an obstetric agent, the Ergot of Rye, has been known for more than two centuries. The earliest account we have of its obstetric employment is from Camerarius, who states that, about 1669, it was used by midwives in Germany to hasten the progress of labour. In 1717, Gregorce published his researches upon it. But we are indebted to Dr. Stern and Chairman of New York, for its introduction into British practice. Some practitioners have denied that ergot has any effect at all; but its value, as an obstetric agent, is now well established. It has been used in obstetric practice hitherto chiefly on account of its power of promoting uterine contraction in expediting natural labour. It does not appear that it is injurious, but there are certain rules which require to be followed in its administration to insure its success and safety. As a general rule, it should not be given in first labour. The labour should be advanced somewhat, and the uteri
fully dilated. There should exist one mechanical obstruction to the delivery of the child from disparity of its size, to the parts of the mother, from disparity of the pelvis, or malpresentation, and it should only be given when the slow progress of the labour is owing to insufficiency of uterine contraction in point of force and frequency. It is generally given in doses of a scruple or half a dram to infusion, or a dram of the tincture, and repeated once or twice if necessary at intervals of fifteen or twenty minutes. The result commonly is that in a short time the labour grows increase in frequency and force, gradually becoming continuous, and this is a source of danger to the child, if delivery is delayed long after the administration of the ergot, as the continuous contraction of the uterus is liable to press injuriously on the cord and the vascular vessels of the placenta, so as to obstruct the circulation in those structures, and thereby destroy the child; and for this reason ergot should not be given unless there is a probability
of the labour being terminated within one,
or two hours.

I have now given ergot several times during
labour with the intention of promoting uterine
action, but not having at the time I gave
it any intention of writing a thesis upon ergot,
I did not pay so much attention to its action
as I otherwise ought have done; but still
these cases left a strong impression upon my
mind of the efficacy of ergot in cases of
 inertia of the uterus, and I well remember
the strong and almost continuous pains which
soon followed its administration. In most cases
I have however acted with one exception to
the efficacy of ergot in promoting uterine
action. In this case the pains continued,
but rather gentle, until the head was down
in the pelvis, when they ceased, almost entirely,
and were quite useless. I then gave two
half drachms close of the ergot, with about
twenty minutes interval between them, but
this did not appear to have the slightest
effect, and I was beginning to think about
the forceps, when I thought I would try a
Another method which was suggested to me by a practitioner of this city was to press firmly with two or three fingers of one hand upon the posterior wall of the vagina, and at the same time to press over the uterus with the other hand. I did this at short intervals, and found it to succeed beyond any expectations. The uterus and abdominal walls contracting strongly every time I did so, and as long as I kept up the pressure, the child was expelled in about ten minutes from the time I commenced this treatment. The patient was gradually under the influence of chloroform during this time. I certainly think it likely that this plan would be persevered in, might often render the use of the forceps unnecessary, and otherwise we should be obliged to have recourse to it.

Expof is of equal service in expelling the retained placenta as in promoting the discharge of the child. It may be also used with advantage to promote the expulsion of a clot of blood or other uterine contents.
Expect is now known to be capable of originating uterine action; and Dr. Ballantyne and others have taken advantage of this circumstance by using it to bring about premature labour, but the statistics of the results of its use for this purpose are not at all encouraging. And besides other means of bringing on premature labour are now known, which are much more effective, and safer to the mother and child. Expect has been found serviceable also in various diseases. It has been strongly recommended in hemorrhages, especially antenatal haemorrhage, in which disease it is often most serviceable.

I have had one, most formidable case of post-partum haemorrhage, in which the expect appeared to be of much use. The child and the placenta had been expelled before my arrival, but the patient had lost much blood, and was bleeding still. I tried the sudden application of cold water to the abdomen and vulva, at intervals without much apparent effect. I then sent for some expect, and in the mean time I introduced my hand into the uterus, intending to excite it to contract. I found it filled
with clots of blood, which I withdrew, but the uterus had not contracted much, and the bleeding continued. The patient often became insensible from loss of blood. I then gave a draught of the powdered ergot at once in infusion, and in a few minutes the uterine had much diminished in size, and the hemorrhage stopped.

In Leucorrhæa, fleet, and chronic suppurating, ergot is sometimes found useful. It has been also used as an emmenagogue, but its virtue as such are very doubtful. Ergot has been recommended by Mr. Brown, Segard, and others, in cases of Paraplegia, and Hemiplegia. I have myself seen five cases of Paraplegia in the Royal Infirmary of Edinburgh treated with this substance. These patients had been subjected to all the ordinary means of treating this disease, but without deriving any benefit. When they entered the Infirmary they were treated with five grains of the ergot three times a day, and their improvement under its use was so marked that four of these patients, who were in
the Infirmary at the same time. Last summer (1859), left nearly if not quite well. The patient, at present in the Infirmary, has been treated with the ergot since the beginning of February last, at which time he could only walk with the aid of a crutch and a walking stick, and then only with great difficulty; now (March 26) he can walk about the ward, or grounds of the Infirmary, without the aid of crutch or stick. Whether the good effects of the ergot in these cases will be permanent or not, is of course very uncertain; but I have no doubt the value of this substance in the treatment of these diseases will be soon ascertained. Now attention has been called to the subject.

And now I conclude, giving somewhat brief account of the Ergot of Rye, and submit it to your perusal.

March 31st, 1860.