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XXIV.—*On the Life and Writings of J. P. E. Vaucher.*

By ALPHONSE DECANDOLLE*.

GENEVA, a few months since, witnessed the decease of the eldest of her naturalists, the author of the '*Histoire Naturelle des Conferves*,' a work ranking as a classic, and cited universally and long since as a model of accurate observations.

We have lost this venerable old man, whom age had not robbed of his physical power, nor of the energy of his deep convictions. We love to recall the rare qualities which distinguished him; that nobleness of soul, which a frankness, sometimes bordering on rusticity, rendered prominent; that simplicity of manners so becoming to the man of learning and the pastor; that cordiality, devoid of vulgarity but abounding in sincerity; that constancy, that disinterestedness in the affections, which rendered M. Vaucher the best of relatives and the best of friends.

His presence amongst us operated as a moral protection and a continual encouragement to study. In our eyes he was the last representative of the school of Charles Bonnet, who cast so great a lustre over our town. He, together with De Saussure and his contemporaries, founded that Society of Natural History and Physics, whose unpretending character and amenity of discussion drew together the Genevese *savans*. At once professor of theology and botanist, he was a connecting link between two of the faculties of our Academy, and became an example of that union of religion with science which so advantageously distinguishes our clergy.

M. Vaucher had taught historical theology for a long time, but his natural tendency was rather towards the religion of the heart, and towards a profound study of the works of creation. The recital of so much strife caused by unintelligible questions, of so many wars and persecutions brought about by theological dogmas, was likely to produce this effect upon

* From the Bibl. Universelle de Genève for July 1841.

an upright and enlightened man. He loved to look upon natural history as a branch of his own theology, and to find therein a variety of proofs in support of his inmost convictions, which were doubly powerful because uncontested and devoid of sectarian rivalry and rancour. His happiness consisted in observing in detail the wonders of nature, and in attributing, with more or less probability, a fixed design to every phænomenon of vegetable life. The theory of final causes was his guide, and the constant object of his reflections; and his last work, the '*Physiological History of the Plants of Europe**,' is the development of this mode of considering botanical science.

M. Vaucher was employed during several years in preparing this work. He published a small part of it in 1830†; but perceiving it to be formed upon too extended a plan, he remodelled and rearranged it with an almost youthful ardour. After long years of intellectual labour and enjoyment, the work was at last printed in four large volumes. On his death-bed he received them, blessed Heaven for the favour of this last satisfaction, and employed his feeble and declining strength in sending some copies to his friends and to that sovereign, his former pupil, from whom he had received flattering marks of kindness‡.

* *Histoire Physiologique des Plantes d'Europe, ou Exposition des Phénomènes qu'elles présentent dans les diverses périodes de leur développement*: Paris, 1841, 4 vols. 8vo.—See '*Annals*,' vol. ix. p. 50.

† See *Bibl. Univ.* 1830 (Sciences et Arts), vol. xlv. p. 379; and 1837, vol. ii. p. 134.

‡ The Prince of Carignano, now King of Sardinia, was brought up in M. Vaucher's institution, at a time when Piedmont was a part of the French empire, and when there was little probability that the house of Savoy, especially the princes of the younger branch, could ever ascend the throne. Then commenced a connexion ever devoted and disinterested on the part of the venerable tutor, ever affectionate on that of the king. I cannot resist the pleasure of quoting the dedication of M. Vaucher's work to Charles Albert; it enables us to comprehend the views by which the author was guided; it is moreover in a style altogether new.

"SIRE,—I now present to you, as a feeble mark of my profound respect and of my lively attachment, this work, the labour of a great portion of my life, and which you allowed me in past years to hope I might be permitted to inscribe to you.

"It is wholly consecrated to the glory of the Creator, whose works have always appeared to me the more admirable the nearer they are considered, and it is designed to produce in those who read it a part of those impressions which they have so often made me experience. It is the study and the meditation of these wonders, of which I as yet only know the outlines, which have embellished my last years, and which have inspired in me a desire, continually more ardent, of one day contemplating them at their source in the bosom of Sovereign Wisdom.

"Deign, Sire, to receive with that touching goodness, of which you have

By the expression, "Physiological History of Plants," M. Vaucher meant the detailed analysis of the phænomena of vegetable life; not of any one plant, regarded as similar in general respects to all others, but of a certain species in particular, or of a certain agglomeration of nearly allied species, forming the same section or the same genus. He passes by the general and ordinary questions of physiology,—absorption by the roots, the ascension of the sap, evaporation by the leaves, the modification of the juices by the atmosphere, the formation of the organs by the nutritive juices, the mode of penetration of the pollen, &c. &c. He prefers studying each plant in detail in the intimate relations of the different organs and the functions of these organs. He describes what we may call the habits of plants, by analogy with the habits of animals. In this manner of considering the subject, M. Vaucher thought he should be original, and should lay the essential foundations of an edifice as yet unerected. In fact, the publication of a considerable work with this particular aim is quite a new thing in science; nevertheless we must not forget, and M. Vaucher himself mentions this, that other naturalists, for example, Conrad Sprengel, Duhamel and Cassini, have published some partial observations of the same kind on fecundation, on the development of the ligneous species, and on the vital phænomena of certain families. All complete monographs, all treatises on cultivation, speak of the succession of phænomena presented by certain plants. The merit of M. Vaucher consists in his desire to extend this kind of observation to an infinity of vegetables which have not yet been sufficiently studied.

The following is the method followed by the author. He enumerates the families and the genera in the order of the works of M. DeCandolle, translates into French the botanic characters expressed in Latin in the 'Prodromus,' and, for the families not yet included in that work, consults the best authors on descriptive botany. Having stated the characters founded on the presence, the situation, and form of the organs, he details his own observations in a physiological point of view. These are sometimes facts relative to the disposition of the leaves in the buds, the varying direction of the peduncles or of the branches, and the development of bulbs and of suckers;

already given me so many proofs, this last offering of a heart which has always tenderly loved you, and has entertained the highest hopes of you.

"J. P. E. VAUCHER."

A few hours after the death of the author, an affectionate letter in the king's handwriting came from Turin announcing the receipt of the book, and also a portrait of the king sent by his orders.

sometimes too, and oftener, to the mode of the dispersion of the pollen, to the different and successive movements of the parts of the flower, and to the dissemination of the seeds. Information of this kind is very precious, when accurate, inasmuch as thereby the descriptions of authors are rendered more complete, some of whom have unfortunately neglected this kind of facts, whilst others, describing from dried plants, have not suspected certain phænomena of the life of plants. Without herbaria we should hardly have any idea of the 40,000 or 50,000 species which grow out of Europe, and which have never been cultivated; they could never have been referred to their genera and families, they could not have been compared in the most essential relations, since they live in distant countries or flower at different periods; but we must also add, without descriptions made from nature the very delicate organs would be ill understood, the different secretions, the mode of action of the pollen, the development of the ovules, the diversities of colour, of consistence, of perfume, which also have their value, would neither be remarked nor well comprehended. Besides, very many persons have not the patience and skill necessary for dissecting fragments of dried plants under a magnifying glass. I know experience proves that we attain nearly everything by this means, and that the advantage of immediately comparing the flowers and fruits which in nature succeed each other at long intervals, compensates for many difficulties; but we also know that dried plants are not very attractive, and that the study of living flowers possesses, on the contrary, a peculiar charm. True botanists understand and love both these means of observation, and use both as opportunity or occasion serves; they also will compare the work of M. Vaucher, made from living nature, with works of another kind, made in a great measure from herbaria. The one will frequently form the completion (*complément*) of the others. Science will not have been placed on new bases, but will have been enriched by new facts.

One point to which M. Vaucher often directs attention is the function which he attributes to the nectar in the fecundation of the flower. He calls this liquid *humeur miellée*, *honeyed moisture*, and notwithstanding the extreme diversity of origin, which he carefully describes, he considers as one and the same agent the liquids which proceed from the torus in many plants, from the base of the petals in some others, from the tissue of the stamens in rarer cases, or from that of the stigma a little before the fall of the pollen. "The principal," says he, "and indeed the only conclusion towards which all the facts explained in this work converge is this, that the honeyed

moisture is the agent of fecundation, without the concurrence of which fecundation could not take place. This humour ordinarily resides in the gland which supports the ovary, where it is often very visible; but sometimes it escapes our observation and we find it on the stigma, which it impregnates at the period of flowering, or on the torus, as in all the *Rosaceæ*; sometimes also it resides in the glands situated either at the base of the stamens, or on some parts of their surface, or in short in the stigma from whence it proceeds; in a word, there is no floral organ where it may not be met with and give signs of its existence*."

In this theory there are two assertions: one long ago admitted, namely, that the viscous liquid of the surface of the stigma is necessary to fecundation; the other new, the demonstration of which will be asked for, viz. that the nectar secreted in other parts of the flower, particularly on the torus, is an agent of the same kind as the viscosity of the stigma. Until the present time the nectar produced by the torus and by the glands has been considered as an excretion, that is to say, as a substance produced to disembarass the plant of the matters become useless in the series of vegetative functions. Those who saw in this product a liquid subservient in some manner to fecundation, did not go so far as M. Vaucher; they supposed at most, with Conrad Sprengel †, that the transportation of the pollen on to the stigma must be made by insects, and that the nectar, as well as the stains of lively colour of many corollas, served to attract into the flower these living agents of vegetable reproduction.

The use of the nectar in fecundation may be demonstrated in various ways. It has been sometimes attempted to suppress the secreting organs, but the conclusions thence deduced appear to me uncertain, and M. Vaucher probably thought so too, for he has not made trial of this kind of experiment. In fact, one of two things must happen; either fecundation takes place notwithstanding the mutilation, or it does not take place. In the first case, it may always be feared that it has been produced by the honeyed moisture from the general surface of the torus, or of the floral organs, which no mutilation could hinder, and of which there are many examples in the ordinary course of vegetable life. If, on the contrary, fecundation has not been effected, we may suspect that this is owing to the wounds being too deep, and to the extraction of the glands necessary rather to the life of the flower than to its fecundation. In natural history, observation leads us further than experiment. M. Vaucher, wishing to prove the physio-

* Vol. iv. p. 521.

† Das entdeckte Geheimniss, &c.

logical function of the nectar, has relied on detailed studies of the progress and series of the phænomena of the inflorescence. His conclusions are rather inductions than proofs. Let us quote some of the phænomena of which he speaks. According to him, it is from them collectively that a well-established conviction results.

“Of the four petals of *Corydalis tuberosa*, the two exterior petals, placed one above the other, exactly close the flower, to which they serve as a calyx; their superior margins are free and reflexed; the two interior ones, lateral and applied exactly one against the other, inclose the anthers in a pouch or quadrangular hood (*capuchon*) and do not separate, although a narrow slit is left between them by which the air penetrates. Fecundation takes place a considerable time before the development of the flower; the anthers lie upon the stigma, which is a vertical and fringed disc, entirely covered with the yellow fecundating dust; the nectary which grows from the torus is a greenish body, filled with a honeyed liquor which proceeds from a well-defined pore, and is diffused in the cavity of the superior petal; thence it insinuates itself by the slit which separates the two interior petals and penetrates to the anthers and the stigma, which it thoroughly moistens. This humour is not designed to attract flies, since it is contained in a closed sac.” The grains of pollen fall on the stigma and burst, in order that their elongated pollinic tubes may penetrate into the interior. It seems, indeed, that the abundant humour described in this particular case must bring about the phænomenon of the rupture of the pollen, if the facts are precisely such as the author has indicated. The advanced season has not enabled me to verify them.

In another chapter he says, that “the anthers of the *Helleborus foetidus* open outwardly and in such a way that their yellowish pollen falls into the melliferous tubes*, filled at this epoch with the honeyed moisture, and gradually as they [the anthers] are matured from the circumference towards the centre, they raise themselves one above the other, and thus convey their pollen to the stigma, which can hardly be fecundated except by the emanations of the nectaries: the little nectariferous tubes are seen quite open, powdered with the granules which absorb the limpid humour.” Here, I confess that the induction appears rather indirect. If the grains of pollen fall to the bottom of the flower, on the torus, or into special cavities in certain plants, we can scarcely conclude that these same grains contribute to the fecundation. Does not an immense quantity of pollinic grains fall upon the earth around

* The bilobed and tubular petals, so remarkable in the tribe of Hellebores.

trees? In what way do they contribute to the fecundation of the ovules? Scarcely does one in a million of these grains again pass from the ground by means of the wind or of insects upon the stigma of a plant of the same species. The pollen is so abundant, that the loss of a considerable proportion of the grains does not hinder the species from being reproduced. Thus the pollen which falls into the nectariferous tubes of *Helleborus fœtidus* is probably so much pollen lost, and the function of these secreting tubes has perhaps no connexion with the rupture of the grains which fall into the liquid. Besides, M. Vaucher adds, that it is not the same in *Helleborus viridis*, and that its nectariferous tubes always appear closed. In short, the author might have been asked how the grains of pollen, bursting in the nectar of the tubes, could be transferred thence to the stigma. The expression which he uses, "the stigmas can hardly be fecundated but by the *emanations* of the nectaries,"—does it indicate an action taking place at a distance, an *aura seminalis*, setting out from the nectariferous tubes where the grains of pollen are, and conducting something invisible to the stigmas? This would seem to be so, according to the words, but the idea of an *aura seminalis* is at the present day inadmissible. We must suppose that this passage relative to the Hellebore, with others containing analogous expressions, were written by M. Vaucher a long time before the modern discoveries of the pollinic tube and its penetration into the stigma. It is the inevitable defect of so extended a work not to be on a level with science on all points. An author cannot be continually varying his plan and expressions in order to follow the progress of discoveries. M. Vaucher quite admits, in several articles, the action of the pollinic tubes, but his book was under preparation during a period of fifteen to twenty years!

Let us proceed in seeking for proofs or presumptions in favour of the supposed action of the nectar.

"In the genus *Agrimonia* the stamens, to the number of fifteen, surround a small convex torus, which is velvety and nectariferous; the anthers have a very wide connective, and bear upon the margins two turgid cells, which open principally towards the summit; they are at first inclined on the bottom of the flower, but at the time of flowering they raise themselves up and spread; afterwards, when they have lost their pollen, their filaments fold themselves and form by their union a kind of grating, and we see the connective impregnate the pollen with the honeyed humour with which it is itself covered, and afterwards the honeyed humour spread itself over all the floral organs." I have in vain endeavoured to verify

this last part of the description. All that concerns the movements of the stamens of the *Agrimonia* appears very accurate, and, in the flowers which I have observed, pollen always fell on the stigmas in consequence of these movements, but I have not perceived any appearance of nectar. Perhaps M. Vaucher had discovered a moment when this liquid is produced; but in any case I doubt whether it can act upon the pollen and upon its transference.

M. Vaucher considered the genus *Lopezia* as one of those in which the action of the nectar in fecundation manifests itself with most elegance. He thus describes the phænomenon: "There is at the bending part of their two petals, at the place where the superior limb begins, a small spherical drop of honeyed moisture, and opposite to it the stamen, as well as the style, enveloped by a whitish and petiolated hood, which botanists consider as an abortive stamen. At the moment when the bilocular and extrorse anther opens its cells in order to scatter its bluish and bright pollen, the hood throws itself down on the inferior lip by a very marked flexure, and the pollen abundantly covers the two melliferous drops which absorb it; afterwards the withered anther is detached from the filament, and the style, till then shapeless and as it were abortive, lengthens insensibly and is terminated by a pretty globose, feathery and papillose stigma, which receives the contents (*émanations*) of the pollen transmitted by the honeyed moisture; for it is impossible to suppose that the anther could scatter its pollen immediately on a stigma not at the time in existence, and whose style was situated at the side opposite to the opening of the anthers; fecundation is therefore, in this case, evidently effected by means of the honeyed moisture, for there is not in the cluster any neighbouring flower whose anther could fecundate our stigma. Two little nectariferous drops may also be remarked at the base of the corolla, similar to those of the petals, and which equally conduce to the fecundation." In admitting that the series of phænomena takes place in *Lopezia* just as the author describes, we cannot help asking how the pollen, after falling into the honeyed moisture of the petals, sends *émanations* at a later period to the stigma. What are these *émanations*? What transportation can take place of the drop containing the pollen to the stigma? Here, it must be confessed, is a gap in the observation or in the description. Perhaps the sense of the passage will be explained by an attentive examination of nature, for our author was most honest, and did not write in order to propose enigmas for botanists.

[To be continued.]



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