

Caveat lector; or, the Linnean origin of the myth of Tournefort as a precursor of von Humboldt

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SUMMARY

Joseph Pitton de Tournefort (1656-1708) is frequently mentioned in biogeography and ecology among those who, before von Humboldt, paralleled the elevational organization of vegetation to its latitudinal zonation on the basis of observations made on Mount Ararat and presented in his *Relation d'un voyage du Levant* (1717). However, as already noticed in overlooked notes by Hooker (1881) and Hemsley (1896), there is no hint to this correspondence in Tournefort's description of his ascent of Mount Ararat. Linnaeus (1744) was the first author who, without any plausible reason, attributed the idea of this parallelism to Tournefort. Based on Linnaeus' work, Mirbel (1815), von Humboldt (1816), Schouw (1823) and Forbes (1846) repeated this wrong credit. Works by these early authors have in turn generated an intricate pathway of repetition of original Linnaeus' error until nowadays. Along with Tournefort, Linnaeus cited Cesalpino (1583), as one who found floral similarities between northern lowlands (Sweden) and southern mountains (Tuscany). However, there is no passage in Cesalpino that might suggest that he made any comparison between the Italian and Swedish floras, although it is possible that Linnaeus used Cesalpino's observations on the Italian flora to make a parallelism with the Swedish one. Cesalpino's recognition of the existence of allied species placed at different elevations may suggest that he has anticipated, by centuries, the concept of vicariance.

INTRODUCTION

Joseph Pitton de Tournefort (1656-1708) was one of the most famous botanists of the 17th century and his most important work, *Eléments de botanique, ou Méthode pour connoître les Plantes* (1694; Latin translation: *Institutiones rei herbariae* 1700), has long been a reference in systematic botany (Becker et al. 1957; Mayr 1982; Greene 1983; Egerton 2018). Today, the figure of Tournefort is rarely remembered, but, curiously, he is mentioned in biogeography and ecology among those who paralleled the elevational organization of vegetation to its latitudinal zonation (Fattorini et al. 2019). This parallelism is attributed to Tournefort on the basis of his observations made on Mount Ararat during his journey in the Levant. However, in Tournefort's description of his ascent of Mount Ararat, there is no hint to this correspondence (and, in general, there are no notes about elevational patterns of vegetation). In this paper I tried to reconstruct the origin of what appears to be a real myth in the history of science.

TOURNEFORT'S MYTH IN BIOGEOGRAPHY

The idea of a parallelism in the elevational and latitudinal variations of vegetation is credited to Tournefort by many ecologists and biogeographers, as shown by the following examples:

The fact of the altimetric zonation of altimetric phenomena, while having its first observations in Italy since the 18th century, thanks to Calzolari and Bembo, soon came to the attention of the major geographers and naturalists of every country, such as Tournefort, Linnaeus, Wildenow, Humboldt, A. De Candolle, Darwin, Wallace, Schlagintweit, Grisebach-Tchiatcheff, Parlatore, A. Engler, A. W. Schimper, assuming from generation to generation the special

character of the research direction and the intellectual climate of the time.¹

Negri (1934: 1) [Translation my own]

About two thousand years later (1717) Tournefort correlated vegetation with climate and distinguished the difference between the vegetation of the lower slopes and the upper slopes of the mountain Ararat [...]. Tournefort (1717) compared Ararat with other mountains.

Shantz (1940: 313-14)

Linné, *Falda smärre skrifter*, p. 93. The idea derived from Tournefort's *Relation d'un voyage du Levant*, where Tournefort "found at the foot of Mount Ararat those plants which were common in Armenia; a little further those which he had seen before in Italy; when he ascended somewhat higher such vegetables as were common about Paris; the plants of Sweden possessed a more elevated region; but the highest tracts of the mountain, next to the summit, were occupied by the natives of the Swiss and the Lapland Alps".²

Larson (1986: 457)

It was on the ascent of Mount Ararat that Tournefort made a great discovery, which later would inspire two great biogeographic theories (that of Linnaeus and that of Humboldt); he discovered that there was an elevational zonation of the

¹ Il fatto della zonazione altimetrica dei fenomeni altimetrici, se ha avuto le sue prime constatazioni in Italia e sino dal XVIII secolo, per opera del Calzolari e del Bembo, si è poi imposto ben presto all'attenzione dei maggiori geografi e naturalisti di ogni paese, Tournefort, Linneo, Wildenow, Humboldt, A. De Candolle, Darwin, Wallace, Schlagintweit, Grisebach-Tchiatcheff, Parlatore, A. Engler, A. W. Schimper, assumendo di generazione in generazione, il carattere speciale dell'indirizzo di ricerca e del clima intellettuale dell'epoca.

² This citation is a footnote to the following passage at the same page: "To explain these limited and heterogeneous observations, Linnaeus linked the dispersion of plants down mountains with their dissemination by water, wind, and other means, and related these ideas to his basic systematic position, the origin of each kind in a single progenitorial unit. The result, given a final statement in *De telluris habitabilis incremento*, was a simple analogy drawn between external form and physical situation: like plants would be found in like stations and habitations".

flora, and, curiously, he found: “In the lower part of Mount Ararat those plants that are common in Armenia; a little further, those that I saw before in Italy; when I ascended a little higher, vegetables that were common in the environs of Paris; the plants of Sweden occupied a higher region; the highest parts of the mountain, close to the summit, were occupied by those native to Switzerland, and the Lapland Alps [...]”³

Papavero et al. (1995: 123-124) [Translation my own]

Since before ecology was a recognized discipline, biologists have been intrigued by the simple question of why species occur where they do. Why are some species confined to small areas while others span the globe? As far back as the early 1700s, Tournefort recognized that plants tend to form distinct zones, thus spawning another suite of questions concerned with species’ associations and community integrity.

Parmesan et al. (2005:108)

Studies concerning primary biogeographical patterns have followed five scientific traditions based on patterns that were described and analysed: (1) spatial variation trends in species richness and spatial exchange of species integrated in taxocenoses (latitudinal diversity gradients [...]); (2) spatial trends of structural trait variation in groups of organisms consisting of their analogous response to specific environmental conditions (spatial gradients of functional species group), which form life zones (Humboldt & Bonpland, 1805; Linnaeus,

³ Fu en la subida del Monte Ararat que Tournefort realizó un gran descubrimiento, que más tarde inspiraría dos grandes teorías biogeográficas (la de Linnaeus y la de Humboldt); descubrió que había una zonación altitudinal de la flora, y que, curiosamente, hallara. “en la parte baja del Monte Ararat aquellas plantas que son comunes en la Armenia; un poco más allá, aquellas que antes viera en Italia; cuando ascendió un poco más alto, vegetales que eran comunes en los alrededores de París; las plantas de Suecia poseían una región más elevada; las partes más altas de la montaña, próximas a la cumbre, eran ocupadas por las nativas de Suiza, y de los Alpes de Laponia [...]”

1781; Merriam, 1894; Schouw, 1823; Tournefort, 1717); (3) spatial variations of structural traits in organisms belonging to the same lineage with wide latitudinal range (spatial variation of the phenotype [...]); (4) patterns of geographical expansion-differentiation of individual lineages (allopatric speciation [...]) and (5) congruent spatial distribution between taxa or biogeographical homology [...], whether in continuous or disjunct space, which result in regionalization systems or congruent disjunctions [...].

For example, Tournefort (1717) had already noticed the analogy between the altitudinal and latitudinal succession of life-forms.⁴

Juarez-Barrera et al. (2018: 996)

at Mount Ararat he [Tournefort] observed patterns of plant distribution at different elevations into zones that matched comparable geographic regions (volume 3, letter 19, as quoted in English translation, Linnaeus 1781:91):

...at the foot of Mount Ararat those plants which were common in Armenia, a little further those which I had before seen in Italy; when I had ascended somewhat higher such vegetables as were common about Paris; the plants of Sweden possessed a more elevated region; but the highest tracts of the mountain, next the very summit, was occupied by the natives of the Swiss and Lapland Alps.

⁴ The references cited by these authors are:

von Humboldt, A., Bonpland, A. (1805). *Essai sur la Géographie des Plantes; Accompagné d'un Tableau Physique des Régions Équinoxiales*. Levrault, Paris.

Linnaeus, C. (1781). On the increase of the habitable Earth. In: *Select dissertation from the Amoenitates Academicæ* (translation by F. J. Brand Trans.). G. Robinson and J. Robson, London.

Merriam, C. H. (1894) Laws of temperature control of the geographic distribution of terrestrial animals and plants. *National Geographic*, 6, 229-238.

Schouw, F. (1823) *Grundzüge einer allgemeinen Pflanzengeographie*. Reimer, Berlin.

Tournefort, J. P. (1717). *Relation d'un voyage du Levant: Contenant l'Histoire Ancienne & Moderne de Plusieurs Isles de l'Archipel, de Constantinople, des Côtes de la Mer Noire, de l'Arménie, de la Georgie, des Frontieres de Perse & de l'Asie Mineure [...]*. Imprimerie Royale, Paris.

Linnaeus indicated that this line of reasoning began with Andrea Cesalpino (1519–1603), but gave no reference; he had in mind Cesalpino's *De Plantis* (1583).

Egerton (2018: 196)

The *Relation d'un voyage du Levant* is a three-volume narrative of the voyage made in the Levant by Tournefort in 1700-1702. The narrative, published posthumously, is presented as a series of Letters to the Secretary of State Count of Ponchartrain, who proposed to the King of organizing a scientific exploration of foreign countries. In the narrative, Tournefort reports a myriad of observations on the most disparate cultural and scientific issues. However, there is no reference to the elevational variation in vegetation forms, neither the idea of a parallelism in elevational and latitudinal patterns of vegetation. This was already noted by Hooker (1881) and Hemsley (1896), in two evidently overlooked papers:

I have been unable to find any such idea expressed in Tournefort's works.

Hooker (1881: 444)

I also have been unable to find any such idea expressed in Tournefort's works. Indeed, his account of his ascent of Mount Ararat, as given in the English edition of his travels, and verified for me by Mr. Daydon Jackson as being essentially the same in French edition, is about as weak and silly a piece of writing as one could well find, and quite unworthy of a man of his reputation. True, he mentions a few plants; but not a word on their distribution [...]. No Alpine plant is included in his meagre list.

Hemsley (1896: 53)

As Hemsley (1896) did not examine personally the original French edition of

Tournefort's work, it could be not completely excluded that an important part of original edition was absent in the English translation, and that this hypothetical passage escaped Jackson's check. Thus, to dispel any doubt, I checked various versions of Tournefort's work. The original French version was published in 1717 in two editions: one (Tournefort 1717a), printed in Paris, in two volumes; the other (Tournefort 1717b), printed in Lyon, in three volumes. In the Paris edition, the Letters are divided into the two volumes as follows: volume 1 contains Letters I-XII, volume 2 Letters XIII-XXII. In the Lyon edition, the Letters are divided into the three volumes as follows: volume 1 contains Letters I-VII, volume 2 Letters VIII-XV, and volume 3 Letters XVI-XXII. In both versions, the ascent of Mount Ararat is described in Letter XIX. The two versions differ only in typesetting and graphical issues.

In addition to these editions, I checked another French version, published in 1718 in Amsterdam, in which the Letters are divided as follows: volume 1 contains Letters I-XI, volume 2 Letters XII-XIII. This version differs from the Paris and Lyon versions in typesetting, orthographic variants, and other minor issues.

In an English version of 1718 (which I suppose to be the first English translation), the book is divided into two volumes as in the Paris version, but the Letters follow a different numbering. The first volume contains Letters I-XII. The second volume contains the remaining ten Letters, which, however, are renumbered from I to X. Letter XIX of the French editions corresponds to the Letter VII of the second volume of this English edition.

In a later English version, published in 1741, the book is divided into three volumes, but with a different and incoherent numbering of the Letters. The first volume contains Letters I-VII, thus corresponding to the volume 1 of the Lyon edition. The second volume contains the successive eight Letters, which, however, are renumbered from I to VIII. The third volume

contains the remaining Letters, which, however, are numbered from IV to X. Letter XIX of the French editions corresponds to Letter VII of the third volume of this English edition.

In all these editions, I read carefully the Letter reporting the ascent of Mount Ararat, and checked any part of the work that might be potentially related to this issue. Also, using scanned versions of all the aforementioned editions, I searched for the words “Ararat”, “Italie”, “Italy”, “Paris”, “Suède”, “Sweden”, “Suisse”, “Swiss”, “Switzerland”, “Lapland”, “Laponie”, “Lapon”, “Lappish”. I can affirm that, in all these versions, there is no description of the elevational variation in the vegetation of Mount Ararat. Thus, Hooker’s and Hemsley’s conclusions can be completely confirmed.

IN SEARCH OF THE ORIGIN OF THE MYTH

As highlighted by Hemsley (1896), Linnaeus was the first author that attributed to Tournefort the idea of a parallelism in the elevational and latitudinal distribution of vegetation. Already in 1737 (*Flora Lapponica*), Linnaeus mentioned that certain plants that occur in Lapland can be also found on Mount Ararat, but without citing Tournefort:

To such an extent that, based only on the plants sent from Greenland, I could venture to establish that there are high mountains even there, although I have never heard of them before; in fact, almost the same plants that grow on the mountains of Lapland grow there. Thus on Mount Ararat there are the same plants § 287. 308 et cetera that grow on our mountains, although none of them can be observed in the surrounding regions.⁵

⁵ Adeo, ut ex solis plantis missis ex Groenlandia determinare audeam Alpes ibidem dari, licet nunquam de eis audivissem antea, crescunt enim ibi fere eadem, quae in Alpibus lapponicis. Sic in monte Ararat crescunt eadem, quae in nostris montibus plantae § 287. 308 &c licet in ambientibus eum regionibus, nulla illarum conspiciatur.

(Linnaeus, 1737: Prolegomena, n. 14)
[Translation my own]

But later, in 1744 (*Oratio de Telluris Habitabilis Incremento* [reprinted in *Amoenitates Academicæ*, vol. 2, 1751), while establishing more explicitly a correspondence between the different types of vegetation occurring at different elevations on Mount Ararat and those observed at different latitudes, Linnaeus attributes to Tournefort a series of observations that, in fact, are completely absent in his work.

Particularly worthy of being remembered is what Tournefort reports on his Journey into the East: of having found, at the foot of the Mount Ararat, those plants that were common in Armenia: climbing a little, he found those he had seen before in Italy: climbing again, those that were offered to his eyes in the environs of Paris: at an even higher place were Swedish plants. But the plants that occupied the highest place close to the summit and covered in snow, were those that are typical of the Swiss and Lappish Alps.⁶

Linnaeus (1744: 34-5) [Translation my own]

It is important to note that there is a very liberal English translation (1781) of Linnaeus’ work that reformulates the text in such a way to convey the impression that Linnaeus cited Tournefort verbatim, thus actually originating an apocryphal text:

Tournefort, in his Journey to the East, makes one observation which deserves to

⁶ Memoratu dignissimum est, quod refert in Itinerario suo Orientali Tournefortius: reperisse se nimirum apud radices Ararati montis plantas illas, quae in Armenia erant vulgares: aliquantum progressus illas invenit, quas in Italia ante viderat: altius scandenti offerebantur Vegetabilia circa Lutetiam Parisiorum crescentia: Plantae Suecicae erant superiori loco positae. Sed summum montis locum proxime ad culmen, nive obtectum, plantae illae occuparant, quae sunt alpinus Helveticis et Lapponicis domesticae.

be remembered on the present occasion: “I found, says he, at the foot of Mount Ararat those plants which were common in Armenia, - a little further those which I had before seen in Italy; when I had ascended somewhat higher such vegetables as were common about Paris; the plants of Sweden possessed a more elevated region; but the highest tracts of the mountain, next the very summit, was occupied by the natives of the Swiss and Lapland Alps.”

English translation of Linnaeus’ *Amoenitates Academicae* by F. J. Brand (1781: 91)

Although Linnaeus does not indicate to which Letter in the *Voyage* he refers, it is obvious that he had in mind the letter describing the ascent of Ararat. It is interesting to note that in a French translation of this Linnaeus’ work, the editor Camille Limoges has introduced the following footnote:

The passage referred to here by Linnaeus is in volume 3, where Letter XIX concerns the expedition to Mount Ararat.⁷

Linné (1972: p. 37) [Translation my own]

Apparently, the editor made this assumption without checking Tournefort’s work.

Hemsley (1896) identified three authors that repeated this Linnaeus’ wrong credit to Tournefort: von Humboldt (1816), Schouw (1823) and Forbes (1846). I found that, before von Humboldt, Brisseau-Mirbel (1815) already praised Tournefort for having recognized the parallelism, almost certainly based on Linnaeus’ *Oratio de Telluris Habitabilis Incremento*:

⁷ Le passage auquel fait ici allusion Linné se trouve au volume 3, où la lettre XIX concerne l’expédition du mont Ararat (Linné 1972: p. 37)

The progress of vegetation on mountains has not escaped the penetration of Tournefort. At the foot of the Mount Ararat, he has seen the plants of Armenia; a little higher, those of Italy and France; still higher, those of Sweden; and on the summits, those of Lapland.⁸

Brisseau-Mirbel (1815: 440) [Translation my own]

In attributing the idea of a parallelism between elevational and latitudinal patterns in vegetation types to Tournefort and its development to Linnaeus, von Humboldt (1816) was also obviously based on Linnaeus’ *Oratio de Telluris Habitabilis Incremento*. However, in the light of the aforementioned pass of Brisseau-Mirbel, von Humboldt’s words “Il ne fallut pas une grande sagacité pour observer que” sound like a direct polemical reference to Brisseau-Mirbel’s “n’avait pas échappé aux regards pénétrants de Tournefort”. Thus, it is very probable that von Humboldt knew this passage of Brisseau-Mirbel, which might be not strange, given the popularity of the book.

There was not necessary to have a great sagacity to observe that, on the slope of the high mountains of Armenia, plants of different latitudes follow each other like climates superimposed on each other. This idea of Tournefort, developed by Linné in two interesting dissertations (*Stationes et coloniae plantarum*), contains however the germ of botanical geography.⁹

von Humboldt (1816: 226) [Translation my own]

⁸ La marche de la végétation sur les montagnes n’avait pas échappé aux regards pénétrants de Tournefort. Au pied du mont Ararat, il avait vu les plantes de l’Arménie; un peu plus haut, celles de l’Italie et de la France; encore plus haut, celles de la Suède; et sur les sommets, celles de la Laponie.

⁹ Il ne fallut pas une grande sagacité pour observer que, sur la pente des hautes montagnes de l’Arménie, des végétaux de différente latitude se suivent comme les climats superposés les uns aux autres. Cette idée de Tournefort, développée par Linné dans deux dissertations intéressantes (*Stationes et coloniae plantarum*), renferme cependant le germe de la géographie botanique.

Schouw (1823: 21-22) presents a sort of elaboration of von Humboldt's text (as suggested by the references to Linnaeus' works *Stationes plantarum* and *Coloniae plantarum*) and Linnaeus' original passage:

Tournefort (voyage au Levant) saw on Mount Ararat that vegetation changes according to the height above the surface of the sea, with at the foot the plants of Asia Minor, at the middle elevation those of France, and at the top the Lappish flora. Linnaeus elaborated on this idea in his treatise *de telluris habitabilis incremento*, gave a terminology of locations in his *Philosophia botanica* and in a treatise, *Stationes plantarum*; and in another treatise, *coloniae plantarum*, dealt with the migration of plants. His *Flora lapponica* contains not only a list of the Lappish plants, but also draws attention to the differences in vegetation produced by the different locations and the different heights above the sea.¹⁰

Schouw (1823: 21-22) [Translation my own]

Forbes (1846) cites Tournefort as the first to have anticipated von Humboldt's ideas of a parallelism between elevational and latitudinal patterns in vegetation types:

Tournefort first remarked, and Humboldt, the great organizer of the science of natural-history geography, demonstrated, that zones of elevation on mountains correspond to parallels of latitude, the

higher with the more northern or southern, as the case might be.

Forbes (1846: 351).

It is most probable that Forbes (who was a talented zoologist and paleontologist, but not an eminent botanist; Fattorini 2017) was based on von Humboldt (1816), whereas Schouw (who was an eminent botanist with a profound knowledge of von Humboldt publications; Egerton 2018) probably read both original Linnaeus' work and von Humboldt's work.

As von Humboldt was one of the most influential naturalists of the 19th century, it is probable that this false attribution to Tournefort persisted in successive authors more through von Humboldt's citation, than by a direct knowledge of Linnaeus' work. Also, the work of Brisseau-Mirbel may have contributed to the reiteration of this error, as it was a very popular reference for botanists. Interestingly, the passage about Tournefort is reported in an English summary of Brisseau-Mirbel's book, which indicates that the recognition of a parallelism between latitudinal and elevational patterns of vegetation was considered very important by the scientific community:

The courses of vegetation on mountains had not escaped the penetration of Tournefort. At the foot of Mount Ararat he had observed the plants which grow in Armenia; a little higher, those of Italy and France: above, those of Sweden; and upon the summits, those of Lapland.

(Anonymous, 1817: 50)

Finally, among the authors of the 20th century that repeated this false attribution, there is the famous science popularizer Louis Figuier:

These changes in the distribution of plants which Linnaeus had observed while walking from south to north, during his

¹⁰ Tournefort (voyage au Levant) sah auf dem Berge Ararat, daß die Vegetation sich nach der Höhe über der Meeresfläche ändere, daß am Fuße die Pflanzen Kleinasiens, auf der mittlern Höhe die von Frankreich, auf der Spitze die lappländische Flora sich zeigte. Linné führte diese Idee in seiner Abhandlung *de telluris habitabilis incremento*, weiter aus, gab in seiner *Philosophia botanica* und einer Abhandlung, *Stationes plantarum*, eine Terminologie der Standörter; und behandelte in einer andern Abhandlung, *coloniae plantarum*, die Migration der Pflanzen. Seine *Flora lapponica* enthält nicht bloß eine Aufzählung der lappländischen Pflanzen, sondern macht auch aufmerksam auf die Verschiedenheiten der Vegetation, welche die verschiedenen Standörter und die verschiedene Höhe über dem Meere hervorbringen.

trip to Lapland, Tournefort had already noticed when he rose, during his trip to Armenia, on the slopes of Mount Ararat. At the foot of this famous mountain, he saw the plants of Armenia; higher up, he found those of Italy, higher still those of Paris; above these were the plants of Sweden; finally, in the vicinity of the eternal snows, those of Lapland.¹¹

Figuier (1865: 455-6) [Translation my own]

In general, it is impossible to establish with certainty which of these sources were used by the successive authors to credit to Tournefort the idea of the parallelism between the elevational and the latitudinal patterns of vegetation, but some hypotheses appear reasonable.

Figuier has been possibly influenced by Brisseau-Mirbel, given the similarity of the two texts. However, Brisseau-Mirbel cites the vegetation of Italy and France jointly, whereas Figuiet says that the “Paris vegetation” has a more high-altitude character than the “Italian” one, as in Linnaeus’ passage. Also, while Brisseau-Mirbel refers generically to France, Figuiet cites specifically Paris, again as in Linnaeus’ text. von Humboldt’s text does not mention the details reported by Figuiet, so it cannot be the source of Figuiet’s information, but cites Linnaeus. Thus, it seems that Figuiet must have been consulted Linnaeus’ work, possibly after reading Brisseau-Mirbel and/or von Humboldt.

Papavero et al. (1995) have consulted Linnaeus, as their citation of Tournefort’s assumed passage is clearly taken from Linnaeus’ work, which they cite in another volume of the same book (Papavero et al.

2001)¹². Egerton (2018) directly cites the English translation of Linnaeus’ work reported above¹³. As this translation altered completely Linnaeus’ text, he was evidently persuaded that Linnaeus reported verbatim a Tournefort’s passage.

While it is clear that the erroneous citation by Linnaeus is the origin of the myth of Tournefort as a precursor of von Humboldt in establishing a parallelism in the elevational and latitudinal patterns of vegetation, the causes of Linnaeus’ mistake remain obscure. As Linnaeus was born one year before Tournefort’s death, it is impossible that he might have obtained some information directly from Tournefort. It is possible that Linnaeus based this description of Mount Ararat on some vague impressions obtained from Tournefort’s work. But even in this case Linnaeus must have largely invented Tournefort’s observations, because there is no mention, in Tournefort’s *Voyage*, of the vegetation of Swedish Alps. Also, the few references to species reported from Paris or Italy present in the *Voyage* are completely disconnected from the description of the Mount Ararat. The few notes on the vegetation/plants of Mount Ararat reported by Tournefort cannot in any way justify Linnaeus elaboration. It is possible that the elevational patterns described for Mount Ararat by Linnaeus must be referred to some other mountain described by another author, and that, betrayed by memory, he has attributed them to the Ararat and hence credited Tournefort as the source. This possibility eventually opens the question of which mountain was confounded with Mount Ararat and which was the source used by Linnaeus.

¹¹ Ces modifications dans la distribution des plantes que Linné avait observées en marchant du sud au nord, pendant son voyage en Laponie, Tournefort les avait déjà remarquées lorsqu’il s’élevait, pendant son voyage en Arménie, sur les flancs du mont Ararat. Au pied de cette montagne célèbre, il voyait les plantes d’Arménie; il trouvait plus haut celles d’Italie, plus haut encore celles de Paris; au-dessus se montraient les plantes de la Suède; enfin, dans le voisinage des neiges éternelles, celles de Laponie.

¹² Nelson Papavero (personal communication) kindly confirmed me that their source was Linnaeus.

¹³ I asked to Frank Egerton which was his source of information. Although he has been unable to trace it with certainty, it is virtually certain that he used Linnaeus.

ANOTHER POINT OF CONFUSION: LINNAEUS' CITATION OF CESALPINO

In the same work, Linnaeus cites Cesalpino, in a way that has been interpreted as an indication that the parallelism was already noted by this latter (see Egerton 2018: 196 - cited above), although this is not really implied in the Linnaeus' text.

From the work of Cesalpino it is apparent that he identified as Alpine all those plants that in Sweden are common and distributed in lowlands, whereas he saw them only on the Tuscan mountains, which however are not part of the Alps.¹⁴

(Linnaeus, 1744: 35) [Translation my own]

In this case, it seems that Linnaeus cited Cesalpino only as a source of information, not as a proponent of the parallelism. In fact, I could not find any passage in Cesalpino's *De plantis* (1583) that might be used to directly support the idea that Cesalpino made any comparison between the Italian and Swedish floras, as I could find no reference to Sweden in *De plantis*. However, it is reasonable that Linnaeus found, among the plants that Cesalpino cites as living on the Tuscan mountains, some that are widespread in Sweden, and hence established the connection. Thus, the connection is entirely due to Linnaeus, although he had used information on the Italian flora from Cesalpino.

It is, however, interesting to note that, in the description of species, Cesalpino uses a comparative approach, in which a series of species are described by contrasting them with the first of the list. In doing this, in some cases he uses expressions such as *Altera in montibus* (i.e. "Another on mountains"), thus indicating the presence at high elevations of a species

14 Ex operibus Caesalpini apparet, illum venditare plantas omnes, quae in Suecia vulgares sunt et campestris, pro alpinis, cum videret eas crescentes solum in montibus Toscanis, qui tamen Alpes non sunt.

different from, albeit allied to, that found in other (lower) places:

Another Valeriana, which is called sylvestris, lives in mountains, in irrigated places. (p. 148)¹⁵ [Translation my own]

Another larger [Oxalis] in mountains, in irrigated places, with leaves that resemble those of Spinacia, with similar flavor. (p. 166)¹⁶ [Translation my own]

Another [Seseli Creticum], similar to the aforementioned, is found in mountains. (p. 295)¹⁷ [Translation my own]

Another [Mercurialis] grows in mountains. (p. 318)¹⁸ [Translation my own]

Another [Amarago] grows in mountains also with similar leaves from the roots. (p. 510)¹⁹ [Translation my own]

Another Cepaea in mountains. (p. 578)²⁰ [Translation my own]

With the exception of Marago, for which also the "reference" species is given as living on mountains, these species introduced by the word "Altera" are reported as montane in opposition to the first cited, which is indicated as living in other (non-montane) habitats.

15 Altera Valeriana, quae sylvestris cognominatur, oritur in montibus, locis riguis.

Here, and for the other taxa mentioned by Cesalpino, I have maintained his nomenclature, with no implication of identity with current nomenclature. For this reason, they are not in Italics.

16 Alteram [Oxalis] in montibus maior, foliis ad Spinaciam accedentibus, sapore simili.

17 Altera [Seseli Creticum] est in montibus similis praedicta.

18 Altera [Mercurialis] in montibus nascitur.

19 Altera [Amarago] in montibus quoque foliis ab radice similibus.

20 Altera [Cepaea] in montibus.

It is evident that these observations are completely disconnected from the idea of a parallelism between the elevational and latitudinal gradient. However, Cesalpino's recognition of the existence of allied species placed at different elevations suggests that he has anticipated, by centuries, the concept of vicariant species.

CONCLUSION

At the present we can only conclude that (1) the parallelism between elevational and latitudinal patterns of vegetation was first noticed by Linnaeus, not by Tournefort or Cesalpino; and (2) the attribution of this idea to Tournefort is a Linnaeus' unexplainable invention. Cesalpino can be credited as possibly the first author that recognized the presence of vicariant species between lowland and high elevation areas.

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REFERENCES

Anonymous (1817) General Views of Vegetable Nature. From the French of C. F. Brisseau Mirbel, Member of the Institute of France. Paris, 1815. The Journal of Science and the Arts, 3(2), 35-60. Available at: https://books.google.it/books?id=KBE_AAAAYAAJ&hl=it

Becker, G., Bianchi, H., Carrière, C., Coste, J-P., Dufert, P., Dughi, R., Duprat, G., Gaussen, H., Guiral, P., Humbert, H., Leroy, J., Meyer, F., Motte J., Ranson G. (1957) Tournefort. Muséum National d'Histoire Naturelle, Paris.

Brisseau-Mirbel, C. F. (1815) *Éléments de physiologie végétale et de botanique*. Première Partie, Magimel, Paris. Available at: <https://gallica.bnf.fr/ark:/12148/bpt6k6539954p.r=C3%89%C3%A9ments%20de%20physiologie%20v%C3%A9g%C3%A9tale%20et%20de%20botanique.%20Partie%201?rk=42918;4>

Cesalpino, A. (1583) *De Plantis Libri XVI*. Marescotti, Firenze. Available at: <https://www.biodiversitylibrary.org/bibliography/60929>

Egerton, F.N. (2018) History of Ecological Sciences, Part 61A: Terrestrial Biogeography and Paleobiogeography, 1700-1830s. *Bulletin of the Ecological Society of America*, 99(2), 192-241. DOI: 10.1002/bes2.1397

Fattorini, S. (2017) The Watson-Forbes biogeographical controversy untangled 170 years later. *Journal of the History of Biology*, 50: 473-496. DOI: 10.1007/s10739-016-9454-7

Fattorini, S., Di Biase, L., Chiarucci, A. (2019) Recognizing and interpreting vegetational belts: New wine in the old bottles of a von Humboldt's legacy. *Journal of Biogeography*, 46: 1643- 1651. DOI: 10.1111/jbi.13601

Figuier, L. (1865) *Histoire des plantes*. L. Hachette, Paris.

Forbes, E. (1846). On the connexion between the distribution of the existing fauna and flora of the British Isles, and the geological changes which have affected their area, especially during the epoch of the Northern Drift. *Memoirs of the Geological Survey of Great Britain*, 1, 336-432. Available at: <https://books.google.it/books?id=H74QAAAIAAJ&hl=it>

Greene, E. L. (1983) Landmarks of the history of botany. F. N. Egerton, editor. 2 volumes. Stanford University Press, Stanford, California, USA.

Hemsley, W. B. (1896) Tournefort and the latitudinal and altitudinal distribution of plants. *Nature*, 55, 52-53. DOI: 10.1038/055052e0

- Hooker, J.D. (1881) On geographical distribution. *Nature*, 24, 443–448.
- Humboldt, A. von (1816) Sur les lois que l'on observe dans la distribution des formes végétales. *Annales de chimie et de physique*, 1, 225–239. Available at: <https://gallica.bnf.fr/ark:/12148/bpt6k6570847h/f235.item>
- Juarez-Barrera, F., Bueno-Hernandez, A., Morrone, J.J., Barahona-Echeverria, A., Espinosa, D. (2018) Recognizing spatial patterns of biodiversity during the nineteenth century: The roots of contemporary biogeography. *Journal of Biogeography*, 45, 995–1002. DOI: 10.1111/jbi.13218
- Larson, J. (1986) Not without a plan: Geography and natural history in the late eighteenth century. *Journal of the History of Biology*, 19, 447–488 (1986). DOI: 10.1007/BF00138287
- Linnaeus, C. (1737). *Flora lapponica*. Salomon Schouten, Amsterdam. Available at: <https://bibdigital.rjb.csic.es/records/item/11540-flora-lapponica>
- Linnaeus, C. (1744). *Oratio de Telluris Habitabilis Incremento*. Cornelius Haak, Leiden. Available at: <https://bibdigital.rjb.csic.es/records/item/11546-redirectio>
- Linnaeus, C. (1751). *Oratio de Telluris Habitabilis Incremento*. In: *Amoenitates Academicae*. Laurentius Salvius, Stockholm. Available at: <http://linnean-online.org/120064/>
- Linnaeus, C. (1781). On the increase of the habitable Earth. In: *Select Dissertations from the Amoenitates Academicae* (translation by F. J. Brand). G. Robinson and J. Robson, London. Available at: <https://books.google.it/books?id=2gcAAAAQAAJ&hl=it>
- Linné, C. (1972). *L'équilibre de la Nature*, textes traduits par Bernard Jasmin, introduits et annotés par Camille Limoges, Coll. « L'histoire des sciences. Textes et études ». Vrin, Paris.
- Mayr, E. (1982). *The Growth of Biological Thought*. Belknap Press of Harvard University Press, Cambridge, Massachusetts
- Negri, G. (1934) *Ricerche sulla distribuzione altimetrica della vegetazione in Italia*. Introduzione. *Nuovo Giornale Botanico Italiano*, 41, 1–40. DOI: 10.1080/11263503409437325
- Papavero, N., Llorente-Bousquets, J., & Espinosa-Organista, D. (1995). *Historia de la Biología Comparada desde el Génesis hasta el Siglo de las Lues*. Volumen III. De Nicolás de Cusa a Francis Bacon. Universidad Nacional Autónoma de México, Mexico City, Mexico.
- Papavero, N., Pujol-Luz J. R., & Llorente-Bousquets, J. (2001). *Historia de la Biología Comparada desde el Génesis hasta el Siglo de las Lues*. Volumen V. El Siglo de las Luces (Parte I). Universidad Nacional Autónoma de México, Mexico.
- Parmesan, C., Gaines, S., Gonzalez, L., Kaufman, D.M., Kingsolver, J., Townsend Peterson, A. and Sagarin, R. (2005), Empirical perspectives on species borders: from traditional biogeography to global change. *Oikos*, 108, 58–75. DOI: 10.1111/j.0030-1299.2005.13150.x
- Schouw, J. F. (1823) *Grundzüge einer allgemeinen Pflanzengeographie*. Reimer, Berlin. Available at: <https://www.digitale-sammlungen.de/en/view/bsb10303223?page=1>
- Shantz, H. L. (1940) The Relation of Plant Ecology to Human Welfare. *Ecological Monographs*, 10, 311–342. DOI: 10.2307/1948507
- Tournefort, J. P. de (1694) *Éléments de botanique, ou methode pour connoître les plantes*.: Imprimerie Royale, Paris. Available at: Vol. 1: <https://gallica.bnf.fr/ark:/12148/btv1b8454361d?rk=21459;2>; Vol. 2: <https://gallica.bnf.fr/ark:/12148/btv1b8453978f?rk=42918;4>; Vol. 3: <https://gallica.bnf.fr/ark:/12148/btv1b8453979v?rk=64378;0>
- Tournefort, J. P. de (1700). *Institutiones rei herbariae*. Typographia regia, Paris. Available at: Vol. 1: <https://gallica.bnf.fr/ark:/12148/btv1b8454353v.r=Institutiones%20rei%20herbariae?rk=21459;2> Vol. 2: <https://gallica.bnf.fr/ark:/12148/btv1b84539845.r=Institutiones%20rei%20herbariae?rk=42918;4> Vol. 3: <https://gallica.bnf.fr/ark:/12148/btv1b8453980h.r=Institutiones%20rei%20herbariae?rk=64378;0>
- Tournefort, J. P. de (1717a) *Relation d'un voyage du Levant, fait par ordre du Roy*. Imprimerie Royale, Paris [2-volume edition] Available at: Vol. 1: <https://books.google.it/books?id=m>

84GAAAAQAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false. Vol. 2: https://books.google.bj/books?id=mHo0h77VIdMC&printsec=frontcover&hl=fr&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Tournefort, J. P. de (1717b) Relation d'un voyage du Levant, fait par ordre du Roy. Anisson et Posuel, Lyon [3-volume edition] Available at: <https://www.biodiversitylibrary.org/bibliography/61385>

Tournefort, J. P. de (1718a) A Voyage into the Levant: Perform'd by Command of the Late French King. D. Browne, A. Bell, J. Darby, A. Bettesworth, J. Pemberton, C. Rivington, J. Hooke, R. Cruttenden and T. Cox, J. Battley, E. Symon, London [2-volume edition]. Available at: <https://www.biodiversitylibrary.org/bibliography/60292>

Tournefort, J. P. de (1718b) Relation d'un voyage du Levant, fait par ordre du Roi. La Compagnie, Amsterdam. Available at: <https://bibdigital.rjb.csic.es/records/item/13721-redirect>

Tournefort, J. P. de (1741) A Voyage into the Levant: Perform'd by Command of the Late

French King. D. Midwinter, R. Ware, C. Rivington, A. Ward, J. And P. Knapton, T. Longman, R. Hett, C. Hitch, S. Austen, J. Nood and C. Woodward, J. and H. Pemberton, London [3-volume edition]. Available at: Vol. 1: https://books.google.it/books?id=nbLip5edYDQC&printsec=frontcover&hl=it&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false; Vol. 2: https://books.google.it/books?id=KQk-AQAAMAAJ&printsec=frontcover&source=gbs_book_other_versions_r&redir_esc=y#v=onepage&q&f=false; Vol. 3: https://books.google.com/cu/books?id=fwk-AQAAMAAJ&printsec=frontcover&hl=it&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

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