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Methodology of Renaissance botany and the ‘Libri picturati’ (A. 18–30) watercolour collection

(1) Introduction

Botany was among the leading disciplines of science during the Renaissance period. Owing to geographical discoveries, many new plants brought to Europe were examined by herbalists, who also started investigating the native flora of particular European countries. At that time there was no commonly used system of plant names, nor standardised method of morphological description, which is why plant illustration played a significant role in documenting nature.

(2) ‘Libri picturati’ (A. 18–30) collection of plant watercolours

General description

The Jagiellonian Library (Kraków, Poland) holds one of the largest collections of plant pictures made during the Renaissance — ‘Libri picturati’ (A. 18–30), connected with the activity of Charles de L’Écluse (Clusius). The collection consists of 13 volumes containing ca 1860 watercolours of plants. The pictures were made in the Netherlands in the second half of the 16th century and the beginnings of the 17th century. In the 17th century it became a part of the Elector Library in Berlin (later the Prussian State Library). During the second World War (in 1941) it was removed for safe-keeping to other places, among others to the Benedictine monastery in Grüssau (now Krzeszów). About 1947 the collection was placed in the Jagiellonian Library in Kraków. For many years the ‘Libri picturati’ were inaccessible to scientists because of their undefined legal status. Some authors thought that it had been lost during the war. Since 1989 it was open to study. Owing to that some specialists started to work on various aspects of these unique plant pictures [e.g. Whitehead et al. (1989); Künkele, Lorenz (1990); Swan (1998); Ubrizsy Savoia (1998); Zemanek A., De Koning (1998); Ramón-Laca (2001); Zemanek A., Ubrizsy Savoia, Zemanek B. (2007)].

The pictures of plants are of such excellent quality that the determination of species is quite possible. We can admire the structure of root, stem, leaves and flowers, and very often fruits with seeds. Over 600 pictures have annotations made probably partly by Clusius. The annotations include such elements as: plant names (in Greek, Latin, Flemish, French, German, Italian), and the short botanical comments containing information on habitat, cultivation, phenology, useful properties and others. For instance annotation to the watercolour of *Iris pseudacorus* (Fig. 1) says:

Occurs everywhere with us in muddy and moist sites, but almost useless and not fragrant.
Flowers in May, the seed matures in August.

Origin of the collection

The first problem to solve was the question of the origin of this collection, because the volumes do not contain any indication how they came into being. The first author who examined the watercolours was Agnes Arber (1912, reprint in 1988) who connected these picture with a famous Flemish botanist — Clusius, because some of the pictures matched with woodcuts in his printed works. Carolus Clusius (1526–1609) whose name was Charles de L’Écluse is claimed to be one of the first professional botanists. He was a director of the royal gardens in Vienna, and later — a director of the Botanic Garden in Leiden, where he became famous as a pioneer of introduction to Europe of many exotic plant species.

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Fig. 1. Yellow flag (*Iris pseudacorus*)

In 2003 the ‘Libri picturati’ project was started concerning interdisciplinary studies on this unique collection of plant pictures. In this project authors from five countries take part, with Dr Jan de Koning and Gerda Uffelen (Leiden) as the main editors. The project includes historical and botanical aspects of the collection (we do not deal with problems belonging to the art history). Owing to the efforts of Helena Wille (1997), and Florike Egmont (2005) a riddle of the origin of the collection was solved. According to their studies the set of watercolours was a combined work by the painters, the plant-lovers who sponsored the painting, and the botanists (among others Clusius) who annotated the pictures. Two groups of pictures were distinguished. First of them was made ca 1564–1569 in the castle Moerkerke (now in Belgium) to order of Karel van Sint Omaars — a rich plant-lover. Clusius who was a friend of Omaars, and spent some years in Moerkerke, probably supervised the painters and made some annotations to the pictures. The second group of the watercolours was made later — at the end of the 16th century and the beginning of the 17th century. After Omaars death the collection came to the possession of another rich plant-lover, Karel van Arenberg, who supplemented the set of watercolours by the purchase and exchanging some materials. Another hypothesis about the origin of the collection put forward C. Swan (1998) who attributed the watercolours to Dirck Outgaertsz Cluyt (Theodorus Clutius), but this idea is less documented.

(3) Methodology of Renaissance botany and the ‘Libri picturati’ (A. 18–30)

Features of the old style of thinking

One of the most interesting problems of the history of science is emerging new ideas and competition between old and new paradigms in scientific works. From this point of view the collection ‘Libri picturati’ is fascinating, because coexistence of the old and new style of thinking in botany could be noticed. To the old paradigm belong: quotations of ancient authors — mainly Dioscorides, Plinius, Galen, Theophrastus; special attention to underground plant organs; the manner of flower depicting; and superstitions about plants (but very few of them).

In the ancient and medieval times the roots were of special interest because they were used in medicine. The authors of the collection were interested in the underground plant organs as well. Maybe it is the sign of the old connection of botany with pharmacy. On the other side, the roots are presented very realistically — many types of underground parts of plants and their modifications are shown, for example storage thickened root in sweet potato. The presentation of flowers also bears the features of the old style of thinking. Generally its shape and colour is painted perfectly, with artistic

skill — we can admire variety of forms and colours, but the internal structure of flower is almost always invisible.



Fig. 2. Fragment of inflorescence of heath spotted orchid (*Dactylorhiza maculata*) with 'smiling face'



Fig. 3. Rose of Jericho (*Anastatica hierochuntica*)

The shape of zygomorphic corolla in orchids is generally depicted realistically, although under great magnification, we can notice a smiling face inside one flower of *Dactylorhiza maculata* (Fig. 2). It reminds interpretations of some herbalists, for instance H. Bock (Tragus) who tried to find anthropomorphic or zoomorphic structures in the orchid flowers. These interpretations are probably connected with the old usage of these plants as aphrodisiacs. It should be underlined that sexual functions of flowers were discovered at the end of the 17th century (J. Camerarius, 1694).

Generally, the authors of 'Libri picturati' discarded old superstitions connected with plants. We have very few of them. One of them, with a critical comment, refers to the rose of Jericho (*Anastatica hierochuntica*) (Fig. 3) — a desert plant which dries up during the draught, and develops leaves immediately after watering. The annotation says:

It opens not only during the Christmas Eve period, and not only on its own, as it was once believed by naïve local people, but always when you want it, after prior spraying it with water or wine.

New currents

The stock of watercolours in 'Libri picturati' as a whole reflects the new currents in Renaissance botany. Many of these trends could be also seen in printed publication of that time, but the collection mirrors them especially closely. These trends are: interest in plant morphology and variety of living forms, ecology, and geographical distributions of plants.

Plant morphology dealing with the external structure of plants (appearance, shape and symmetry) is one of the oldest branches of botany. Its beginnings, in ancient times, were shaped by Theophrastus of Eresus. In the Renaissance some authors of the printed works contributed a lot to the development of morphology. In the 'Libri picturati' we can find many morphological structures, maybe some of them depicted for the first time. We have no morphological terms here. Only the picture, as universal language of information shows realistic view of particular plant organs, for example — many types of stem.

Probably we have one of the first pictures of the root nodules in *Papilionaceae* (*Fabaceae*) family (Fig. 4). They were described for the first time almost hundred years later by Marcello Malpighi in his work *Anatome Plantarum* (1679). He observed the root nodules on the roots of broad bean (*Vicia faba*), and presumed that they were caused by insects. The correct cause of the root nodules, symbiosis of papilionaceous plants with nitrogen fixing bacteria, was provided as late as in the 19th century (e.g. Woronin 1866).



Fig. 4. Root nodules on the roots of broad bean (*Vicia faba*)



Fig. 5. 'Plant monstrosity' — deformation of apple fruits, fused in pairs

At the end of Renaissance the interest in the curiosities of nature could be noticed. This fascination is mirrored in 'Libri picturati'. We have ca 40 examples of 'monstrosities'— atypical forms of plant organs, e.g. fasciated stem, multiplication of the number of flowers, deformation of apple fruits, fused in pairs (Fig. 5), etc.

Another new current very vital in Renaissance time was an interest in plant habitat and phenology. These problems we include now to plant ecology. The term 'ecology' was introduced in the 19th century (1866) by Ernst Haeckel.

In the annotations to the pictures from the 'Libri picturati' collection one can find many types of ecological information. Some notes refer to relationships between plants and their environment, especially climate (insolation, humidity) and type of soil. The most abundant data concern the types of habitats and species associated with them. For 25 % of pictures we have also phenological information.



Fig. 6. Sea-coast halophytes – glasswort (*Salicornia europaea* s.l.) and annual seablite (*Suaeda maritima*)



Fig. 7. Ruderal species – nettle (*Urtica dioica*)

As for the types of habitat the most abundant are plants of aquatic and wetland sites. Very interesting is rare ecological group: sea-coast plants – halophytes (15 taxa). The annotation on one of the sheets with two species (Fig. 6) says:

They like very much salty soils and sea-coasts, and grow in stable union: to such degree that many people considered, wrongly, there were not two, but one plant, and proposed such opinion.

This information could be treated as early description of plant community. Many centuries later J. Braun-Blanquet described in Languedoc the similar type of association formed by other species.



Fig. 8. Melon
(*Cucumis melo*)



Fig. 9. Small tobacco
(*Nicotiana rustica*)

Numerous notes pertain to the anthropogenic habitats, that is to say ruderal plants accompanying human settlements (Fig. 7), and segetal growing in the gardens and cultivated fields. It is the proof of the changes of natural environment by man in the 16th century in Western Europe. Some pictures have also the notes about the condition of particular species in cultivation. For example — melon (*Cucumis melo*) (Fig. 8):

Likes sunny places, fertilized well, and soil tilled thoroughly. With us ripens in August and September, in warmer sites earlier.

Phytogeography as separate discipline emerged at the beginnings of the 19th century, owing to Alexander von Humboldt's works, but many centuries earlier, in the Renaissance, some authors were interested in plants distribution. In 'Libri picturati' phytogeographical information could be found in annotation to the species 146 times. The most numerous are the names from the Netherlands (which confirms the hypothesis of making the pictures in this country). Very large group are the Mediterranean species — especially from Iberian Peninsula, and Italy. Less numerous are names from Germany, Switzerland, France, Britain, and Bohemia.

The separate problems are the new species coming from various continents introduced to Europe in the 16th and the beginnings of the 17th century. One of the first pictures in the world is that of *Dracaena draco* — exotic species coming from Canary Islands. Another early presentation concerns *Nicotiana rustica* (Fig. 8) native of America.

To sum up the 'Libri picturati' collection it is not only beautiful 'painted garden' joining the aims of art and science, not only botanical documentation of the flora of Europe and of some plant introduction, but also an unique historical source showing us the Renaissance way of thinking about botany.

(4) Acknowledgements

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