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I. Further Experiments with Darnel (*Lolium temulentum*)

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The following name was added to the list of Associates :—

ANDREW T. JAFFRAY, Cinchona Plantations, Darjeeling.

The following Communications were read :—

I. *Further Experiments with Darnel* (*Lolium temulentum*). By ALEXANDER STEPHEN WILSON.

In addition to the opinions regarding darnel, quoted in a previous paper, the following facts may be mentioned. In 1285, 1 qr. 6 bush. of darnel were sold at Ibstone at 2s. the qr. In 1322, 3 qrs. were sold at Maldon, at the same rate. In 1334, at the same place, 4 qrs. were sold, also at 2s.; and in 1342, at Leatherhead, 2 qrs. were sold at 1s. and 1s. 4d.

Professor Rogers, from whose "History of Agriculture and Prices in England" these figures are taken (vol. ii. "Tables of Rarer Grain"), states in his first volume (p. 222) that he is unable to identify darnel, and that he has "searched in vain in glossaries" for this and other terms, "which," says he, "seems completely to have died out." The term darnel has certainly not died out of glossaries, nor common dictionaries; it has undoubtedly been applied to *Lolium temulentum* from remote mediæval times, and the probability is greater that the "darnel" of the thirteenth and fourteenth centuries was the darnel of the sixteenth, than that it was some other grain. Tusser, writing in the sixteenth century, asks, "Doth darnel good among the flowery wheat?" (A sonnet against a slanderous tongue.) Rogers does not state for what purpose it was used, but the fact that it was sold in such quantities as 3 qrs. and 4 qrs. almost precludes the idea that it was regarded as poisonous. It may have been used as food for poultry, for which purpose, as previously noticed, it was recommended by Columella, and has been used by the present writer.

In other places Tusser calls darnel "cockle." In speaking of Dredge and Barley in November's "Husbandry," he says :—

"Some useth to winnow, some useth to fan,
Some useth to cast it as clean as they can.
For seed go and cast it, for malting not so,
But get out the cockle and then let it go."

And in March's "Husbandry" he says:—

"I speak not of mayweed, of cockle, and such,
That noyeth the barley so often and much."

Again, in May, he sings:—

"The brake and the cockle be noisome too much,
Yet like unto boodle no weed there is such."

In which, while it is clear that Tusser did not like darnel as a weed any more than Virgil had done, nor as a part of his malt, he drops no hint that he thought it absolute poison.

Gerarde, in his chapter "Of Darnell," remarks that, "Among the hurtful weeds darnel is the first." "Seeds easily shaken out and scattered abroad." "Grows in fields among wheat and barley, of the corrupt and bad seed, as Galen saith." And though he further refers to the opinions of Galen and Dioscorides as to the medicinal properties of darnel, not a word is said as to its being poisonous.

Parkinson describes nine species of darnel, and he says:—"If the seed happen into drink it will cause a giddy drunkenness; the meal of darnell is very good to stay gangreenes. . . . It also cleanseth the skin of all lepryes." He does not say it is poisonous, and it may also be said of wheat and barley, that if their seed happen into drink they will cause a giddy drunkenness.

In Symson's MS. Account of Galloway, of date 1684, quoted in "Caledonia" (iii. 284, 285), it is stated that, "The bere was generally very oatie, that is, mixed with wild oats; and in some districts it was mixed with darnel, which they called *roseager*; that being narcotic, occasioned strangers to find fault with the ale, though it did not much trouble the inhabitants, who thought it no ill ingredient, as it made the drink stronger.

In addition to the more recent opinions quoted in my former paper, mention may be made of those expressed in "The Grasses of Great Britain." Mr Charles Johnson, who writes the text, observes in his introduction (p. 12), that the "deleterious character" of *Lolium temulentum* has been "positively determined;" and, in describing the

plant, he tells us that "many cases are recorded in medical works of poisoning by darnel. The seeds," he continues, "ground and made into bread, with a small proportion of wheat or other flour, and eaten in this manner repeatedly, produce vomiting, purging attended by giddiness, pain, and swelling of the limbs, and eventually gangrene, and death. A small farmer near Poitiers, in France, died in consequence of persevering in the use of bread so circumstanced; while his wife and servant, who discontinued to eat it after the earlier symptoms, recovered. In some instances people have lost their limbs by subsisting on meal in which any considerable quantity of darnel grain was commingled. About thirty or forty years back, according to Christison, almost the whole of the inmates of the Sheffield Workhouse were attacked with symptoms supposed to be produced by their oatmeal having been accidentally adulterated with *Lolium*. Linnæus states that the seeds mixed with bread-corn produced but little effect unless the bread be eaten hot. . . . The ultimate effects are, on the broad scale, not very dissimilar to those produced by diseased or ergotised grain."

Dr John Lowe, who read a paper on darnel before this Society, and whose experiments are referred to in "Anne Pratt's Flowering Plants," informs me in a note that his first trials were made with seed of unknown source, obtained from Messrs Lawson. Of these he says—"Beginning with 2-drachm doses infused in boiling water, I took next a half ounce of the seed, drinking the infusion, and masticating and swallowing the seeds. Having obtained some recent seed, grown in the Botanic Garden by Mr M'Nab, I began with smaller doses of 1 drachm, increased to half an ounce, until the seed was all consumed. Not the slightest effect was produced on the pulse or general system, and I therefore concluded either that the effects had been overstated, or that the seed grown in Scotland possessed less noxious properties; the latter being probably the fact."

The darnel crop of the following experiments consisted of about eighty separate plants, the best of them showing from twenty to thirty stems. In consequence of the alarming development of fungi on the spikelets, I pulled

the whole up before the seeds were dead ripe. About forty of the spikes showed ergotised kernels, specimens of which are herewith submitted. Whether these fungi are genetically connected with ergot may be worth inquiring. They are of two descriptions, and red and white in colour. The red fungoid masses very closely resemble, in consistency and colour, the true ergot in its early stage upon seeds of *Glyceria fluitans*; while the white, which has the appearance of a mould, seems to grow from the spores, exuded in large quantities from the young ergot, and carried down the rachis by dew and rain.

All the spikes affected with clearly developed ergot were set aside. Those affected with the above fungi were also kept by themselves; while the spikes freest of blemish were used for the principal experiment.

When the clean seed had dried naturally upon the stems it was threshed off and ground into meal by a coffee-mill, and cleared of the husk or palea by a fine wire sieve. The meal thus consisted of the body of the kernel and the greater part of the bran or outer coats, along with a small amount of comminuted husk. One thousand grains were baked into an ordinary loaf of wheaten flour, the proportions of the dry meal being 14 per cent. darnel, 86 per cent. wheat. Another thousand grains of darnel meal were also mixed with wheaten flour and made into twenty biscuits, the percentage of darnel meal being twenty-five, and each biscuit containing 50 grains of darnel. The loaf was of a dark brown tinge, not quite so dark as whole wheat meal bread. The biscuits showed the bran and bits of the husks as brown and greenish specks.

On October the 8th I ate one biscuit at breakfast, being 50 grains of darnel; on the 9th, one slice of bread at breakfast, containing 100 grains; on the 10th two slices at breakfast, containing 200 grains; on the 11th, two slices at breakfast, and two biscuits at tea, being 300 grains; on the 12th, two slices of bread at breakfast, two biscuits at dinner, and two biscuits at tea, being 400 grains; on the 13th, two slices of bread at breakfast, two biscuits at dinner, and three at tea, equal to 450 grains; and on the 14th, I finished with one slice of bread at breakfast, two biscuits at dinner, and five biscuits at tea, equal to 500

grains; thus eating on seven consecutive days 2000 grains of darnel meal.

As Linnæus and others had asserted that little effect was produced by darnel, unless eaten hot, the two slices of the 11th, one slice and two biscuits of the 12th, and five biscuits of the 14th, were eaten as hot as they could be put into the mouth. But indeed the notion of eating bread hot is nearly meaningless; since by the process of mastication all bread arrives in the stomach at nearly the same temperature. In the present case it was carried into the stomach along with scalding hot tea. No effects of any kind have been experienced.

Dr Balfour had mentioned in a note to the writer that the darnel seeds raised in the Botanic Garden were usually eaten by birds. Columella recommended *Lolium* for poultry. Mr Johnson, already quoted, seeks to strengthen his position in regard to *Lolium temulentum*, by suggesting that "some deleterious property" exists also in rye-grass seeds (*L. perenne*), since granivorous birds, according to his observation, never eat them. The present writer has on several occasions seen patches of newly sown rye-grass seeds eaten up, where uncovered, by domestic fowls. The portion of bran and the ground up husks sifted out of the above darnel meal were mixed with oatmeal; the mixture was readily eaten by a tame magpie and the common poultry. A large quantity of the darnel seeds which were rejected as being covered with fungi were also set down to poultry, and greedily eaten up, one reckless cock and hen in particular setting full crops at defiance. No observable results followed.

The conjecture of Dr Lowe and others that poisonous qualities may not be developed in the darnel grown in Scotland, is based partly on the assumption that darnel is poisonous when grown in other countries, and partly on the analogy of some other plants, the qualities of which are affected apparently by differences of situation. But we must first exhaust the analogies of the grasses. Is pure darnel seed ever poisonous anywhere? We see that anciently it was regarded as possessing the popularly ascribed qualities in the south of Scotland. But the malted seeds of all grasses possess intoxicating qualities.

Barley is not accounted poisonous because its malt is intoxicating. But has any grass been actually proved to change its character from wholesome to poisonous by change in the place of growth, or constituents of soil?

Have wheat, spelt, rye, barley, and oats altered their chemistry during all their history and all their wanderings? Do the descendants of the wheat and barley which Herodotus admired at Babylon twenty-three centuries ago, poison John Smith to-day, in New South Wales?

In the above experiment the darnel meal was taken in the form and manner in which it would be taken if grown amongst corn and milled and eaten with the meal, and in which its assumed pernicious properties are said to have been experienced. But most of the grasses are liable to be ergotised. This autumn (1873) I have collected many highly ergotised specimens in about fifteen genera. The existence of the disease called ergotism in past times makes it probable that in an undrained country, and in fields full of natural grasses, growing amongst the corn crops, the amount of ergot was far greater than at present. The oat-grass, which still defies extermination from corn-fields, is very liable to ergot, and frequently has spurs three-quarters of an inch in length. It is almost an absolute certainty that the darnel growing amongst the old wheat and rye was ergotised to some extent. Is it probable that this ergot was removed before the corn was ground? If it was not removed, then the pernicious effects attributed to darnel were at least partly due, not to its healthy seeds, but to its ergotised seeds. And if the ergotised seeds were an adequate cause of disease, why add another cause? When it is further borne in mind that the old crops were very frequently a maslin of wheat and rye, and that the latter is peculiarly liable to ergot (perhaps from exposing its feathery spores in flowering), the verdict of Not Guilty in favour of healthy darnel seeds is seen to be still more in accordance with the evidence. Does any one condemn healthy rye seeds, because ergotised rye seeds are poisonous? It is not impossible that a protracted diet of darnel meal, containing its bran and part of its husk, as would necessarily be the case, might have certain disarranging effects upon the system; but the same may also be possible

regarding oatmeal or whole wheat meal. Mice are found to strip off and reject the bran of at least many varieties of wheat in a very complete way, but an article of diet may be detrimental without being poisonous. If the quantity of 2000 grains of darnel eaten in a week be said to be an insufficient test, the question then gets more precise, and becomes, At what quantity do poisonous effects begin to appear? And who has made such experiments as to warrant him in saying that though 2000 grains in a week are harmless, 3000 or any other quantity will prove fatal?

It will be incumbent on those who contend for the poisonous character of healthy darnel seeds, to show that in any alleged case of disease all ergotised seeds had been removed from the grain. Is it a probable thing that the farmer of Poitiers removed the ergot? This story, and some others to a like effect, are wholly destitute of scientific limitations, while Christison's suggestion is entirely unwarranted. Actual experiments cannot be set aside by conjectures, and by assumed analogies. Whoever would maintain the bad name which has been attached to darnel, must rebuild his assertions on experiments, the conditions and surroundings of which are adequately known and set forth.

II. *Remarks on the Old Trees in the Home Park at Hampton Court.* By JAMES M'NAB.

Mr M'Nab had visited Hampton Court in September last, and made measurements of many of the largest trees in the park. Among the limes standing at the extreme end of the south avenue, one measured 12 feet 6 inches in circumference, another 15 feet 6 inches, and another 16 feet, at 3 feet from the ground. These limes average from 110 to 120 feet in height. There are numerous elms of very large size, the measurements of which were given. Many of these are still in a thriving state. He next referred to the dead or dying stumps of great trees in the park. One of these is 22 feet 3 inches in circumference, another 23 feet 6 inches, and another 25 feet 4 inches near base, and 41 feet in circumference at 6 feet from the ground. The last is called the pulpit elm. The stump stands 8 feet