



Antonio Saltini

AGRARIAN SCIENCES IN THE WEST

translated by Jeremy J. Scott

VOLUME TWO

The Prelude to the Agrarian Revolution

Nuova Terra Antica





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Translated by Jeremy J. Scott

In memory of Mrs. Marjorie Eleanor May,
widow of a professor of Hong Kong University
who, out of necessity, rented out rooms in Bournemouth to foreign students
and who focused her affection and kindness on a sad and serious Italian youth:
the affection of a friendly grandmother,
the kindness of a most sensitive friend.

Nuova Terra Antica





II

Two Italian Naturalists Demolish the Dogmas of Aristotelian Biology

The Anatomical Experiments of a Court Physician

Mention has already been made, in the previous chapter, of the contribution to the birth of modern biology that would come from the work of two seventeenth-century Italian naturalists: the Bolognese Malpighi and the Arezzo-born Redi. Given the logical link between agrarian science and knowledge of biological principles, the work of these two Italian physicians necessarily stands among the premises that made renewed study of agriculture and livestock-breeding possible – premises that were as important in their fields as were Galileo’s discoveries to progress in the mechanical arts. The work of Redi and Malpighi, therefore, must be considered here not because it proposes new agrarian techniques but because it opened the way to such discoveries in the future. One must observe, therefore there, Redi’s *Osservazioni intorno agli Animali Viventi che si trovano negli Animali Viventi (Observations Regarding Living Creatures that are to be found in Living Creatures)*, published – complete with a rich set of plates – in Florence in 1684, undoubtedly deserves a place in the present discussion. Comprising 201 pages of material that is presented without any systematic order but great literary skill – Redi was not only a scientist but also a refined poet and humanist scholar – this quarto volume contains the results of the physician’s anatomical experiments and the observations regarding animal parasites made thanks to an extraordinary number of vivisections and autopsies on a wide range of species (mammals, birds, reptiles, fish, invertebrates). Given he was a court physician, Redi had the opportunity to dissect such large mammals as wolves, deer, martens and badgers, which the duke’s gamekeepers obtained for him. Furthermore, he could commission these ducal servants to supply him with woodcocks, pigeons, seagulls, owls, eagles, tortoises and vipers (the tortoises being used to see how long



The portrait of Redi in the edition of *Esperienze intorno alla generazione degl'insetti* published in Naples in 1687. Born in Arezzo in 1626, Redi studied grammar and rhetoric in Florence and later medicine and philosophy in Pisa. In addition to the two main subjects of his scholarly life, Italian Literature and Natural Sciences, he would develop a passionate interest for the French and Spanish languages, drawing, fencing, and music. Court physician to Ferdinando II and Cosimo III de' Medici, he multiplied his work in all fields where his genius inspired him to conduct his explorations. In literature, he gained a perennial place in the history of poetry with *Bacco in Toscana*, the short poem of anacreontic inspiration, born from a 1666 hoax and perfected up to its final draught in 1685.





they survived after the removal of their brain, the vipers to test how long, after the snake had been killed, the poison in their fangs remained lethal to pigeons or cockerels). His official position also enabled Redi to obtain all sorts of marine life from the fishermen of Livorno: not only shellfish, molluscs and echinoderms, but also dolphins, sea bream, hammerheads, sole, torpedo rays and even the small eels that in springtime swam up the Arno to the ponds where they would settle.

All these creatures great and small were subjected to detailed anatomical examination in order to investigate and then describe the shape and size of their organs (heart, lungs, liver, intestines and testicles). However, Redi was also equally meticulous when he dissected these organs themselves, in search of the parasite worms that were his main area of interest. Indeed, his most significant legacy to the development of modern biology would come from this exploration of the vast variety in the form and size of these parasites.

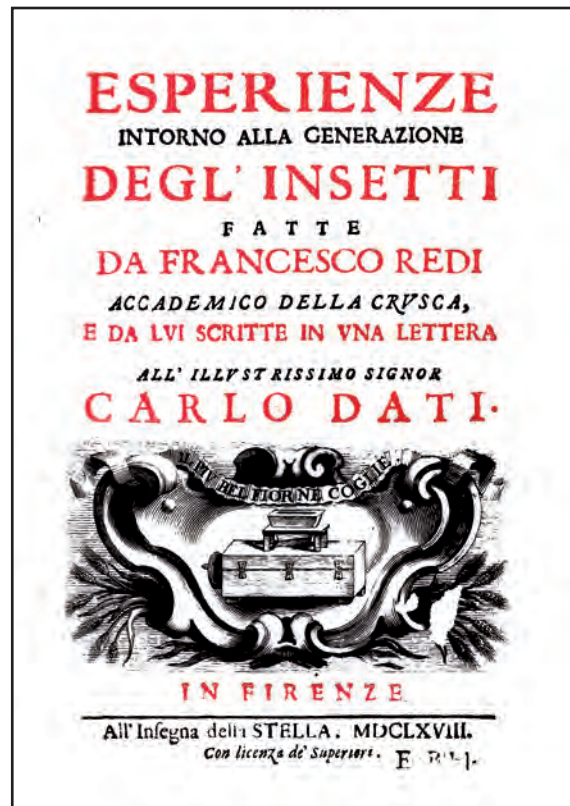
A Debunker of Popular Beliefs and Superstitions

The *Osservazioni* is a colourful mix ranging over such matter as experiments on the reproduction system of snails, accounts of the bears and lions that had died in the Grand Duke's zoo, and tests to see how long animals such as dogs and chickens might survive when left without food. What is particularly striking are the flashes of, typically Tuscan, sarcasm the author directs against popular beliefs which evidence gleaned from the dissecting table shows to be incoherent. And that earthy irony can be just as ruthless when its object is not superstition but unsupported notions put forward by famous scientists. For example, in his account of the dissection of a slug (p. 44), Redi has this to say:

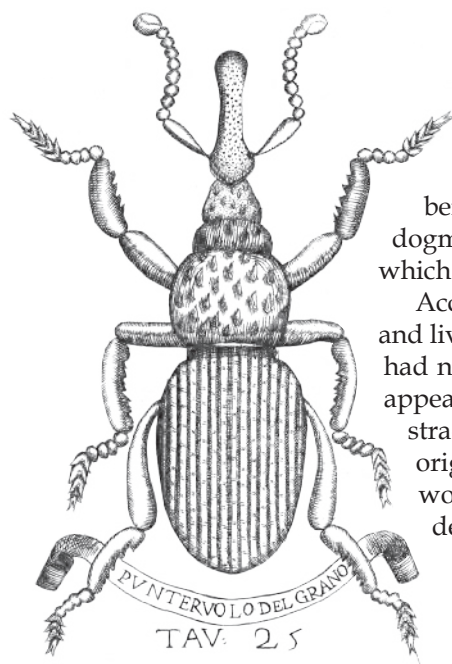
«To put it crudely, the lungs are in the form of a bladder located at the opening to that

foramen, and they occupy the entire space which is covered by that white bone which in common parlance is called the slug's "head stone". This bone is located in the middle of the hood or cloth that covers the slug's neck; it is set in its own pouch of skin, and is convex on one side, concave on the other. Ancient and modern writers say great things about the properties of this bone. Let's leave such things to those who enjoy deceiving and being deceived. At most, I will allow myself to believe that in medicine this bone produces the same effects as pearls, as crab shells and the shells of marine shellfish. And in recent times this has been referred to by Martin Lister, a very detailed and noble English writer. And it is true that when ground up and mixed with Spirit of Vitriol, the bone produces the same fermentation that one sees with pearls, mother-of-pearl, all kinds of seashells, eggshells and deer antlers [...] But surely it would be a most refined and solemn deception to send poor sick folk running here and there all day long in search of slugs so that they might

On this page and the next, the frontispiece of the two works making up Redi's contribution to the birth of modern biology. In the *Esperienze*, he demonstrates that the larvae teeming in decomposing organic matter originate from eggs laid by insects; in the *Osservazioni*, he proves that the parasite worms living in animals are the descendants of worms of the same species whose eggs were introduced into their bodies. These two demonstrations destroy the foundation of the Aristotelian theory of spontaneous generation, the conception of life that for nearly two thousand years guided human knowledge of nature.



The Demolition of the Notion of Spontaneous Generation



From the plates illustrating the *Esperienze*, the figure of a *Sitophilus granarius*, the characteristic weevil infesting granaries. Redi's classification of insects anticipates the great taxonomy of the family that René Antoine de Réaumur will attempt, for the first time, in 1754.

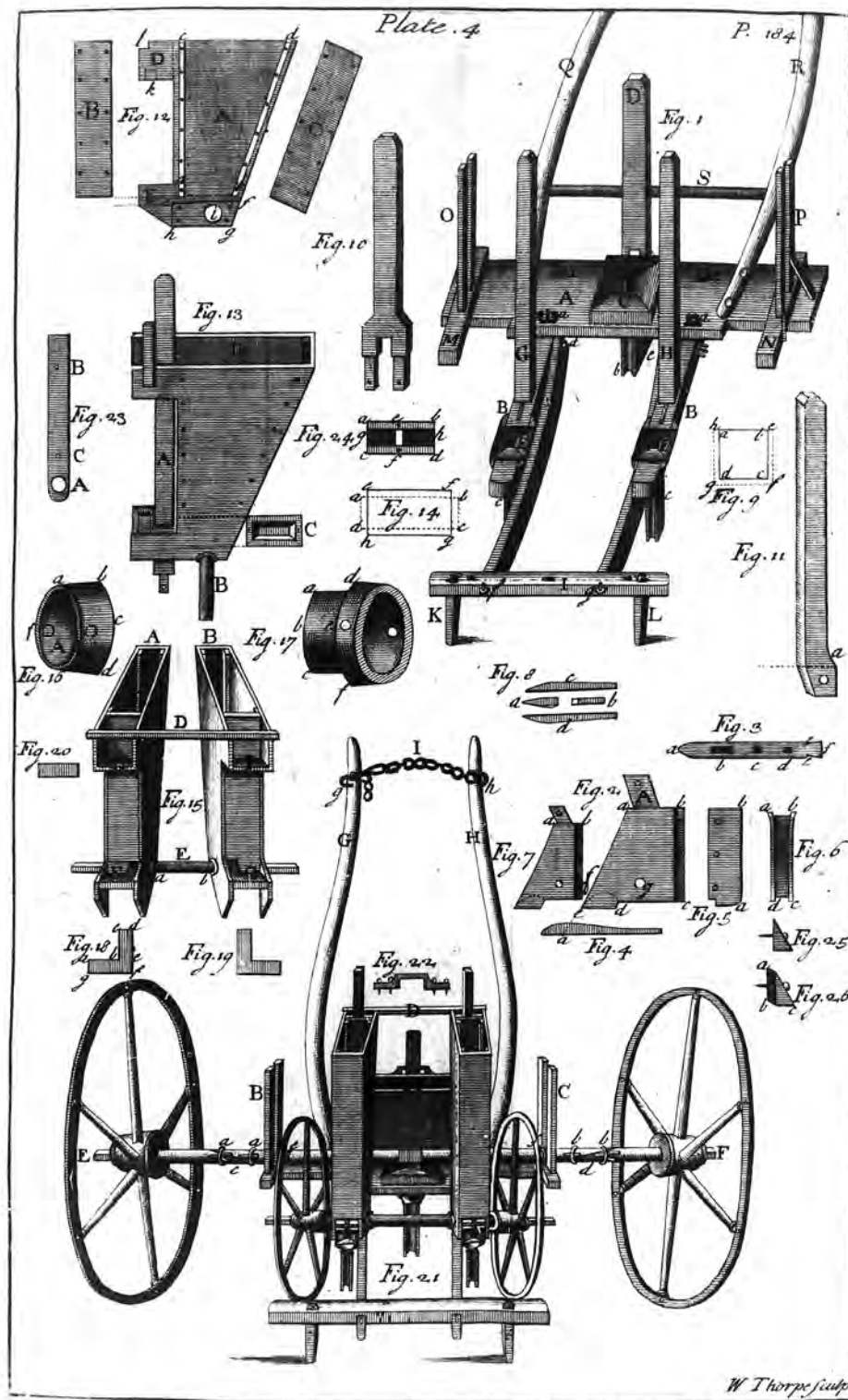
Just as significant at the level of pure science – though heralding rather quicker results in the field of practical application – was the second biological advance contained within the *Osservazioni*: Redi's demonstration that each living being descended from a creature of the same species, and that outside this continuous process of transmission animal life did not exist. What this apparently simple statement did was confute the idea that beings could be generated from putrefying matter, a previously unchallenged dogma of ancient science that had been championed in the work by Theophrastus which develops upon the ideas of Aristotle.

According to Aristotle, there was no substantial discontinuity between the mineral and living world, the intermediate "link" between them being insects, creatures that had no vertebrae or respiratory organs comparable to the upper animals and thus appeared to bring together characteristics of both inanimate and living matter. This straddling of the two worlds meant that the Greek philosopher claimed that insects originated from the decomposition of the bodies of vertebrates. Theophrastus would then extend the idea to argue that insects might also originate from plant decomposition, a notion which – as we have seen – would be supported by Virgil and De Crescenzi, and even by Olivier De Serres.

Citing this intermediate status of insects between the inorganic and animal world, and the principle of *generatio ex putri*, Filippo Buonanni, a theologian and naturalist, had responded to the contrary theses that Redi had put forward in a previous work, *Esperienze intorno alla Generazione degli Insetti*. The formal respect due to such a religious authority scarcely veiling his irreverently ironic tone, Redi now replies to the arguments put forward by Buonanni, bringing forward incontrovertible proof that there can be no life that does not derive from a living being. On page 62 of the *Osservazioni*, he begins:

«The famous and most learned scholar Samuel Bochart put forward an opinion very similar to that of Father Filippo Buonanni when in the first book of the first part of his *Animali della Sacra Scrittura*, he has this to say on insects: De caetero haec animalia maxime sunt imperfecta, quippe quae nec venas habent, neque sanguinem, neque cor, neque iecur, neque pulmonem, neque vesicam, neque ossa, neque spinam, neque adipem. Taceo quod in plerisque visus, auditus, olfactus aut nullus est, aut hebetior. But this truly great scholar was writing in his study, and he wrote what he had found on such a subject in the works of other authors. He neither prided himself on, nor even thought of, being an experimental philosopher, who aims never to claim anything with certainty unless he has observed it with his own eyes in many trials and re-trials.

Having incidentally mentioned here the learned Father Buonanni, it would seem that I should respond to certain experimental challenges that he, as a defender of *Generatio ex Putri*, has done me the honour of raising with regard to my own experiments on the generation of insects. These are his own words in the first part of Chapter Five: "I do not know how Redi would answer an experiment that I myself carried out when I took a number of hyacinth flowers and crushed them up and placed them in a glass jar with an earthenware lid, awaiting to see some sort of spontaneous generation from that sodden mass. Indeed, after having kept the jar for a few weeks in a cupboard I saw that numerous transparent worms of mucous substance had been generated, continually climbing up and down the surface of the glass". I do not want to raise a single thing against this experiment carried out by Father Filippo Buonanni; I would simply ask that same Father to do me the courtesy of repeating the experiment, and when he does so to close the jar in which he places the crushed hyacinth flowers very carefully and diligently, making sure that the lid fits flush into the neck of the jar and then sealing the whole thing so rapidly that it is not even possible to imagine any slightest fissure or crack. As for what will happen after that, I willingly resign myself to the sincerity of his own most judicious and incorruptible judgement, which – I



From the 1751 reprint of the *Horse-Hoeing Husbandry*, an accurate illustration of the parts of the drill Tull conceived for the turnip. The machine was meant to plant three rows of seeds: three hoppers, one placed near the vehicle's principal axis, two near the auxiliary axis. They support the prow-shaped coulter that place the seed in the furrow they open up in the earth. The flow of the seed from each hopper is assured through a distribution device in which a cogwheel rotates in the wooden cylinder that joins the axle shafts of the wheels. Iron joints fix the central and terminal parts of the axis, brass bushes facilitate the rotation of the cogwheel in the distribution device. The ingenious practicality of the mechanisms conceived by Tull transforms his machines into the prototype of the drills that will, in the following centuries, furrow fields in the entire world: it did not, however, bring the creative British agronomist much success for his inventions. One of the reasons for the diffidence with which they were received was probably because the local blacksmiths were unable to make the complicated mechanisms for their essential parts with precision. It would only be when the metallurgical industry was able to mass-produce the parts of any mechanical tool that the sowing machine invented by Tull would become the prototype of an instrument that was essential for the mechanization of farm work.

the presence of three crucial engineering ideas. The first of these is the distribution box, the mechanism that receives the seed from the bottom of the hopper and then pours it into the tubes linked to the drills. The drive belt transmits the rotatory motion of the wheel to an axle that runs through the hopper and is fixed to a winged bobbin that picks up the seed from the bottom and pours it into the opening that feeds the drill tubes. The ratio between the diameters of the wheels connected by the drive belt decides the speed





VII The Principles of Agrarian Policy in the Age of Enlightened Despotism

The Social Philosophy of a Master Historiographer

Following in the footsteps of Weston and Tull, the founders of experimental agronomy, English scientific culture throughout the rest of the century would focus upon the observation and comparison of agricultural techniques and the evaluation of new instruments and procedures – that is, upon the mechanisms linking progress in agriculture with that in commerce and manufacturing. In Italy, however, there would be a singular lack of original experimentation. The boast of agronomical culture here was the study of the correlation between agriculture and civic institutions, an analysis which would give rise to the first overall theory on the means by which a ruler might guarantee adequate food supplies and provisions for his realm.

In relation to this issue of secure food supplies, Italian political thinkers examined the benefits and costs of various instruments at the ruler's disposal: changes in the very fabric of land ownership and division; the even distribution of tax burdens; the norms governing contracts for the exploitation of publicly-owned land; regulation of the sale and commerce of food supplies; better education for the peasant farmer class; the foundation and function of academies, bodies which informed landowners of agronomical innovations. The earliest expression of reflection upon these matters is to be found in three chapters of *Della Pubblica Felicità oggetto de' buoni Principi* [*On Public Happiness: The Goal of the Good Prince*], the last work written by Ludovico Antonio Muratori.

Recognised by both contemporaries and later scholars as the greatest historian in eighteenth-century Italy, Muratori was an indefatigable researcher into and incomparable commentator upon documentary evidence regarding the history of Italian states from the Fall of Rome to the heart of the Early Modern Age. He was born the son of a craftsman in Vignola, and – as numerous other would-be scholars from humble backgrounds had



The portrait of Muratori commemorating his death and celebrating his tireless work as prefect of Modena's ducal library. Very few authors have written, during the course of their lives, an equivalent number of pages, very few have dealt with such a number of topics challenging those of ancient philosophers, and very few have been able, whatever theme they developed, to propose such a clear, original concept. In plain terminology, free of fanciful literary ambition, through his numerous works the scholar from Modena in the 1st half of the 18th century explores the horizons that numerous essayists, economists and naturalists of the Enlightenment will deal with in the second half of the century. His intellectual status is to be found in the two collections of documentary sources in which he invites the major Italian scholars to collaborate, thus achieving a record yet to be surpassed after three centuries, also due to the uncontrollable individualism of Italian scholars and which only his own prestige has been able to coordinate.





The market place is of major importance in the economical and civil life of all ancient societies. When the special appeal of a market square causes the event to be extended further after the market days, it becomes a fair, a meeting of merchants who bring their own wares after long journeys on muddy and unsafe roads, thus making it an occasion for farmers and peasants of large landowners to substitute the oxen that have reached the end of their career, to sell off the most valuable farm products, wheat and wine, breeder cattle and pigs ready for slaughter. All types of actors, card sharpers and charlatans would intermingle with the merchants, all intent to obtain from the farmer the price he received for four sheep or the calf which took months to produce.



the two positions reflects variations in ideals and temporal perspective, but it is not the fruit of looking at different worlds. Nor does it show that what Muratori had to say on the matter was necessarily outdated. The brilliant polemicists and essayists who attacked the *ancien régime* system of food administration would ignore what Muratori had written. However, they did not have the breadth of historical knowledge which makes what he





Tuscany, a land of particular economical viability, has numerous, crowded markets. David Tenier braves the colourful and noisy frenzy of a big country fair during his stay in Florence, in the Impruneta market in an illustration from the Alte Pinakothek in Munich. Following in the footsteps of his father from Antwerp, brother of gifted artists though not of equal success, Tenier "the younger" spends his extraordinarily long life, that lasted nearly for the entire 17th century, in a prodigious amount of work, whose tesserae cover the principles and cardinal issues most famous towns and countryside of Europe. The famous painting represents the marvellous scenario of one of the most spectacular market squares that Florentine architects have ever built in a village aiming to compete with the splendours of a metropolis. Giuseppe Maria Crespi will imitate the work of the great Flemish artist, when, some years later, he portrays men and animals thronging another famous Florentine market at Poggio a Caiano.

has to say on the system of state food administration and regulation such a valuable contribution to our understanding of a long period in the history of human use and misuse of food resources.





Aristocratic Hunting Rights: A Blight upon the Countryside



A loaf in the unmistakable shape of Tuscan bread is the motto a Florentine artist paints, in 1653, for the Academic *Rifiorito* (Re-flowering), the patrician Francesco Ridolfi. The filling would appear to be made of slices of salami.

The last part of Muratori's outline of agricultural policy is his denunciation of the economic absurdity and moral iniquity of aristocratic hunting rights, which meant that farmers' fields not only fell prey to swarms of game birds and animals (protected sources of lordly pleasure which could not be driven off) but were also regularly invaded by hunting packs and horsemen that destroyed what little had survived such depredations.

Various authoritative historians – foremost amongst whom one might mention Gaetano Salvemini – have identified such hunting privileges as one of the factors that contributed to the powder keg of peasant hatred towards the nobility that would explode so devastatingly during the French Revolution. In his Chapter XXVII Muratori gives an eloquent account of the damage caused by game and the packs hunting them. Again echoing what had been said by that severe judge of social customs, Olivier de Serres, the Italian's comments reveal him to be an acute observer of human history, someone who denounces this plague of game, hounds and hunters as a senseless dissipation of resources. It is an opinion that would be shared by later historians.

«In various parts of the countryside one sees no small abuse result either from excessive rigour in the banning of hunting or excessive permissiveness in allowing it. First of all, there is the Prince who enjoys some woods or land as his allodial property and reserves them for his own use through the imposition of hunting rights. Each and every person can see that this is fair. However, if the Prince then decides to extend these prohibitions over the allodial property of his subjects; if he concedes to his vassals the exercise of such hunting rights within the dependent properties of their own fiefdoms, then to a Prince who is a true lover of his people one should make the following observations. First of all regarding the great harm that can result for agriculture, which, as we have seen, should be the object of care for all good governments. In the above-mentioned prohibitions we sometimes find that it is forbidden to pull out scrub vegetation, to uproot brushwood growing within ditches, to cut trees within woods or to mow pastures when the time is right. Similarly, one cannot release one's own livestock into pastures unless one has approval from gamekeepers, who are worried that the animals might crush the game birds' eggs or fledglings. And it is even worse when it comes to raising boars, deer, stags and roe-deer in woods without enclosures or walls or wooden fences. Such animals are allowed to wander out of the woods into the sown fields owned by other people, who are forbidden to kill them... And then there are the numerous trials held and punishments inflicted in some places as a result of the prohibition upon hunting or due to the action of peasants' dogs. These prosecutions cause great dismay amongst the agricultural classes and thus have a consequence for the cultivation of the countryside. And I say nothing of the harm done to the peasants when they are forced to work as beaters; raising game for hunters in woodland and countryside, they lose entire days of work, perhaps when there are important agricultural tasks to be done. No prince whose heart is truly inhabited by love of his people, by genuine paternal clemency, would allow such abuses or order such rigorous impositions. Can it ever be said to be his duty to allow the pleasure of a few people to cost such displeasure and harm to an entire guild of working folk? There is no doubt about it: every time a hunt is declared anywhere except upon the prince's own allodial estates, a tax is imposed upon the public. And this tax is a heavy one, because of the damage it can lead to, as well as being unjust, because the Laws of Nature guarantee each person the right to defend his own property against those who wish to damage it.»

If the prince represses the peasant's natural right to defend his sown fields against boar or deer, he is in fact violating the natural order that legitimizes his own power. Muratori's condemnation of this most odious of *ancien régime* privileges could not be more categorical. A clear-sighted observer of a present that would inevitably become history, the curate of Modena hands down a verdict on this matter that reflects a fully modern awareness of civic rights and duties.





Although he may be remembered for his meticulous attention to detail, we can place this artist amongst those who dedicated themselves to evoke rural surroundings in such a harmonious atmosphere as to exceed the limits of reality. A native of Prenzlau, Jakob Phillip Hackert, after his studies in Germany and sojourn in Paris, lived in Italy and expressed, through his paintings, the same neoclassical taste that permeated the rural poetry of the time. He came to Rome in 1768 with his two brothers, then went to Naples, and in the same year became court artist to Ferdinando IV, and was involved in the realization of the Reggia of Caserta and the hunting villa of the Carditello, the ideal amusement park for royalty, and the first Italian example of a rational royal cultivation centre. To the Real Sito (Royal Place) Hackert dedicated two paintings: *Harvesting at Carditello* and *Grape-picking at Carditello*, which show an undulating scenario that looks much more like the countryside around Caserta than the marshy lowlands surrounding the hunting villa.

*Where grew thousands of grasses and roots
Of the most varied appearance, taste and properties
And an immense population of birds and wild animals
Built lairs and nests, providing amusement and nourishment
For us, as well as pleasure, clothing and other resources -
Man by himself overturns the old customs
And undermines the natural order.
O, how human intelligence is always ready and prompt
To work to man's own harm and against his true interests!
Either through a delight in novelty, or through yearning greed
Or because ill-born and driven by the feelings of his heart.
And it is not only with axe and torch
That he cuts a way for himself up there, taking no account
Of the risks and difficulties, laying waste to vast tracts
Of woodland, and covering the immense hillsides
With ash, to the great offence and fearful anger of the great Mother
Goddess;
for the task he also uses the ploughshare, and the huge
Mass of mature oxen, with spades and hoes [...]»*

Faithful to the canons of classical poetry, the poet may first see the relations between forest cover and the management of water resources in naturalistic terms, but then he wraps the whole thing in legend and mythology, depicting Diana, goddess of the forests, complaining to her father Jove that Man is destroying her woodlands in order to extend the sown fields sacred to Ceres. Moved by his daughter's laments, the Lord of Olympus unleashes floodwaters upon the tilled earth. In one of the most effective pages of his entire poem, Spolverini describes the fury of the elements on such occasions, offering his own vivid version of Virgil's description of an awesome summer storm.



The representatives of a vast range of insect families in the page of an English zoological atlas conserved, without specifying its provenance, in a library at Milan. Although only a few years older than those illustrating Ginanni's work, the illustrations are far more accurate, allowing the identification of most genera: microlepidoptera, aphids, cochineals, leaf beetles, fruit sawflies. The accuracy of the drawings is not, however, equaled by the precision in the denomination of each species, that are identified through approximate descriptions, larva, butterfly, fly, and the indication of the plant on which it settles and makes passages or galls. During the same years that the plate was engraved, natural science scholars were able to exchange their own observations on an already large number of plants by using the binomial definitions as classified by Linnaeus: a goal which, for insects, was still very remote. This gap was due to the fact that the Swedish scientist had access to huge amounts of material collected over two centuries by physicians and botanists interested in the classification of vegetables for pharmacological reasons, whereas for the classification of insects, in 1734 Réaumur found himself exploring a yet to be discovered continent in the natural world.

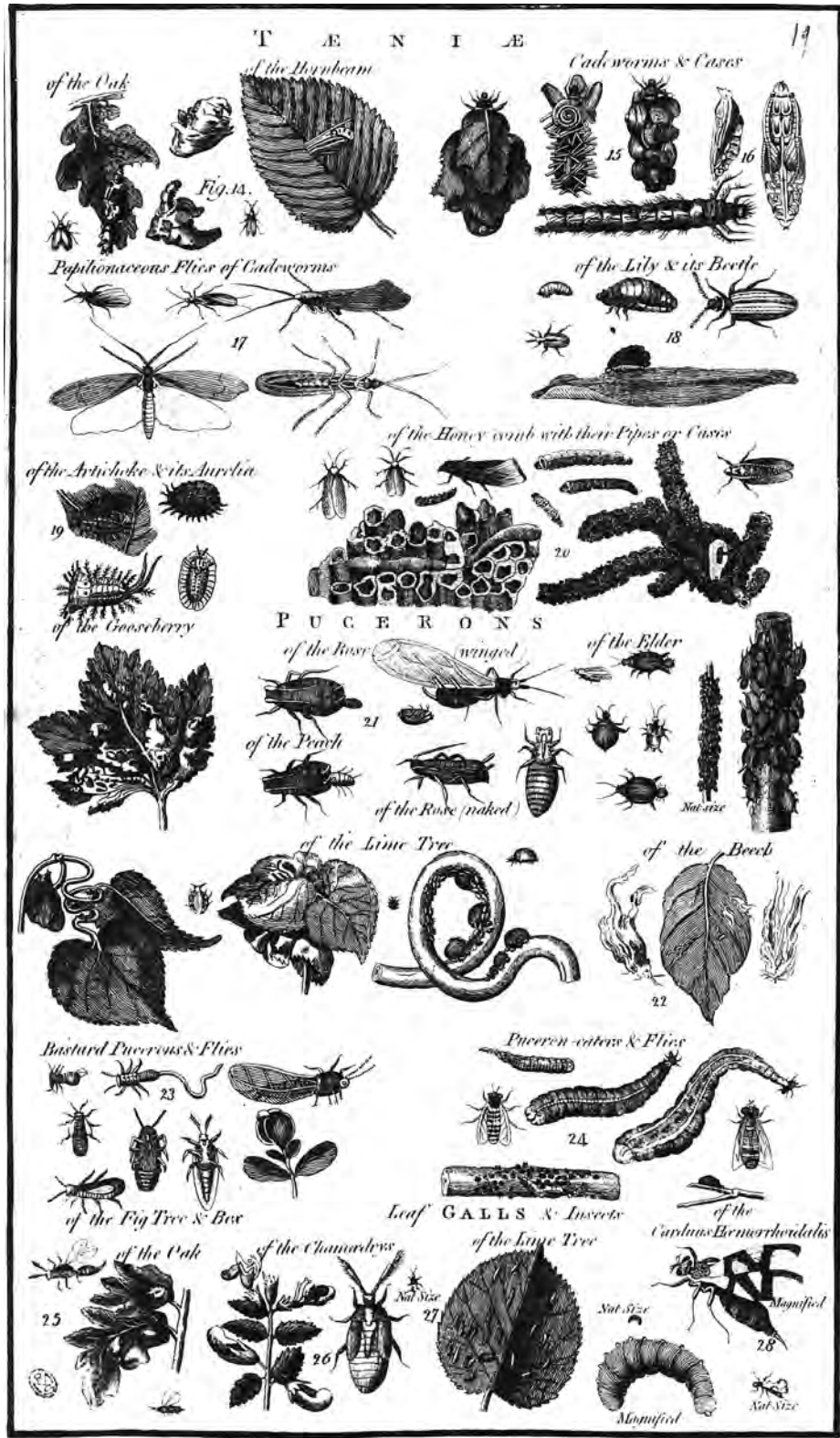




Plate 403 in Bulliard's Herbarium shows (A) *Agaricus arundinaceus* and (B) *Agaricus foraminulosus* – two of the innumerable fungi to be found in European woods and forests.

age-old contempt for its prime source of wealth and dedicated their intellectual and financial resources to improving exploitation of farm holdings.

The idea of a dictionary of agronomy was not a new one; since Tarello's *Ricordo*, it had inspired more than a few compilations of agronomical notions. As Ronconi tells us in the *Preface* to his own work, he himself was inspired to adopt this format by the reading of a French text *L'Agronome*, upon which he had had ample time to reflect "during the period when my bothersome affairs kept me far from my beloved homeland". Where exactly he had been abroad during this time, Ronconi does not say; however, the fact that a French work suggested the form of his own – plus the presence throughout his text of numerous ideas taken from Duhamel du Monceau – suggests that this unwelcome period of foreign residence had been in France itself.

The very fact that Duhamel's work is taken as a model for an Italian work published in 1771 might be taken as proof that the author was a man of great scientific insight and up-





and species of microscopic plants are much greater in number than has been believed by numerous worthy modern observers.»

As Goidanich observes, this farewell to the reader is amazing for the reductive way in which it treats the discovery that would mark the beginning of the whole discipline of plant pathology. However, the reference to a paregon that has grown into a weighty tome also reveals the author's determination to "encase" his own scientific discoveries within a vast and ponderous volume. As has already been pointed out, it was this characteristic of the *Alimurgia* which would lead to Targioni Tozzetti's remarkable discoveries falling into oblivion; which would prevent full appreciation – or even recognition – of the extraordinary horizons that the Tuscan had opened up for a sphere of knowledge that was essential for progress and development within agrarian science and technology.

Two Types of Corpuscles in the Blisters of Wheat Rust

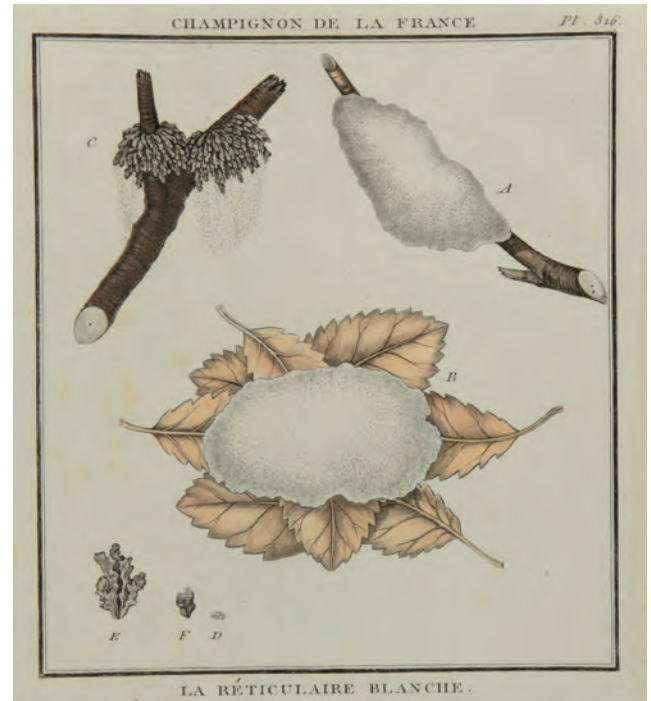
«Rational thought has convinced, and experience taught, me that the study of the mistakes made by other men is a sterile and futile occupation – not to say a total waste of time – for any philosopher in search of Truth. Hence, wishing to say something about Wheat Rust and lay before the Public what I have examined, seen and observed [...] I have decided to merely mention the main hypotheses to be found in works by the naturalists who deal with this topic, showing that each is unfounded. Thereafter, I immediately present that which numerous observations and rigorous examination have led me to believe can be decided and established with certainty.»

Mildly irreverent in its reference to the sort of philological enquiry favoured by Ginanni, this assertion of the empirical spirit reveals a cultural mind-set that is the very opposite of that which had inspired Targioni Tozzetti's *Alimurgia*. And it is with this statement of intent that Felice Fontana opens a short sextodecimo volume of just over one hundred pages which is entirely dedicated to his own observations regarding plant disease and the deductions he bases on those observations. Clearly, this professor at Pisa University had selected a much narrower field of enquiry than that explored by Targioni Tozzetti; however, this narrowing of focus is also reflected in his great attention to experimental detail and his accurate, painstaking exposition of results.

The first observation Fontana reports is that the pulverulent substance that covers the culms and leaves of wheat plants infected with rust contains two different corpuscles, which can be easily distinguished under the microscope.

«I collected a large quantity of the said powder from many wheat plants, either by shaking the leaves and stalks or by using a penknife to remove it where the plants seemed most blotchy and darkest in colour. Placed on a glass [slide] and viewed under a sharp lens, the powder appeared made up of various groups [...] In fact, this powder comprised two sorts of corpuscles. Some were like small eggs in shape, and almost all of the same form and size; the others were rather long, and in shape rather similar to little mushrooms or to ordinary nails.»

The bodies of the first, egg-shaped, type were general opaque, or just slightly transparent, even in the strongest sunlight. Most of them were oval in shape, though some were elliptical in form, and a very few had a pointed or irregular tip. They were of a more or less intense jujube colour, with dark sides [...] The other species of Rust powder looked like numerous groups of mushrooms or heaped up nails with large rounded heads. To these heads were attached thick, long cones. They almost looked like so many small acorns wedged into a calyx, which ended in a long tail.»

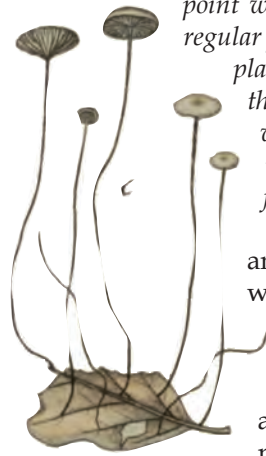


From the plates that Bulliard publishes in the seventh of the eleven years during which the printing of the *Herbier* lasted, the figure of three species of saprophyte mould that the French botanist includes in the family of the *Reticularia*, a term which he will abandon as he enhances his knowledge, when it will be possible to have also amongst microscopic fungi continuously more detailed distinctions. An authentic galaxy of forms and biological aptitudes, the saprophyte fungi that settle on decomposing organic matters offer the early biologists a field of observation where, inevitably, preliminary distinctions are necessary, whose schema will later be superseded by the most precise definition of genera and species.





Once more from Bulliard's *Herbier*, the *agaric epiphille*, another saprophyte with decaying leaves.



point where it was attached to the little egg. The perfect egg shape, and the regular form of the tail or stem made me think that this was another parasitic plant different to that of the nail-form plants I had already observed; and that the little eggs were the fruit or the pericarps of this small plant. And I was made even surer of this because such an idea seemed to me to explain why these little eggs might [also] be found without their tails or any form of attachment [to the host plant].»

This is the most ingenuous of all Fontana's uses of the plant analogy that informs his work; its insubstantiality becomes clear when we see that the naturalist even cites the absence of any apparent attachment as proving his claim, with the implication that in such cases the "little bodies" have come away from their peduncle as easily as peaches or apricots come away from a branch. Furthermore, as in the work of Targioni Tozzetti, this plant analogy leads to the deduction that rust spores are fruit filled with seed, rather than being reproductive organs themselves.

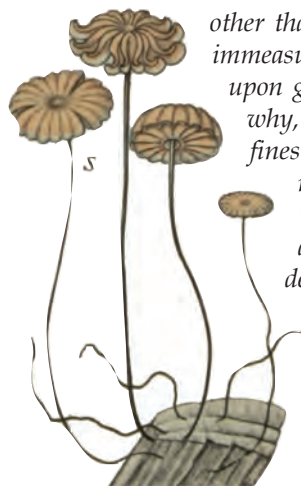
Indeed, Fontana pushes the plant parallel even further than the Tuscan does, claiming to have seen those very seeds under the microscope; as we saw, Targioni Tozzetti admitted that this was beyond the capabilities of the optical instruments at his disposal. Seduced by the power of his own certainty, the Trento-born naturalist sees what he is looking for, providing us with just one more example of how the use of microscope might add to – rather than reduce – the optical illusions that dog scientific research:

«If there are no reliable observations which enable us to decide with regard to the seeds of black rust plants, we have very probable visual evidence that the little eggs of red rust are fruit or pericarps - that is, receptacles for the true seeds of the plant. Using a very fine and pointed needle, I have been able a number of times to open some of these minute eggs, finding them full of tiny egg-shaped grains or corpuscles that are entirely transparent. One can see these tiny corpuscles even easier when one lightly squashes the little eggs of red rust between two thin glass slides.»

Optical Illusions and Biological Advances

Applying what he has discovered under the microscope to a consideration of rust-devastated crops, Fontana at the end of his short book underlines how his discovery provides an explanation for the ruin that sudden infection by a microscopic organism can cause to the crops of an entire region.

Another member of the saprophyte population that grows on a bed of leaves covering a wood, the *agaric androsace*.



«Having thus established and confirmed that Wheat Rust is nothing other than a mass of parasitic plants, which may be small but are of vast, immeasurable numbers, one can immediately understand the effects it has upon growing or sprouting wheat. First and foremost [one understands] why, if the stalks and leaves are attacked by such a terrible disease, the finest crops which seemed to promise the fullest harvest wither away to nothing or almost nothing: distributed over numerous places, these innumerable little plants are greedy for sap and nutriment and absorb all the nutritional humour within the wheat, which is thus deprived of its nourishing chyle and soon languishes and wilts.»

Having explained the destructive potential of the pathogen, the scientists must now identify the reason for the speed of the epidemics and why they occur in concomitance with specific weather conditions (a concomitance which Targioni Tozzetti took as the lynchpin of his own theory regarding the genesis and spread of the disease). Fontana writes:





XXII

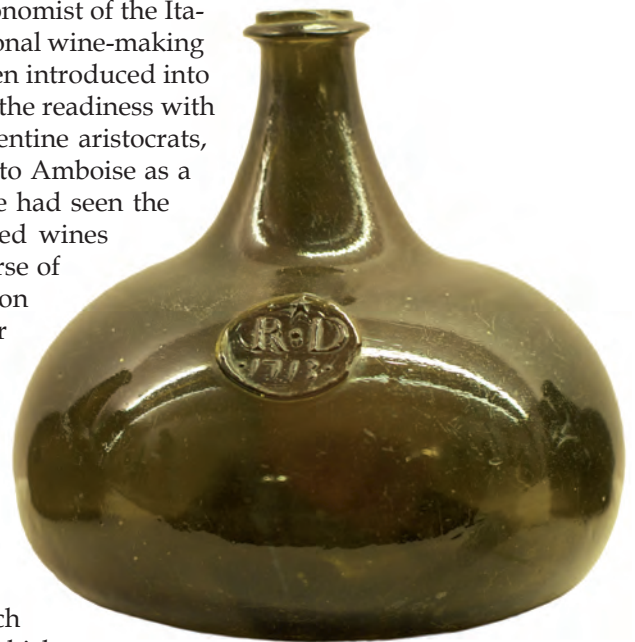
Opening the Way to a Renaissance in Italian Oenology

Poetic Descriptions, Agronomical Precepts

We have already examined what the most insightful agronomist of the Italian Renaissance had to say about the contrast between traditional wine-making practices in the Lombardy of his day and those which had been introduced into Italy by the victorious French. We have also seen evidence of the readiness with which a taste for French-type wine developed amongst Florentine aristocrats, more than one of whom would follow Catherine de' Medici to Amboise as a court dignitary. Yet though by the end of the century France had seen the new method for obtaining strong, clear and richly-bouqueted wines clearly analysed in Olivier de Serres' *Théâtre*, in Italy the course of events was rather different: initial moves towards innovation in wine-making were stifled by the re-assertion of a taste for traditional Italian wines, which were dense in colour, totally without bouquet and highly acidic.

Agrarian writing in sixteenth-century Italy illustrate the strong contrast between these two approaches to wine-making. However, later agronomical texts reveal not so much the conflict between them as the fact that innovation had been stifled by the traditional methods which Gallo and Davanzati described as giving way to a new taste in wine. One is, however, well-aware of the difficulties in drawing such a conclusion solely on the basis of documentary evidence in which a number of adjectives are open to different interpretations. Furthermore, the claim that Italian vineyards had turned away from French wine-making methods seems to be contradicted by the praise of certain Italian wines voiced by Bacci and by those who echoed his appreciation of Italian oenology. Foremost amongst those works is *Bacco in Toscana*, a rapturous dithyrambic text by Francesco Redi, whose status as a naturalist makes him a reliable authority on the organoleptic properties of what is, after all, the product of a biological process.

In his verse, this Arezzo-born physician voices unconditional praise for one category of wine and absolute contempt for another – a clear sign that the market of the day offered wines of both high and low quality. Within the class of the better wines, the poem includes primarily those from hillside vineyards, whilst the poor-quality beverages were those made from the grapes grown in the plain. To describe the former wines, the poet uses a series of dazzling adjectives; however, though these undoubtedly refer to precise organoleptic characteristics, it is not possible to identify with any certainty the chemical properties of the libations which the divine narrator is exalting. Throughout, the poem uses a range of expressive adjectives to capture qualities in a wine that are worthy of praise. As examples one might mention:



The oldest containers for liquids for which we have documentary evidence are the leather wine-bags mentioned in *The Odyssey*. It would be twenty-two centuries before the first glass wine bottle was manufactured: in 1632 in England by Sir Kenelm Digby (the procedure would not, however, be patented until 1661, by John Colnet). The shape of that early bottle was very close to that of this "onion bottle" now in the Wine Museum of Castello di Poggio alle Mura, close to Montalcino: 15.5 cm high, the bottle has a circumference of 52 cm and is marked "R.D. 1713".





The most important advances in glass technology were made in England in the second half of the seventeenth century, when coal replaced wood as kiln fuel and thus made it possible to produce more robust bottles (whether they were of blown or moulded glass, both procedures being used right up to the end of the nineteenth century). At the same time, the addition of new chemical compounds to the raw materials made the glass more brilliant, and as a result English bottles quickly became widespread throughout Europe. These are three different "onion bottles" from the Poggio alle Mura museum: the first is 20cm high with a circumference of 36cm; the second - marked "Thesher 1713" - is 13.5cm high with a circumference of 43.5cm; the last is 17.5cm high with a circumference of 45cm.

*«With its fine colour of ripe strawberries,
Barbarossa delights me (166-167)*

[...]

Or that fine, sparklingly clear

Vermilion-red [wine]

Which is the boast of the Arezzo area (253-255)

[...]

[Another wine], perhaps more sparkling,

More effervescent and more darting [on the palate].» (258-259)

But perhaps it is the adjectives that Redi uses to slight the wines he does not like which are more helpful in understanding the characteristics he does appreciate in a wine. For example,

«That over-sweet,

Plebian,

Colourless, Bodiless

Thin piss from Bracciano» (95-98)

By drawing a contrast with these four adjectives, we get a clear idea of what a good wine should be: forthright, strong, full-bodied and richly coloured. All four of these are characteristics we still look for in a wine, but what chemical qualities are they the result of? This is a question which even the most expressive poetic adjective cannot resolve. Look, for example, at some lines dedicated to Chianti:

«Good Chianti, a decrepit,

Majestic

Imperious Wine

Which flows through my heart.» (713-716)

Are we to understand that first adjective as a hyperbole referring to the patient ageing of the wine, or is it intended to praise the flavour of wine which has been aged



Abstract

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