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MR. DUHAMEL'S 1728
TREATISE ON THE VIOLET ROOT
ROT OF SAFFRON CROCUS:

'PHYSICAL EXPLANATION OF A DISEASE
THAT PERISHES SEVERAL PLANTS IN THE
GASTINOIS, AND SAFFRON IN PARTICULAR'

(with a summary in Dutch)

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Né à Paris le 10 Mars 1704.

Mort à Paris le 18 Août 1782.



H. L. DUHAMEL DU MONCEAU
1700-1782

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PREFACE

In preparation of 'A historical survey of botanical epidemiology' (ZADOKS & KOSTER, 1976) the older phytopathological literature was searched and several interesting papers were unearthed. Among these, DUHAMEL's (1728) 'Physical explanation' appeared to be a real classic. According to my knowledge, it is the first published experimental study of a plant disease. In many respects, this study stands up to modern criticism, even though fresh and uncontaminated soil had to be used instead of sterilized soil for the simple reason that sterilization had not yet been invented.

DuHamel's research is absolutely modern with respect to the methodology applied and the remedies indicated. He is probably the first scientist to realize that a plant disease is caused by a fungus, his 'contagious' plant, which is a parasite feeding on its host. He demonstrated that his 'parasitic plant' could multiply, and thus was an independent living entity. He recommended among other things heat treatment by means of direct sunshine, and he hinted at biological control. The freshness of DuHamel's approach has hardly been appreciated by later plant pathologists. Few of the great classical authors (FABRICIUS, 1774; PLENCK, 1794; MEYEN, 1841) quote DuHamel. KÜHN (1858) discussed the *Safrantod* but, writing for farmers, he mentioned no authors. Some recent French authors acknowledge his existence (e.g. VIENNOT-BOURGIN, 1949).

In view of the historical importance of DuHamel's paper on crocus 'death' the decision to translate, annotate, and republish the paper was an easy one. The translation was made in 1974, in planes travelling the skies of Latin America. The translation keeps as close to the French original as possible, attempting at the same time to be compatible with the English eye and ear. Dr. Richard D. Schein, Professor of Plant Pathology at the Pennsylvania State University, corrected the English translation, carefully following the original text. Dr. H. C. D. de Wit, Professor of Plant Taxonomy at the Wageningen Agricultural University, kindly solved my problems in plant identification.

Thanks are due to the editors of the 'Mededelingen van de Landbouwhogeschool' who accepted the manuscript, which had travelled over many desks, without further comment.

INTRODUCTION

THE MAN

Henry-Louis DuHamel du Monceau was born in Paris in the year 1700, and died in Paris on August 23rd, 1782. Duhamel, Hamel, du Hamel or Monceau, his name was written in various ways, belonged to the landed gentry of France. He was the wealthy *seigneur* of the estate of Denainvilliers in the *pays* then called Gastinois and now Gâtinais, some 100 km south of Paris.

DuHamel studied in Paris at Harcourt College. Making little progress, in part because the natural sciences were poorly taught, he decided to take courses in the sciences at the King's Garden. According to EKLUND (1971), on whom I rely mostly for these biographical notes, this story is exaggerated for effect. While attending lectures at the King's Garden around 1720, DuHamel became acquainted with established as well as young and promising, French scientists including the botanist Bernard de Jussieu.

The Royal Academy of Science asked DuHamel, a non-member, to investigate a disease destroying the saffron plant in the Gâtinais. DuHamel, coming from that district and possibly knowing about the problem from his own tenants, was highly motivated. He consulted the literature and soon concluded that his references were of no avail. The growers could not give DuHamel any useful information. They are used to seeing miracles and do not pay attention to them, he sneered. So, DuHamel sat down to investigate for himself the effects and causes of the disease.

DuHamel's research report was read to the Royal Academy of Sciences on April 7th, 1728, and published in the same year. The paper was well received and led to his election as assistant chemist (*adjoint chimiste*) and as a member of the Academy in that same year. In 1730, DuHamel was made associate botanist (*associé botaniste*) of the academy, in recognition of his knowledge of botany. In 1732, he received an appointment as general inspector of the navy, with the specific duty to assure the quality of the timber used by the French navy. However, his major interest was in agriculture. He contributed much to the modernization of French agriculture by advocating the ideas of Jethro Tull, laid down in 'Horse-hoeing Husbandry', 1733, and adapting these ideas to French conditions.

DuHamel stayed bachelor, dividing his time between Paris and Denainvilliers, and devoted his life to work. His brother managed the estate and the family fortune and also carried out many of DuHamel's agricultural projects and experiments. Many of DuHamel's writings were technical rather than scientific. They were so much appreciated that he received honours from over a dozen learned societies. Several of his works have been translated into Dutch, English, German, Italian and Spanish.

THE LOCAL SETTING

DuHamel's estate was in the *pays* called the Gâtinais, an old district, some 100 km south of Paris, traversed by the river Loing, south of the area called the Brie, enclosed by the valleys of the Loire, Yonne, and Seine. The central town is Montargis. The area lies at low altitude, is relatively flat, and consists largely of impermeable clay soils. The unhealthy marshy area with many shallow ponds has been reclaimed since DuHamel's time. The area was very poor. One of the few cash crops produced was the saffron crocus, *Crocus sativus* L., which flowers in the autumn. The stigmas of the crocus flowers constitute the commercial saffron. The cultivated crocus is a sturdy plant which can be grown under a variety of conditions. It has one to three large violet flowers with red to purple veins. The long stigmas are orange yellow; when dried they are aromatic. The flowers are harvested just before wilting, preferably in the morning. The stigmas and the tops of the styles are immediately separated from the flowers by breaking the style just below the stigma. The stigmas are dried in hair sieves over charcoal stoves to one fifth of their original weight. They are placed in hermetically sealed boxes, in layers alternating with sheets of paper. The saffron from the Gâtinais was once famous, but most saffron now comes from Spain, Western Asia, and the vale of Kashmir.

Saffron has been used for many purposes. The Romans prepared a perfume from it. In early times, the yellow colour of the extract was applied to dresses of high ranking people in Greece and Ireland. In DuHamel's time, the colorant was highly valued by the painters of miniatures. Miniatures were produced from the 16th through 19th century. They were small portraits, less than 10 cm diameter, painted on ivory with water soluble paint using narrow brushes and a hand lens. The colorant was also applied in some liqueurs. Saffron has been used as a spice since the Middle Ages; somewhat bitter and aromatic, it cannot be confused with any other spices. It is still used in Provençal fish soup, *bouillabaisse*, and in some recipes for pike. Finally, saffron was used in medicine (*Stigmata croci*), though it seems to have no demonstrated therapeutic value.

Saffron cultivation had to be abandoned in France (Gâtinais and, later, in the Midi) and in England (Saffron Walden, Essex, 16th century), partly because of frequent attacks by the fungus *Rhizoctonia crocorum*.

THE CAUSAL FUNGUS

DuHamel's description of the fungus is so vivid that no real doubt remains as to its identity. He saw the imperfect state only and called it *Tuberoïdes*. Persoon called it *Safrantodes*, and also *Sclerotium crocorum* (1801). De Candolle renamed the fungus *Rhizoctonia crocorum* (Pers.) DC. (1815), a name 'authorized' by FRIES (1823). Other synonyms are *Rhizoctonia violacea* Tul. (1851), *Rhizoctonia asparagi* Fuck. (1870), and so on.

The continuity in the botanical nomenclature, with its descriptions and re-

visions, and in the phytopathological literature, with its references, permits tracing the disease down to recent times. According to PRILLIEUX (1882), L. R. Tulasne disclosed some interesting facts about the crocus death. However, Tulasne rejected the parasitic nature of the fungus. Small fleshy bodies, not unlike perithecia, filled the conical depressions above the stomata of the inner surfaces of the bulb scales. Tulasne supposed the fungus killed the crocus by interfering with the excretion of saps from the tissues and with the uptake of air necessary for life.

An interesting piece of evidence has been produced by Wakker, the 19th century Dutch plant pathologist, who first described a bacterial disease of plants. Wakker made an extensive study of the diseases of flower bulbs in the period 1881 through 1885. He published on *Peziza bulborum* Wakker, now known as *Sclerotinia bulborum* (Wakker) Rehm (REHM, 1896) on crocus (WAKKER, 1886). The sclerotia germinate in spring and form *Peziza*-type apothecia. DuHamel, who observed so carefully, would have seen them if they were present. Evidently, his disease was not caused by *Sclerotinia*. WAKKER (1887) wrote: 'As is known, the Crocus species that produces saffron, *Crocus sativus*, suffers in France from two diseases, of which the main one, known under the name of *la Mort*, is caused by *Rhizoctonia violacea*, a subterraneously growing fungus with nice dark purple mycelium. Mr. Krelage was so kind to enable me to study this disease in the summer of 1885 with authentic examples coming from France. I could then convince myself easily that it had nothing to do with our crocus disease, which was practically certain beforehand, because the mycelium of *Rhizoctonia*, which is very easy to recognize, is never found with our diseased crocus plants. The other disease of *Crocus sativus* known to me carries the name of *tacon* in France...', and also *morve*.

The perfect stage of DuHamel's fungus, first described as *Hypochnus purpureus* Fr. (1821), and now called *Helicobasidium purpureum* (PATOULLARD, 1885), belongs to the order Auriculariales.

THE DISEASE

The soil-borne fungus is quite polyphagous. The host range includes well over 40 unrelated genera, listed by WOLLENWEBER (1932), VIENNOT-BOURGIN (1949), BUTLER & JONES (1955), and others. DuHamel was the first to study the host range of the fungus. These diseases are usually called violet root rots. The disease on crocus has also been called 'copper web' (GRAM & WEBER, 1952). It causes the plants to die in roundish patches, also noted by DuHamel. The soil-borne fungus has violet strands of mycelium forming a felted mass on the outer surfaces of the dry scales surrounding the corm. On the inner surface are numerous tiny sclerotium-like bodies, first white, then violet, and ultimately brown. From these, mycelium grows into the flesh of the corm and destroys it. The fungus has also been found in alfalfa, which again wilts in roundish patches. The main roots are covered by a dense mat of violet mycelium. From this mycelium, threads and

strands penetrate the soil and infect fresh roots, which then rot away (WOLLENWEBER, 1932).

PRILLIEUX (1891) made a detailed study on the penetration of host plants by the fungus into beet and alfalfa roots. He refers to Tulasne, who was struck by the small dark hemispherical bodies described variously as *périthèces*, *péridioles*, or *corps miliaires*. Prillieux adopted the latter designation, millet-like bodies, for what are presently called sclerotia. From the interior of these millet-like bodies the finest and least coloured filaments organize themselves. They grow towards the root near the millet-like body, and penetrate by pushing aside the suberized outer cells of the root. After penetration of the periderm the filaments spread in all directions and enter the host cells.

Survival of the fungus is effected by sclerotia and possibly by resting mycelium left behind in the soil after the death of the host tissue. The fungus is a slow grower. The disease is favoured by a light soil with a high humidity. The fungus is very persistent, due to the long-lived sclerotia and its wide host range.

Towards the end of the 19th century violet root rot caused a real epidemic on alfalfa in meridional and southwestern France. Whole fields perished in two or three years. PRUNET (1893) advised the isolation of infested patches of alfalfa by means of a ditch, as did DuHamel, but he also recommended chemical control. The walls of the ditch were to be powdered with sulphur and the infested patch was to be covered with a heavy layer of chalk. In recent times the disease seems to have decreased in importance, possibly due to adequate crop rotation and improved tillage and drainage.

SUMMARY

This paper offers a translation in English of DuHamel's 1728 text, published in French, on the violet root rot of the saffron crocus (*Crocus sativus* L.), caused by the fungus currently called *Helicobasidium purpureum* Pat. (imperfect form *Rhizoctonia crocorum* (Pers.) DC). The original text is reproduced.

The introduction contains some biographical, phytopathological and epidemiological notes. The paper reproduces the earliest experimental study in plant pathology presently known, a study which is still up to standards.

DuHamel gives the first experimental proof that:

1. a fungus is an independant living entity capable of multiplication,
2. a fungus can be a parasite living at the expense of its host,
3. a plant disease can be caused by a parasitic fungus, and
4. a plant disease can be infectious.

Key words:

Saffron, root rot, violet root rot, epidemiology, focus formation, disease control, cultural control, biological control, heat treatment, host range.

SAMENVATTING

DuHamel's verhandeling uit 1728 over het rhizoctonia rot van de safraan-crocus:

'Fysieke verklaring van een ziekte die verscheidene planten in het Gastinois te gronde richt, in het bijzonder de safraan'.

Dit artikel bevat DuHamel's oorspronkelijke franse tekst uit 1728 alsmede een vertaling in het engels, voorafgegaan door een inleiding met enkele biografische, fytopathologische en epidemiologische aantekeningen. De besproken ziekte van de safraan-crocus (*Crocus sativus* L.) wordt veroorzaakt door de schimmel *Helicobasidium purpureum* Pat. (imperfecte vorm *Rhizoctonia crocorum* (Pers.) DC). DuHamel's artikel brengt verslag uit van het oudst bekende experimentele onderzoek in de plantenziektenkunde, een onderzoek dat voldoet aan hedendaagse normen. DuHamel bewijst als eerste dat:

1. een schimmel een zelfstandig levende eenheid is in staat tot vermenigvuldiging,
2. een schimmel kan leven als een parasiet ten koste van zijn gastheer,
3. een plantenziekte kan worden veroorzaakt door een parasitaire schimmel, en
4. een plantenziekte besmettelijk kan zijn.

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NOTE TO THE READER

In the translation some terms have been marked with an asterisk*. Their meaning is given here.

Saffron	- <i>Crocus sativus</i> L.
bistre	- a sooty brown colour
Truffe de Mathiote	- <i>Tuber melanospermum</i> Vitt.
Aveline	- <i>Corylus avellana</i> L.
<i>Astragalus</i> etc.	- <i>Lathyrus tuberosus</i> L.
<i>Genista Spartium</i>	- probably a yellow flowered Papilionaceous plant with root nodules
<i>Solanum radice esculenta</i>	- probably the common potato, <i>Solanum tuberosum</i> L.
Hièble	- usually translated as elder (<i>Sambucus</i> spp.); here is probably meant alder, <i>Alnus glutinosa</i> (L.) Gaertn., which has nitrogen fixing root nodules
<i>Coronilla flore vario</i>	- <i>Coronilla varia</i> L. (<i>Papilionaceae</i>)
Arreste-Boeuf	- <i>Ononis spinosa</i> L. (<i>Papilionaceae</i>)
Morgeline	- a Caryophyllaceous plant, probably <i>Stellaria</i> spp. or <i>Holosteum</i> spp.
Seneson	- <i>Senecio</i> spp.

Words within () have been added for easy reading.

TRANSLATION

MEMOIRS OF THE ROYAL ACADEMY OF SCIENCES

PHYSICAL EXPLANATION

of a disease that perishes several plants in the Gastinois, and saffron in particular.

By Mr. DU HAMEL

7 April 1728.

Nature, prodigal as it is, furnishes us few plants of so wide a usage as saffron*. Its flowers are pleasant to see and to smell. Its pistil is considered to be a precious thing. It belongs to the spices used in cooking; it serves the painters of miniatures; it provides the dyers with a very fine colour; the physicians apply it quite usefully against various diseases; its foliage itself and its petals serve, in the district where it is cultivated, to make fodder for the animals.

But resembling in this the most precious plants, this one is tender and delicate, and cannot be conserved but by a care proportionate to its usages.

That is why, regardless of the precaution the inhabitants of the Gastinois take for its conservation, it does not cease to be attacked by several diseases, which all tend to destroy it.

Of all those to which this plant is subject, there is none more dangerous, nor any more harmful to it than the one which the inhabitants of the district call the *death*. And I was surprised by the damages which this disease causes in the places that have the misfortune to be afflicted with it.

And, actually, who would not be (surprised), seeing that a plant attacked by a disease becomes murderous to others of its species? Has anyone until now noticed contagious epidemics in plants? That which attacks the bulb of saffron is none the less of that nature, because like the pest of animals, it spoils the neighbouring bulbs, and soon the limit of the field will feel the effect of the contagion if one did not prevent the communication by a deep trench; it is essential to make it at the very beginning of spring, because the *death*, which makes much progress in that season, makes hardly any in the others; a circumstance worthy of mention, in the season when the plants would seem to be most able to resist the contagion, they succumb to it, and perish in greater number.

Nothing seemed more interesting to me than to search for the cause of such extraordinary facts. Its discovery would be of great use to botany and agriculture, and would serve the conservation of many plants, which, after having multiplied for a long time in certain sites, perish there completely without one knowing to what to attribute the loss. For that (purpose) I have made several observations, the details of which follow.

My first attention was to consult the authors, to assure myself whether they had spoken of this disease, but none seemed to have had knowledge of it.

Little satisfied by my readings, I took recourse to those who apply themselves to the cultivation of this plant; but what clarification can one draw from people whom the most admirable things do not affect, and who, accustomed to see wonders, do not give it any attention: Some said to me that the rot and the moulding were the cause of that disease, and others, more reasonable, frankly confessed to me that they only knew the effect, without ever having thought of what to attribute it to.

After several interviews with those persons, I realised that I had nothing to expect but from my (own) researches and I began them by examining the surface of the soil in the infected sites. In that examination I discovered neither insects, nor plants, nor other particularities which could not be found everywhere else, which rendered this process as useless as the foregoing, and decided to have the soil opened in order to penetrate to where I had opportunity to judge what was the origin of the disorder. I examined it bit by bit as it was dug out, and I arrived at the bulbs without observing anything remarkable. I found those which occupied the centre, those which occupied the middle part and those which were at the border limits of the infected site, in three different situations, proportionate to the progress which the disease had made on them, and in the state in which I will describe them.

Those from the middle which had been the first attacked, were completely destroyed, their cover of integuments that one knows to be in the saffron, a mass of reticulate, very thin membranes lying one on the other and of a fine silvery straw colour, could not stand any separation, were wrinkled, withered and of a very disagreeable earthy brown. But this was not the only mark of their loss. A large quantity of glandlike bodies of a dark red (colour), the majority of the size of beans, covered them on the outside, and these bulbs contained inside but an earthy substance, blackish, of the nature of that soot that the miniature painters call *bistre**, except that one could see at the middle of their cavities the skeleton of the bulb, or rather its main fibres desiccated and denuded of their fleshy substance.

Those of the centre examined, I passed to those which occupied the middle part, which I found in a situation much approaching the first ones, their scales were, however, not so faded, and still enclosed some remnants of the bulbs, but completely disembodied (if I am allowed to use this term) and completely similar to a gruel; which did me know sufficiently that they would soon be similar to the others. I saw the same glandlike bodies which I had remarked, but better fed, and fuller with life, and I began to detect in the soil violet threads that formed a kind of network.

The route that I had taken in my observation led me to the bulbs which occupied the circumference, and which consequently should be the least damaged ones. They, too, were in a state clearly different from that of the first ones.

The body of the bulbs was hardly changed: some had as the only sign of contagion but a few violet threads, which traversed the membranes of the integuments: others had on their integuments, or between the scales which form them, some small bodies similar to those which I have just discussed, and one did

not see yet but some violet flecks on the substance of the bulb. Furthermore, the soil was always pervaded by violet threads.

Finding the glandular bodies and these violet threads only on the infected sites, I suspected that they were the cause, or at least the effect of the disease, which caused me to consider them with more attention; I worked to detach them from the soil that surrounded them, and I succeeded so well by the use of rinsings, that I had the satisfaction to see them in their natural state.

These glandular bodies are very similar to the Truffle of Mathiole*, in the firmness of their flesh as well as their irregular shape. But their surface is hairy and of red-brown colour. Their size does not exceed that of a hazelnut*. Their taste has something of that of the mushroom, and has an earthy aftertaste. Some adhere to the scales of the Bulb, and others are two or three inches distant from them.

The threads are usually of the thickness of yarn, of a violet colour, and hairy like the glandular bodies. Some stretch from one body to another, and some penetrate among the integuments of the saffron bulb, separate into several branches and penetrate as far as the body of the bulb without seeming to enter it noticeably. They form in that route an infinity of anastomoses and divisions and are dotted with numerous little nodes or ganglia, which seem to be nothing else than an accumulation of the wool that covers these glandular bodies and these threads.

These observations which I have made in different seasons and in different soils, have made me believe that these glandular bodies were a parasitic plant, which draws its nutrition from the saffron bulb by means of its threads, which I regard as its roots. It vegetates in the way of the truffle, that is to say, that it never appears outside, but is born, grows, and multiplies in the interior of the soil, from which follows according to my first observation that one sees nothing on the surface of the soil to which one could attribute the cause of the disease.

This plant multiplies by the roots which push out from the new tubercles, rather like the *Astragalus scandens tuberosa radice**, the *Genista Spartium** and the *Solanum radice esculenta**, etc. It is therefore that, according to the same observation, the progress of the disease always assumes the round shape, because the plants spread equally in all directions, as can easily be seen in the strawberry whose offshoots or runners extend equally to all sides.

It seems certain that the new plant feeds itself at the expense of the saffron bulb, because its roots penetrate its integuments and attach themselves to its substance proper which languishes according to the progress which the roots make on it, a quality which makes it more parasitic than all others, because these types of vegetals usually only change the trees and the plants to which they attach themselves. If one adds to that that this disease makes nearly all its progress in the three months of spring, I do not believe that one could doubt that the new plant is the veritable cause, because it is in that season that the roots profit and grow the most.

I have not neglected any of the experiments from which I had reason to expect some clarification. Out of those numerous that I have made, and which I do not

report, to avoid being too lengthy, here is one which in itself assures me of the existence of the plant, of its manner of growth and of its action on the saffron bulbs, which is too much my subject not to take few words to tell the story.

In the month of October 1726 I placed tubercles of the *death* with their soil and bulbs of saffron in three pots which I filled with new soil in which there was no *death*, and to ascertain that it damaged only the saffron bulbs, I planted in the same pots bulbs of lily, of daffodil, of tulip, and I have left them in the experiment until the month of October of this year; I considered that by then the *death* must well have multiplied, because according to the nature of its development it makes all its progress in the period of the sap.

This time having passed thus, and at the end of the month of October in 1727, I inverted my pots and I saw quantities of new tubercles out of which came many violet threads, which intertwined with the roots of lily planted in the same pot. I freed them of their soil, and I found several heavily damaged, others completely rotten. The body of the lilies seemed to me not yet to have suffered much, but it was surrounded by so many threads that it appeared to me quite probable that it would soon undergo the same fate as its roots.

That multiplication of tubercles finally convinced me that they really were a plant, and their action on the roots of the lilies caused me to believe that they could feed themselves on plants other than the saffron: but the enlightenments which I drew from my experiment, far from making an end to my observations, engaged me in new researches, for assured on the one hand that it was a plant, it seemed to me essential to know if it was in the soil before the saffron, or if it was planted there with it. Seeing on the other hand the damaged roots of the lilies, I was not allowed to remain in the uncertainty of knowing whether the new plant was capable to damage others, or if it could feed itself only on the saffron.

One profitable procedure does forget a number of useless ones, I experienced that truth, when having dug into several fields without finding anything, I perceived in a field where there had never been (any) saffron, my contagious plant which exercised its tyranny on the roots of the alder*, of the *Coronilla flore vario**, of the *Arreste-Boeuf**, and on the bulbs of *Muscari*. Thus one can be assured that this plant comes where there is no saffron, and feeds itself on other plants of which it likewise causes the loss, though it had been observed on the saffron only, by the considerable damage it causes to those who cultivate it.**

At first it seemed surprising to me to see the plants which I just mentioned perish in the midst of numerous others that had all their foliage, like the *Morgeline**, the *Seneson**, the wheat, the barley and several others, but it was not difficult for me to understand that the contagious plant, not coming to the surface of the soil, but inhabiting it at half a foot of depth, could not damage those that have their roots only at the surface, whereas it causes to perish those which throw them deeper. Furthermore, I have remarked that the contagious plant damages the saffron only very slightly in the first year that it is planted, and consequently cannot do much harm to annual plants.

** De la Chesnée Monstreul de Caën in the second edition of his *Floriste François*, page 187, mentions a disease of tulips, which by its effects seems to have a similar cause.

I believe the cause of the disease of the saffron sufficiently disclosed by the existence of the new plant which I have just described: but to what class, to what genus to relate that plant? Here is what I think.

Nearly all the authors who have worked to classify the plants in a methodic way, have made a particular class of those that have neither flower nor apparent seed, and have given them the name of imperfect plants; except Mr. De Tournefort, who, in order to speak more correctly, has qualified this class with the heading: *Plants of which one does not know the flowers or the fruits*. I am quite far from believing that these great botanists would have pretended, in establishing that class, to regard the plants that compose it as devoid of parts that are so essential to them, they know them too well to ignore that all these plants bear flowers and fruits. Mr. De Tournefort, for example, would know better than anybody the dust that escapes from the shields of the *lychens*. The seeds that are enclosed in the fruits of several mosses, the grains that one finds on several species of mushrooms, and that what Porta has said on the seed of truffles**. But our methodical scientist has believed to be able to choose for the establishment and distinction of those genera, the parts always visible and easy to observe, so that he pays no attention to the grain of the plants that the best microscopes can hardly make visible, and keeps himself only to the naturally visible parts for the establishment of his classes and his genera.

It is by following this method that I have believed to place the new plant about which it goes in the class of those that I just spoke of, because until now I have not been able to detect on it either flower or grain. So it remains to choose in that class a genus that could accommodate it. It has no resemblance whatsoever with the *Lycoperdon*, the agarics and the mosses, that which it has to some species of *Lychee* is too imperfect to merit attention. There are but the genera of the mushrooms, or of the truffles to which one could relate it.

Long threads that it grows in the soil, a hairiness that accompanies it everywhere, and even seems to precede her, with small, woolly tubercles produced by these threads, made me first inclined to place it in the ranks of the mushrooms: but could one dare to count among the species of that genus a plant that does not come out of the soil? It seemed to me rather that the solidity of the tubercles, their irregular form caused by the different arrangements of the bodies which surround it, combined with its way of vegetating in the interior of the soil without appearing at the outside, are qualities which belong to the truffle.

It is true that there are mushrooms which carry threads at their stalks and tubercles that seem to have some relation to those of that plant. Steerbeek and the Count of Marsilly have made engrave several of that kind. But besides that these threads and these tubercles are of a thin substance, cottony and clearly different from the others, those mushrooms never fail to reproduce themselves on the surface of the soil, which differentiates them totally from the new plant, that far from appearing at the outside remains enclosed there at a half foot of depth.

On the other side, the interior colour of its flesh is in summer of a red-brown,

** In his *Phytognomonie*, page 367.

and in winter of a black, lightly marbled with red, whereas the truffle is white in summer and brown marbled with white in winter. The new plant has roots from which it draws its nutrition and by means of which it multiplies itself, and the truffle is without roots and seems to multiply itself only by the grain that it includes internally. Nevertheless, as it has more in common with the truffle than with any other plant, I believe that one could give it the name of *Tuberoïdes*.

Besides these relations, it also resembles the truffle, in that it often includes foreign bodies in its substance, like gravel, and sometimes a small clod of hardened soil. Thus the story of the governor of Carthagera who, on biting a truffle, found a denarius between his teeth, according to the report of Pliny, should no longer be evidence against the feeling of those who ascertain the vegetation of the truffle.

The farmer can already realise that in discovering a new plant by my researches, I offer him a new monster to fight, and it is on this point that I base the principal utility of this memoir, but maybe this plant would not seem so odious when I would introduce it to him as an aid that will work in concert to destroy for him from his field the alders, the *Coronilla*, the *Muscari* and several other plants that often occur in the best fields in so great a quantity that they choke the wheat and make it perish.

Really, would one blame him who, to destroy the ants that are often such a nuisance, would raise *ant-lions* in order to hunt them?

One could object perhaps, that by this means, I infect the soil with a plant that will be very difficult to destroy: but the most useful things ask to be employed with discretion. That is why one must not use it but in the fields exclusively destined to produce grain, because this plant, as I have already remarked, does not cause any damage to those that are annuals, nor to those that have roots only at the surface of the soil. At any rate, I suggest this as an idea that occurred to me, that I have not yet been able to confirm by experimentation, but that has appeared to me to merit some attention.

If, according to this idea, this plant can be of some use in the grain fields, it must, according to my observations, be quite a nuisance in many other places. What damage, for example, might it not cause in a flower garden, where in less than two years it could destroy a bed of rare and precious plants? How many amateurs possibly have abandoned the cultivation of flowers, discouraged by seeing them perish notwithstanding their good cares, or at least went to considerable costs to remove the soil of their gardens, and to put new (soil) in its place, erroneously attributing its bad quality to a disaster of which the new truffle alone was the culprit. But the disorders that I attribute to it, as simple suppositions, are not so considerable in comparison with those that I have seen it produce on the saffron bulbs, where the progress of the blight is so evident, that if one would not undertake to remedy it, one would soon see a whole field lost to the point that one could no longer plant saffron there, even after twenty years of rest.

One can hardly be a witness of these blights without seeking a remedy, also hardly had I known the *Tuberoïdes*, when I searched for the means to destroy it: but I could not yet have that satisfaction, because as it likes mainly stony, dry and

arid soils, and is only rarely found in rich and humid soils, ploughing serves more to multiply than to destroy it.

But if one has not the means to get completely rid of it, one has at least (something) to protect oneself from its disorders, because its progressing by the prolongation of its roots, one must only prevent the communication to safeguard the healthy bulbs. To succeed, one must dig away the soil all around down to a half-foot depth immediately when one observes the blight, and take care not to spread it over the neighbouring bulbs, for fear that the contagion should be carried there, burying there the new plant: but one must make a hill of it on the very place where the bulbs are spoiled.

By this means one preserves the bulbs that are not yet damaged, without curing those that already are. It is certain that there is no remedy when the contagion has penetrated to the core, but the experiment has taught me that by undoing the bulbs that are only lightly attacked from their integuments, and by exposing them some days to the sun, they become perfectly healthy and grow as well as if they had never been affected by the disease. The reason for this seems clear to me, in that in peeling them one takes away with the integuments the killing threads, and by exposing them to the sun, the remainders of the contagious plant dry up, the wounds heal, from which follows the perfect recovery of the bulb.

EXPLANATION OF THE FIRST ILLUSTRATION,

Which represents the saffron, or the Crocus sativus that is discussed in this memoir.

- A. The bulb covered by its membranous envelopes, reddish in some, and whitish in others.
- B. The bulb freed from its coat and cut by half, of which the diameter is about one inch, with a fleshy substance, its form flattened at the bottom, and its surface surrounded by small circular lines where the membranous envelopes are attached.
- C. Membranous sheath that envelopes the leaves of the bulb and the tube of the flower until the surface of the soil.
- D. Leaves or fan of the bulb. Their number varies from five to eight, their length is one foot by one line of width, on the upper side they are grooved in the form of a gutter, of green-brown colour at the margins, and white on the vein in the bottom of the gutter.
- E. The open flower, which is a white tube, equal from the bottom to its top, is divided into six parts and widens in the form of petals of a linen-grey colour: they are about two inches long and nine to ten lines wide.
- F. The whitish anthers (are) half an inch long, carry tops forked at the bottom. These tops contain a very fine, yellow powder in capsules.
- G. The embryo is triangular; when the flower has gone, it becomes a capsule with three sides divided into three compartments that contain several round seeds; but they usually do not ripen in the Gastinois area.

H. The pistil that is attached to the embryo; it is a white and single thread up to the height of the anthers, where it becomes yellow and divides most often into three ends of a beautiful dark red. They somewhat exceed the length of the petals, have the thickness of a thread at the bottom and become wider at the top, where they have some very tiny indentations.

It has to be mentioned that that red part of the pistil is the only one that is used in the ragouts, and in medicine, and that serves the dyers.

EXPLANATION OF THE SECOND ILLUSTRATION,

Which shows the Tuberoïdes and the way in which it is attached to the bulbs of saffron.

- A. The *Tuberoïdes* in its natural size, with its violet and hairy roots, by the prolongation of which it multiplies.
- B. Small ganglions, or new tubercles that are formed at the extremities and at the anastomoses of several roots.
- C. State of the saffron in the centre of the infected places, where nothing remains but the scales of the bulb in their usual form, the substance being completely consumed by the action of the *Tuberoïdes*.
- D. State of the saffron in the middle part, between the centre and the circumference, where the tubercles are attached to the scales, and where the roots of the *Tuberoïdes* penetrate the substance of the bulb, have let him lose his solidness and have made him resemble a pulp.
- E. State of the saffron at the circumference where the roots of the *Tuberoïdes* have only penetrated the scales of the bulb, without having damaged the substance.

EXPLICATION PHYSIQUE

D'une maladie qui fait perir plusieurs Plantes dans le Gastinois, & particulièrement le Safran.

Par M. DU HAMEL.

7. Avril
1728.

LA nature toute prodigue qu'elle est nous fournit peu de Plantes d'un aussi grand usage que le Safran. Ses fleurs sont agréables à la vûe & à l'odorat. Son pistile est considéré comme une chose précieuse. Il entre dans les apprêts de cuisine; il sert aux Peintres en miniature; il fournit aux Teinturiers une très belle couleur; les Medecins l'employent très utilement dans plusieurs maladies: sa Fanne même & ses pétales servent dans le pays où on le cultive, à faire du Fourrage pour les bestiaux.

Mais semblable en cela aux Plantes les plus précieuses, celle-ci est tendre & délicate, & ne peut être conservée que par des soins proportionnés à ses usages.

C'est pourquoy quelque précaution que les habitans du Gastinois qui la cultivent prennent pour la conservation, elle ne laisse pas d'être attaquée de plusieurs maladies, qui toutes tendent à la détruire.

De toutes celles auxquelles cette Plante est sujette, il n'y en a point de plus dangereuse, ni qui lui soit plus nuisible que celle que les habitans du pays appellent la *Mort*. Et j'ai été surpris des desordres que cause cette maladie dans les endroits qui ont le malheur d'en être affligés.

Et qui ne le seroit pas en effet, de voir qu'une Plante attaquée d'une maladie devient meurtrière des autres de son espèce? En avoit-on jusqu'ici remarqué de contagieuses Epidémiques dans les Plantes? Celle qui attaque l'Oignon du Safran est cependant de cette nature, puisque semblable à la peste des animaux, elle gâte les Oignons voisins, & bientôt

l'extrémité du champ se sentiroit de la contagion si l'on n'empêchoit la communication par une profonde tranchée qu'il est essentiel de faire dès le commencement du Printemps; parce que la *Mort* qui fait beaucoup de progrès dans cette saison, n'en fait presque point dans les autres; circonstance digne de remarque, dans la saison où les Plantes paroissent le plus en état de résister à la contagion, elles y succombent, & périssent en plus grand nombre.

Rien ne me parut si intéressant que de rechercher la cause de faits si extraordinaires. Sa découverte seroit d'une grande utilité pour la Botanique & pour l'Agriculture, & serviroit à la conservation de plusieurs Plantes, qui après s'être long-temps multipliées dans quelques endroits y périssent entièrement sans qu'on sçache à quoi en attribuer la perte. J'ai fait pour cela plusieurs observations, dont voici le détail.

Ma première attention fut de consulter les Auteurs, pour m'assurer s'ils avoient parlé de cette maladie, mais aucun ne m'a paru en avoir eû connoissance.

Peu satisfait de mes lectures, j'eus recours à ceux qui s'appliquent à la culture de cette Plante; mais quel éclaircissement peut-on tirer de gens que les choses les plus admirables ne touchent point, & qui accoutumés à voir des prodiges, n'y font aucune attention : Les uns me dirent que la pourriture & la moisissure étoient la cause de cette maladie, & les autres plus sensés m'avoüerent ingénüement qu'ils ne connoissoient que l'effet, sans avoir jamais pensé à quoy l'attribuer.

Après plusieurs entretiens avec ces personnes, je reconnus que je n'avois rien à esperer que de mes recherches, & je les commençai, par examiner la superficie de la terre dans les endroits infectés. Je ne découvris dans cet examen ni insectes, ni plantes, ni autres particularitez qui ne se trouvaient par tout ailleurs, ce qui rendit ce procédé aussi inutile que les précédens, & me détermina à faire ouvrir la terre pour pénétrer jusqu'où j'avois lieu de juger qu'étoit l'origine du mal. Je l'examinai à mesure qu'on la fouilloit, & j'arrivai aux

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Oignons sans rien appercevoir de remarquable. Je trouvai ceux qui occupoient le centre, ceux de la partie moyenne, & ceux qui étoient aux extrémités de l'endroit infecté, dans trois situations différentes, à proportion du progrès que la maladie avoit fait sur eux, & dans l'état que je vais les représenter.

Ceux du milieu qui avoient été les premiers attaqués, étoient entièrement détruits, leur robe ou téguments que l'on sçait être dans le Safran, un amas de membranes réticulaires fort minces couchées les unes sur les autres & d'un beau couleur de paille argentin, ne pouvoient souffrir aucune division, étoient ridés, fanés, & d'un brun terreux fort désagréable. Mais ce n'étoit pas la seule marque de leur perte. Une grande quantité de corps glanduleux d'un rouge foncé, gros la plupart comme des Fèves, les couvroient extérieurement, & ces Oignons ne contenoient intérieurement qu'une substance terreuse, noirâtre, de la nature de cette suyc que les Peintres en miniature appellent *Bistre*, excepté que dans le milieu de leurs cavitez on voyoit dans la plupart le squelette de l'Oignon, ou plutôt ses principales fibres desséchées & dénuées de leur substance charnue.

Ceux du centre examinés, je passai à ceux qui occupoient la partie moyenne, que je trouvai dans une situation fort approchante des premiers, leurs téguments n'étoient cependant pas si flétris, & renfermoient encore quelques débris de l'Oignon, mais entièrement decorporés, (s'il m'est permis de me servir de ce terme) & tout-à-fait semblables à de la bouillie; ce qui me faisoit assés connoître que bientôt ils seroient semblables aux autres. J'y vis les mêmes corps glanduleux que j'avois remarqués, mais mieux nourris, & plus pleins de vie, & je commençai à découvrir dans la terre des filets violets qui formoient une espèce de réseau.

La route que j'avois prise dans mon observation me conduisit aux Oignons qui occupoient la circonference, & qui par conséquent devoient estre les moins endommagés. Aussi étoient-ils dans un état bien différent de celui des premiers.

Le corps des Oignons n'étoit presque point altéré: les uns

n'avoient pour toute marque de contagion que quelques filets violets, qui traversoient les membranes de leurs téguments ; les autres avoient sur leurs téguments, ou entre les lames qui les forment, quelques petits corps semblables à ceux dont je viens de parler, & on ne voyoit encore que quelques taches violettes sur la substance de l'Oignon. Au reste la terre étoit toujours traversée de filets violets.

Ne trouvant que dans les endroits infectés ces corps glanduleux & ces filets violets, je soupçonnai qu'ils étoient la cause, ou du moins l'effet de la maladie, ce qui m'engagea à les considérer avec plus d'attention ; je travaillai à les détacher de la terre qui les environnoit, & j'y réussis si bien par le moyen des lotions, que j'eus la satisfaction de les voir en leur état naturel.

Ces corps glanduleux sont fort semblables à la Truffe de Mathiole, tant par la solidité de leur chair, que par leur figure irrégulière. Mais la superficie en est veluë & de couleur rouge-brun. Leur grosseur n'excede pas celle d'une Aveline. Leur goût tient de celui du Champignon, & a un retour terreux. Les uns sont adhérents aux téguments de l'Oignon, & les autres en sont éloignés de deux à trois pouces.

Les filets sont ordinairement de la grosseur d'un fil, de couleur violette, & veluë comme les corps glanduleux. Quelques-uns s'étendent d'un corps à un autre, & quelques-uns vont s'insérer entre les téguments de l'Oignon de Safran, se partagent en plusieurs ramifications, & pénètrent jusqu'au corps du Bulbe sans paroître sensiblement y entrer. Ils forment dans cette route une infinité d'anastomoses & de divisions, & sont parsemés de quantité de petits nœuds ou ganglions, qui ne paroissent autre chose qu'un amas de la laine qui couvre ces corps glanduleux & ces filets.

Ces observations que j'ai faites en différentes saisons & dans différentes terres, m'ont fait juger que ces corps glanduleux étoient une Plante parasite, qui tire sa nourriture de l'Oignon du Safran par le moyen de ses filets, que je regarde comme ses racines. Elle végète à la manière de la Truffe,

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c'est-à-dire, qu'elle ne paroît point au dehors, mais naît, croît, & se multiplie dans l'intérieur de la terre, d'où vient suivant ma première observation qu'on ne voit rien sur la superficie de la terre à quoi on puisse attribuer la cause de la maladie.

Cette Plante se multiplie par les racines qui poussent de nouveaux Tubercules, à peu près comme l'*Astragalus scandens tuberosa radice*, le *Genista Spartium*, & le *Solanum radice esculentâ*, &c. C'est pour cela que, suivant la même observation, le progrès de la maladie affecte toujours la figure ronde, parce que les Plantes qui tracent poussent également en tout sens, comme il est aisé de le voir dans le Fraisier dont les trainasses ou fleaux s'étendent également de tous côtés.

Il paroît certain que la nouvelle Plante se nourrit aux dépens de l'Oignon du Safran, puisque ses racines pénètrent ses régumens, & s'attachent à sa propre substance qui dépérit à proportion du progrès que les racines font sur elle, qualité qui la rend plus parasite que toutes autres, puisque ces sortes de végétaux ne font ordinairement qu'altérer les arbres & les Plantes auxquelles ils s'attachent. Si l'on joint à cela que cette maladie fait presque tout son progrès dans les trois mois du Printemps, je ne crois pas qu'on puisse douter que la nouvelle Plante n'en soit la véritable cause, puisque c'est en cette saison que les racines profitent & s'étendent le plus.

Je n'ai négligé aucune des expériences dont j'avois lieu d'espérer quelque éclaircissement. Dans le nombre de celles que j'ai faites, & que je ne rapporte point, pour éviter d'être trop long, en voici une qui seule m'assûre de l'existence de la Plante, de sa manière de végéter, & de son action sur les Oignons de Safran, ce qui est trop de mon sujet pour n'en pas faire le récit en peu de mots.

Je mis dans le mois d'Octobre 1726 des Tubercules de *Mort* avec leur terre & des Oignons de Safran, dans trois pots que je remplis d'une terre neuve où il n'y avoit point de *Mort*, & pour m'assûrer si elle n'endommageoit que les Oignons

Oignons de Safran, je plantai dans ces mêmes pots des Oignons de Lis, de Narcisse, de Tulipe, & les ai laissés en expérience jusqu'au mois d'Octobre de cette année; je jugeai bien qu'alors la *Mort* devoit s'y être multipliée, parce que suivant l'ordre de la végétation, elle fait tout son progrès dans le temps de la sève.

Ce temps donc étant passé, & sur la fin du mois d'Octobre de 1727 je renversai mes pots, & je vis quantité de nouveaux Tubercules dont il sortoit beaucoup de filets violets, qui s'entrelassoient avec les racines de Lis plantés dans le même pot. Je les dégageai de leur terre, & j'en trouvai plusieurs fort endommagées, d'autres entièrement pourries. Le corps des Lis ne me parut pas avoir encore beaucoup souffert, mais il étoit environné de tant de filets qu'il me paroïssoit fort probable que dans peu il auroit le même sort que ses racines.

Cette multiplication de Tubercules acheva de me convaincre qu'ils étoient véritablement une plante, & leur action sur les racines des Lis me donna lieu de croire qu'ils se pouvoient nourrir d'autres Plantes que du Safran: mais les lumières que je tirai de mon expérience, bien loin de mettre fin à mes observations, m'engagèrent à de nouvelles recherches, car assuré d'un côté que c'étoit une Plante, il me paroïssoit essentiel de sçavoir si elle étoit dans la terre avant le Safran, ou si elle ne s'y plantoit qu'avec lui. Voyant d'un autre côté les racines des Lis endommagées, il ne m'étoit pas permis de rester dans l'incertitude de sçavoir si la Plante nouvelle étoit capable de nuire à d'autres, ou si elle ne pouvoit se nourrir que du Safran.

Un procédé avantageux en fait oublier un nombre d'inutiles, j'éprouvai cette vérité, lors qu'après avoir fouillé plusieurs champs sans rien trouver, j'aperçûs dans une terre où il n'y avoit jamais eû de Safran, ma Plante contagieuse qui exerçoit sa tyrannie sur les racines de l'Hieble, du *Coronilla flore vario*, de l'Arreste-Bœuf, & sur les Oignons du *Muscari*. Ainsi on peut être assuré que cette Plante vient où il n'y a point de Safran, & se nourrit d'autres Plantes dont

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elle cause également la perte, quoiqu'on ne l'ait remarquée que sur le Safran, par le dommage considérable qu'elle cause à ceux qui le cultivent.*

Il me parut d'abord surprenant de voir les Plantes que je viens de nommer perir au milieu de quantité d'autres qui avoient toute leur verdeur, comme la Morgefine, le Seneçon, le Bled, l'Orge, & plusieurs autres, mais il ne me fut pas difficile de concevoir que la Plante contagieuse ne venant point sur la superficie de la terre, mais que l'occupant à demi-pied de profondeur, elle ne pouvoit endommager celles qui n'ont leurs racines que sur la superficie, pendant qu'elle fait perir celles qui en jettent de plus profondes. Et de plus j'ai remarqué que la Plante contagieuse n'endommage que très peu le Safran la première année qu'il est planté, & par conséquent ne peut faire un tort considérable aux Plantes annuelles.

Je crois la cause de la maladie du Safran suffisamment découverte par l'existence de la nouvelle Plante dont je viens de donner la description : mais à quelle Classe, à quel genre rapporter cette Plante ? Voici ce que j'en pense.

Presque tous les Auteurs qui ont travaillé à ranger les Plantes sous un ordre methodique, ont fait une Classe particuliere de celles qui n'ont ni fleur, ni graine apparentes, & leur ont donné le nom de Plantes imparfaites; excepté M. de Tournefort, qui pour parler plus correctement a qualifié cette Classe du titre : *des Plantes dont on ne connoît ni les fleurs ni les fruits*. Je suis bien éloigné de croire que ces grands Botanistes ayent prétendu, en établissant cette Classe, regarder les Plantes qui la composent comme privées de parties qui leur sont si essentielles, ils les connoissoient trop pour ignorer que toutes ces Plantes portent fleurs & fruits. M. de Tournefort, par exemple, connoissoit mieux que personne la poussiere qui échappe des Ecussions des *Lychen*. Les semences qui sont renfermées dans les fruits de plusieurs Mousses,

* De la Cheinée Monstreul de Caën dans la seconde édition de son *Floriste François*, page 187. fait mention d'une maladie des Tulipes, qui par ses effets paroît avoir une cause semblable.

Les grains que l'on trouve sur plusieurs especes de Champignons, & ce que Porta a dit de la semence des Truffes *. Mais nôtre sçavant methodiste a cru pouvoir choisir pour établir & distinguer ses genres, les parties toujours sensibles & aisées à appercevoir, de sorte qu'il conte pour rien la graine des Plantes que les meilleurs Microscopes peuvent à peine rendre sensible, & s'arrête seulement aux parties naturellement visibles pour établir ses Classes & ses genres.

C'est en suivant cette methode que j'ai crû devoir placer la Plante nouvelle dont il s'agit dans la Classe de celles dont je viens de parler, parce que je n'ai pû jusqu'à present découvrir sur elle ni fleur ni graine. Il reste donc à choisir dans cette Classe un genre qui puisse luy convenir. Elle n'a aucune ressemblance avec le *Lycoperdon*, les *Agarics* & les *Mousses*, celle qu'elle a avec quelques especes de *Lychen* est trop imparfaite pour meriter qu'on y fasse attention. Il n'y a que les genres des Champignons, ou des Truffes auxquels on pourroit la rapporter.

De longs filets qu'elle pousse dans la terre, un velu qui l'accompagne par-tout, & paroît même la preceder, avec de petits Tubercules lanugineux produits par ces filets, me faisoient d'abord incliner à la mettre au nombre des Champignons : mais oseroit-on conter parmi les especes de ce genre une Plante qui ne sort point de terre ! Il me paroîtroit plutôt que la solidité des Tubercules, leur figure irréguliere causée par le different arrangement des corps qui l'environnent, jointe à leur manière de végéter dans l'intérieur de la terre sans paroître au dehors, sont des qualitez qui appartiennent à la Truffe.

Il est vrai qu'il y a des Champignons qui portent à leur pedicule des filets & des Tubercules qui semblent avoir quelque rapport à ceux de cette Plante. Steerbeck & M. le Comte de Marilly en ont fait graver plusieurs de cette espece. Mais outre que ces filets & ces Tubercules sont d'une substance rare, cotoneuse, & bien differente des autres, ces Champignons ne manquent jamais de se produire sur la superficie

* Dans la *Phytognomonie*, pag. 367.

de la terre, ce qui les différencie totalement de la nouvelle Plante, qui bien loin de paroître au dehors y demeure renfermée à demi-pied de profondeur.

D'un autre côté, la couleur intérieure de sa chair, est en esté d'un rouge-brun, & en hyver d'un noir légèrement marbré de rouge, au lieu que la Truffe est blanche en esté, & brune marbrée de blanc en hyver. La nouvelle Plante a des racines dont elle tire sa nourriture, & par le moyen desquelles elle se multiplie, & la Truffe est sans racines, & paroît ne se multiplier que par la graine qu'elle renferme intérieurement. Cependant comme elle a plus de rapport à la Truffe qu'à toute autre Plante, je crois qu'on pourroit luy donner le nom de *Tuberoïdes*.

Outre ces rapports, elle est encore semblable à la Truffe, en ce qu'elle renferme souvent dans sa substance des corps étrangers, comme des graviers, & quelquefois des petites mottes de terre endurcie. Ainsi l'Histoire du Gouverneur de Carthagène qui, en mordant une Truffe, trouva sous les dents un denier, suivant le rapport de Plin, ne sera plus une preuve contre le sentiment de ceux qui assurent la végétation de la Truffe.

Le Laboureur peut déjà s'appercevoir qu'en découvrant par mes recherches une nouvelle Plante, je lui offre un nouveau monstre à combattre, & c'est en ce point que je fais consister la principale utilité de ce Mémoire, mais cette Plante ne lui paroîtra peut-être pas si odieuse, lorsque je la lui proposerai comme un aide qui travaillera de concert avec pour lui détruire de son champ les Hyebles, les *Coronilla*, le *Muscari*, & plusieurs autres Plantes qui viennent souvent dans les meilleures terres en si grande quantité qu'elles étouffent le Bled, & le font perir.

En effet, blâmeroit-on celui qui pour détruire les Fourmis souvent si incommodes, élèveroit des *Formicaleons* pour leur faire la chasse?

On m'objectera peut-être, que par ce moyen, j'insecte la terre d'une Plante qu'il sera fort difficile de détruire : mais les

ehofes les plus utiles demandent à être employées avec discernement. C'est pourquoi il ne faut s'en servir que dans les terres purement destinées à faire venir du grain, parce que cette Plante, comme je l'ai déjà remarqué, ne cause aucun dommage à celles qui sont annuelles, ni à celles qui n'ont leurs racines que sur la superficie de la terre. Au reste je propose ceci comme une idée qui m'est venue, que je n'ai pu encore confirmer par l'expérience, mais qui m'a paru mériter quelque attention.

Si suivant cette idée cette Plante peut être de quelque utilité dans les terres à grain, elle doit, suivant mes observations, être bien incommode dans quantité d'autres endroits. Quel dégât, par exemple, ne causeroit-elle pas dans un Jardin de fleurs, où en moins de deux ans elle peut détruire une planche entière de plantes rares & précieuses? Combien de curieux ont peut-être abandonné la culture des fleurs rebutés de les voir périr malgré tous leurs soins, ou du moins se sont engagés en des frais considérables pour ôter la terre de leurs Jardins, & en mettre de nouvelle à la place, attribuant mal à propos à sa mauvaise qualité un désastre dont la nouvelle Truffe estoit seule coupable? Mais ces desordres que je lui attribue, sous de simples soupçons, sont peu considérables en comparaison de ceux que je l'ai vû produire sur les Oignons de Safran, où le progrès du mal est si sensible, que si l'on ne prenoit soin d'y remédier, on verroit bientôt tout un Champ perdu au point de n'y pouvoir plus mettre de Safran, même après vingt ans de repos.

On ne peut guères être témoin de ces maux, sans en chercher le remède, aussi à peine eus-je connu le *Tuberoïdes*, que je cherchai les moyens de le détruire: mais je n'ai pu encore avoir cette satisfaction, parce que comme il se plaît principalement dans les terres graveleuses, seches & arides, & qu'il ne se trouve que rarement dans les terres grasses & humides, les labours servent plutôt à le multiplier qu'à le détruire.

Mais si l'on n'a pas de moyens pour s'en débarrasser totalement, du moins en a-t-on pour se mettre à l'abri de ses

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desordres, car son progrès se faisant par l'allongement des racines, il ne faut pour garantir les Oignons sains qu'empêcher la communication. Pour y réussir, sitôt qu'on s'aperçoit du mal, il faut cerner la terre à un demi-pied de profondeur, & se garder de la repandre sur les Oignons voisins, de peur d'y porter la contagion, en y enterrant la nouvelle Plante : mais il faut en former une butte sur la place même où les Oignons sont gâtés.

Par ce moyen on preserve les Oignons qui ne sont point encore endommagés, sans guérir ceux qui le sont déjà. Il est certain qu'il n'y a pas de remède lorsque la contagion est parvenue jusqu'au cœur, mais l'expérience m'a fait connoître qu'en dépouillant de leurs téguments les Oignons qui ne sont que légèrement attaqués, & les exposant quelques jours au Soleil, ils deviennent parfaitement sains, & poussent aussi-bien que s'ils n'eussent jamais été atteints de la maladie. La raison m'en paroît claire, en les dépouillant on emporte avec les téguments les filets morbifiques, & en les exposant au Soleil, les restes de la Plante contagieuse se dessèchent, les playes se cicatrisent, d'où s'ensuit la parfaite guérison de l'Oignon.

*EXPLICATION DE LA PREMIERE FIGURE,
Qui represente le Safran, ou le Crocus sativus, C. B. P.
dont il est parlé dans le Mémoire.*

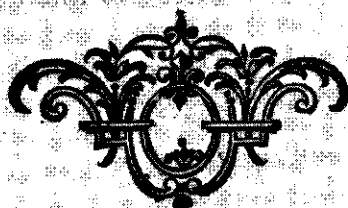
- A. L'Oignon recouvert de ses enveloppes membraneuses, roussâtres dans quelques-uns, & blancheâtres dans quelques autres.
- B. L'Oignon dépouillé de sa robbe & coupé par moitié dont le diamètre est d'environ un pouce, a la substance charnuë, sa figure applatie par dessous, & sa superficie environnée de petites lignes circulaires où s'attachent les enveloppes membraneuses.
- C. Gaine membraneuse qui renferme les feuilles de l'Oignon & le tuyau de la fleur jusqu'à la superficie de la terre.

- D.** Feuilles, ou fanne de l'Oignon. Leur nombre varie depuis cinq jusqu'à huit, leur longueur est d'un pied sur une ligne de large, elles sont canelées en forme de gouttière par dessus, de couleur verd-brun par les bords, & blanches sur la nervure dans le fond de la gouttière.
- E.** La fleur épanouie, qui est un tuyau blanc, égal depuis la base jusque vers son sommet, se divise en six parties, & s'évase en forme de pétales de couleur gris de lin : Elles ont environ deux pouces de longueur sur neuf à dix lignes de largeur.
- F.** Les Estamines blancheâtres longues de demi-pouce, qui soutiennent des sommets fourchus par le bas. Ces sommets portent dans des capsules une poussière jaune très-fine.
- G.** L'embryon qui est triangulaire; il devient, lorsque la fleur est passée, une capsule à trois faces divisée en trois loges qui renferment plusieurs semences rondes; mais elles ne meurissent pas ordinairement dans le Gastinois.
- H.** Le Pistile qui prend son attache sur l'embryon; c'est un filet blanc & unique jusqu'à la hauteur des Estamines, où il devient jaune, & se divise le plus souvent en trois brins d'un beau rouge foncé. Ils excèdent un peu la longueur des pétales, sont de la grosseur d'un fil par en bas, & deviennent plus larges par le haut, où ils ont quelques crénelures très-fines.

Il est à remarquer que cette partie rouge du pistile est la seule qui s'employe dans les Ragoufts, & en Medecine, & qui serve aux Teinturiers,

*EXPLICATION DE LA SECONDE FIGURE,
Qui représente le Tuberoïdes & la maniere dont il s'at-
tache sur les Oignons du Safran.*

- A. Le Tuberoïdes dans sa grosseur naturelle, avec ses racines violettes & veluës, par l'allongement desquelles il se multiplie.*
- B. Petits Gaglions, ou nouveaux Tubercules qui se forment aux extremités & aux anastomoses de plusieurs racines.*
- C. Etat du Safran dans le centre des places infectées, où il ne reste plus que les téguments de l'Oignon dans leur forme ordinaire, la substance étant entièrement consommée par l'action du Tuberoïdes.*
- D. Etat du Safran dans la partie moyenne, entre le centre & la circonférence, où les Tubercules sont attachés sur les téguments, & où les racines du Tuberoïdes pénètrent la substance de l'Oignon, lui ont fait perdre la solidité, & l'ont rendu semblable à de la boüillie.*
- E. Etat du Safran à la circonférence où les racines du Tuberoïdes n'ont encore penetré que les téguments de l'Oignon, sans avoir endommagé la substance.*



TROISIEME

