THE PHENOLOGICAL OBSERVATIONS AND NETWORKING OF ADOLPHE QUETELET AT THE ROYAL OBSERVATORY OF BRUSSELS

LE OSSERVAZIONI FENOLOGICHE E LA RETE DI ADOLPHE QUETELET ALL'OSSERVATORIO REALE DI BRUSSELS

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Abstract

The history and publications around the plant phenological observations of Adolphe Quetelet at the Royal Observatory of Brussels is traced. Quetelet's phenological data are located within the time frame 1839-1872. He played an important role in the development of phenological observations by issuing and distributing his instructions and creating a network of observers on the national and international level.

Keywords: phenology, Quetelet, Brussels, 19th century, networking, statistics

Riassunto

L'articolo traccia un profilo storico e bibliografico delle osservazioni fenologiche condotte da Adolphe Quetelet all'Osservatorio Reale di Brussels nel periodo che va dal 1839 al 1872. In particolare viene posto in risalto l'importante ruolo di Quetelet in termini di sviluppo delle attività osservative fenologiche tramite la creazione e distribuzione di istruzioni e la creazione di una rete nazionale ed internazionale di osservatori.

Parole chiave: *fenologia, Quetelet, Brussels, 19° secolo, reti fenologiche, statistica*

1. History of the phenological observations at the Royal Observatory of Brussels

In 1826 King Guillaume I of the United Kingdom of the Netherlands founded the Royal Observatory of Brussels. Two years later, Adolphe Quetelet (1796-1874) was appointed astronomer but it took many more years – and a Belgian revolution - before the Brussels Observatory started to carry out climatological observations on 1 January 1833 (Demarée, 1996; Demarée *et al*., 2002).

Quetelet's work in phenology did take place within the framework of the Belgian Academy of Sciences of which Quetelet was the Permanent Secretary till his death. An early set of instructions for the periodical phenomena was published by the Academy in 1842 (Quetelet, 1842a). Quetelet carried out the observations on the grounds of the old Observatory in Sint-Joost-ten-Noode. The first year of observations was 1839 (Quetelet, 1842b). A first overview of the observations of the periodical phenomena was published as chapter IV of the book *'Sur le Climat de la Belgique'* (Quetelet, 1849). A 15-pages leaflet, dated 25 April 1853, was printed by the Royal Academy of Sciences containing the instructions for the observation of periodical phenomena (Quetelet, 1853). Soon the network created by Quetelet spread out over Belgium and over Europe (Ihne, 1884; Schnelle, 1955).

Observations of periodical phenomena at the garden of the Observatory of Brussels (as well as from other Belgian and foreign sites) were published by Quetelet in the Memoirs of the Belgian Academy under the headings 'Observations botaniques', 'Observations zoologiques' and 'Observations faites à des époques déterminées' as a part of the 'Observations des phénomènes périodiques' for the years 1839 till 1872 (Quetelet, 1841/1875, 1842b, 1848/1851, 1852/1853, 1855a, 1855b, 1857, 1861a, 1861b, 1863). Edmond de Selys-Longchamps (1813-1900), a botanist, ornithologist and entomologist at Waremme, requested to add to the phenological observations of the state of the vegetation on the days of 21 March, April and October.

Adolphe Quetelet died in Brussels on 17th February 1874. His son Ernest replaced him as acting Director of the Observatory until the nomination of Jean-Charles de Houzeau de Lehaie (1820-1888) in 1876. The last published phenological observations from the Quetelet period date from the year 1872. A few observers continued to forward their phenological observations to the Academy. It is not known exactly what happened afterwards with the phenological observations at the old site. The Observatory was definitely relocated to the present site at the Plateau of Ukkel by December 1890. Jean Vincent (1851-1932) published instructions for the plant and animal phenological observations (Vincent, 1894). His instructions contained a list of plants and animals to be observed. The carrying out of phenological observations at the new site started in 1896 and was continued till 1983 date at which all phenological observations stopped at

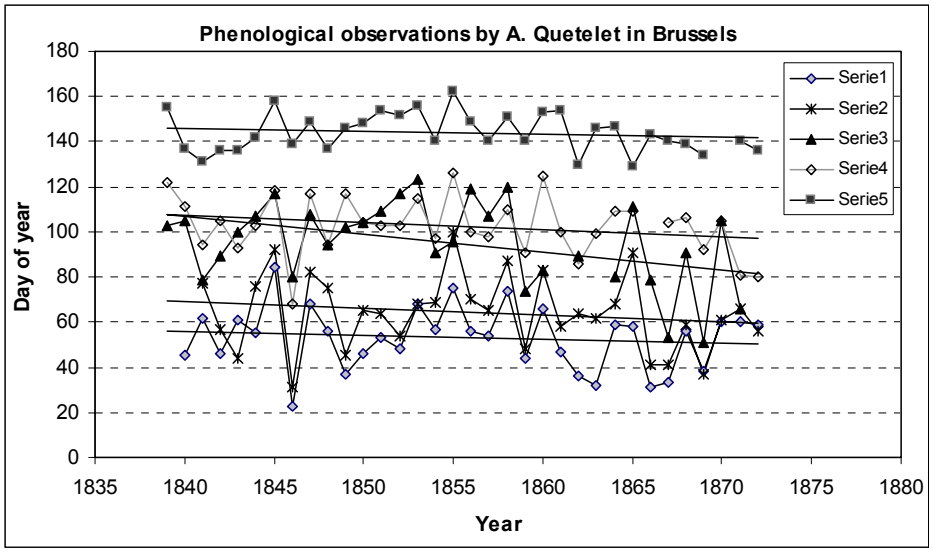

Fig. 1 - Time-series of the first flowering phenological observations by Adolphe Quetelet at the Royal Observatory of Brussels, period 1839-1872. The selected plants are *Galanthus nivalis* (Series 1), *Cornus mascula* (Series 2), *Saxifraga crassifolia* (Series 3), *Pirus communis* (Series 4) and *Philadephinus coronarius* (Series 5).

Fig. 1 *– Serie storiche delle prime osservazioni fenologiche relative alla fioritura svolte da Adolphe Quetelet all'Osservatorio Reale di Brussels nel periodo 1839-1872. Le piante indicate sono* Galanthus nivalis *(Serie 1),* Cornus mascula *(Serie 2),* Saxifraga crassifolia *(Serie 3),* Pirus communis *(Serie 4) and* Philadephinus coronarius *(Serie 5).*

the Royal Meteorological Institute of Belgium (Demarée & Chuine, 2007).

2. Plant phenological networking in Belgium and in Europe

Of course, plant phenological observations were carried out at other locations in Belgium and communicated to Quetelet at the Royal Academy of Sciences. Plant phenological observations were published consequently in the 'Mémoires' of the Belgian Royal Academy. Quetelet received also co-operation on his phenological questionnaire from several European countries and a European phenological network was established. For instance, Quetelet's and Zantedeschi's examples were followed by Father Serpieri at the Meteorological Observatory of Urbino in Italy. Serpieri published a report in which for about 280 plants the dates of flowering were given for the period 1857 till 1865 (Barsali, 1922; Puppi, personal communication). Unfortunately, parts of these Belgian and European observations were not published in the 'Mémoires' of the Academy and their manuscripts could not yet be traced.

3. The coining of the word *'Phenology'*

Quetelet named his botanical and zoological observations natural periodical phenomena – of the vegetable kingdom – of the animal kingdom. Charles-François-Antoine Morren (1807-1858), a botanist at the University of Liège, contributed to the observations of periodical phenomena collected by Quetelet (see e.g. Morren, 1845). However, in 1853, Morren named his observations for the winter 1852-1853 '*phénologiques'*, coining herewith the word 'phenology' (Morren, 1853). Although Morren is often credited for the first use of the word 'phenology', the exact reference to his paper is however extremely rare (Demarée, 1996). The word *'phenology'* is derived from the Greek words 'phainomai' (φαινομαι = to appear) and 'logos' (λόγοσ = word, study). Morren can also be credited for having coined the word 'anthochronology' (άνθοσ = flower) in his correspondence with Quetelet on the periodical phenomena for the year 1842 (Morren, mss., 1842). This word is used in the following titles: 'Observations anthochronologiques sur la périodicité des motilités sexuelles pour les plantes' and 'Observations anthochronologiques sur les périodes diurnes'.

Curiously enough, Quetelet continued to use the term '*periodical phenomena'*. However, after his death, the word *'phenology'* was used in the 1880s in parallel with the term *'periodical phenomena'* in *'Ciel et Terre'*, the journal of astronomers and meteorologists connected to the Royal Observatory.

4. International statistical Congresses

International statistical congresses were held in Brussels (1853), Paris (1855), Vienna (1857), London (1860), Berlin (1863), Florence (1867), The Hague (1869) and Saint Petersburg (1872) with the aim to standardize statistical observations in countries (Quetelet, 1873). Adolphe Quetelet played an important role in all these congresses. In Quetelet's publication only one single mention is made on the 'periodical phenomena' and its use in statistics; this occurred at the Vienna congress (Quetelet, 1872, p. 25-26). Quetelet refers to Carl Linnaeus (1707-1778) for the beginnings of this science and to the work undertaken at the Royal Academy of Belgium. The mission was given to the Sixth section of the Vienna congress. Two Austrian geologists, Fr. Foeterle and Ami Boué (1794-1881), proposed several excellent measures which were all adopted.

It is known that a long-term cooperation existed between Karl Fritsch (1812-1879). This conducted to submitting a report on the periodical phenomena of animals and plants to the Sixth section of the London Statistical Congress in July 1860 as was asked to him and to M. Fritsch, main author of the work, at the Vienna Congress (Quetelet, 1860). These recommendations were officially accepted

but no one worked according to them except Fritsch himself (Schnelle, 1955; Koch *et al*., 2008). Quetelet published in co-operation with Linster at Pulkowa [Polkova near Saint Petersburg] in Russia and with Fritsch at Vienna (Quetelet, Linster & Fritsch, 1865; Quetelet, 1865) a comparative study of the dates of flowering and leafing in Brussels, Stettin and Vienna.

5. Phenological data at the Royal Observatory of Brussels

The phenological observations by Quetelet at the Royal Observatory deal with the following stages: flowering, leafing, fructification and losing the leaves. Up to 500 plants were observed. An example of phenological time-series corresponding to the plants *Galanthus nivalis* (Series 1), *Cornus mascula* (Series 2), *Saxifraga crassifolia* (Series 3), *Pirus communis* (Series 4) and *Philadephinus coronarius* (Series 5) is given in Figure 1. The graphs represent the day of year (doy) for the reference years 1839-1872. The five series all show a negative linear trend.

6. Conclusions

The phenological work done by Quetelet at the Brussels Observatory has been pioneering not only for its observations but also for its national and international networking. The phenological observations of Adolphe Quetelet at the Royal Observatory of Brussels cover the time frame 1839-1872. Several hundreds of plants were observed for the stages: flowering, leafing, fructification and loss of leaves. These data are a valuable tool extending phenological data far into the nineteenth century and constructing long-term phenological time-series.

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