Introduction

Johannes Hedwig was born in Hungary (then Transylvania) in 1730 and lived in Vienna, Chemnitz and Leipzig during his lifetime. He died in Leipzig in 1799 after a short illness. Hedwig trained as a physician but maintained an active interest in botany throughout his life, focusing his studies mostly on mosses. For a review of the life and work of Hedwig see FLORSCHÜTZ (1960), MARGADANT (1968), and contributions to the '2000 Hedwig Symposium' published in Nova Hedwigia Vol. 70. This volume consists of a series of papers on Hedwig: his life and work (FRAHM, 2000), the Hedwig-Schwägrichen herbarium (GEISSLER, 2000), his bibliography (WISSEMAN, 2000), published biographical information on him (WAGENITZ, 2000), and on Hedwig's influence on the classification of mosses in modern times (VITT, 2000).

Hedwig published his pioneering observations on mosses (including on antheridia, protonema and sporophytes) and descriptions of new species throughout his career (HEDWIG, 1782, 1784, 1787-1797, 1798, 1799). Arguably his most important contribution to bryology today was through the posthumously published Species Muscorum Frondosorum (SMF), the culmination of his life's work (HEDWIG, 1801). Hedwig enumerated 372 taxa within SMF and drew the illustrations for the 77 plates himself. SMF was edited after the death of Hedwig by Christian Friedrich Schwägrichen, a former botany student of Hedwig's (FLORSCHÜTZ, 1960). Schwägrichen went on to complete four more supplemental volumes for SMF (SCHWÄGRICHEN, 1811-1816, 1823-1827, 1827-1830, 1842) which can be considered a separate endeavour to the original publication of Hedwig.

The Hedwig-Schwägrichen herbarium

Associated with SMF, and its supplements, was the herbarium collection of Hedwig, added to later by Schwägrichen, on which these authors based their descriptions and that they used as a reference when working on the SMF series. Hedwig was aware of the importance of a good herbarium and he himself collected and exchanged plants with other botanists, including O. Swartz from Stockholm, Sweden and Rev. P. Muhlenberg from Lancaster, Pennsylvania, U. S. A. Hedwig's plants were pressed, arranged and glued onto 17 x 21 cm paper sheets, the sheets were labelled (usually in the bottom left corner) and then placed inside blue protective covers (Fig. 1). The species name was written on the upper or lower left side of the cover. The covered specimens were then filed horizontally and stored within small wooden boxes (Fig. 2). Charles Bonner estimated that there were 1100-1200 sheets containing around 2000-4000 individual specimens present in the Hedwig-Schwägrichen herbarium at G (BONNER in FLORSCHÜTZ, 1960).

The Hedwig herbarium, more correctly termed the Hedwig-Schwägrichen herbarium, was bought and sold many times before it finally came to rest in Geneva (for a comprehensive review of the history of the movements of the Hedwig-Schwägrichen herbarium see FLORSCHÜTZ, 1960 and GEISSLER, 2000). The movement of the herbarium is thought to have resulted in the loss of some of the original specimens and in the creation of some duplicate collections (SAYRE, 1977; KOPONEN, 1979). After the death of Hedwig his herbarium was bought by his son, Romanus Adolf Hedwig (1772-1806). Although R. Hedwig did not do extensive taxonomic work on mosses he continued to exchange plants with other botanists and sent a small set of duplicates of his father's mosses to Augustin-Pyramus de Candolle (herbarium in G as G-DC) in exchange for a collection of ferns from the Antilles (FLORSCHÜTZ, 1960).

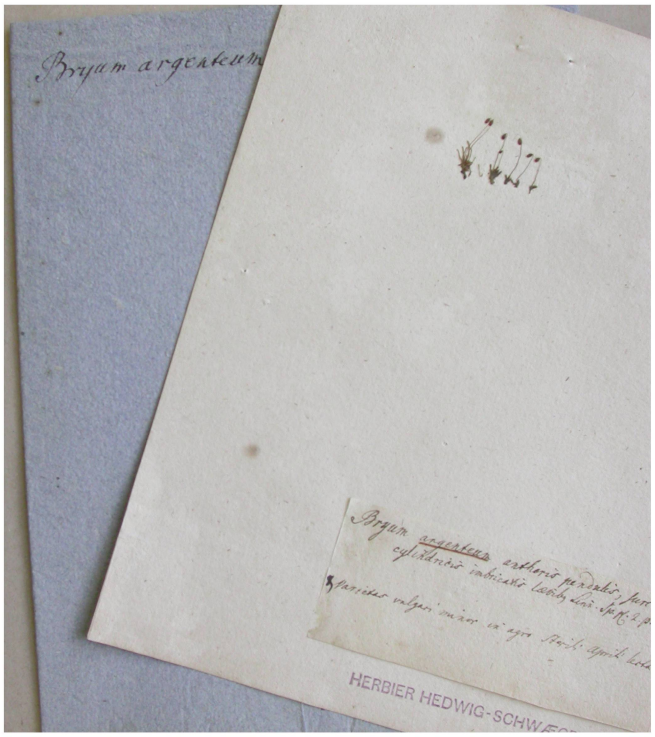

Fig. 1

In 1810, after the death of R. Hedwig the 'Hedwig herbarium' was sold to Schwägrichen, who continued to work with and add to the collection while he finished the SMF supplements. In 1852, after the death of Schwägrichen, the now 'Hedwig-Schwägrichen herbarium' was offered for sale and was bought by Jean-Etienne Duby who was based in Geneva at that time. After the death of Duby in 1885 his herbarium was divided up into three sections

(liverworts and other cryptogams; European mosses; exotic and some European mosses) and was sold in these parts (FLORSCHÜTZ, 1960). The liverworts (including the Christian Gottfried Daniel Nees von Esenbeck collection) and other cryptogams were bought by the University of Strasbourg and the European mosses were apparently sold to Léonce Motelay at Bordeaux, France (GEISSLER, 2000), although nothing is mentioned about this purchase in

Fig. 2

the biography of Motelay (FLORSCHÜTZ, 1960), no paperwork concerning the purchase has been unearthed, and no Hedwig-Schwägrichen collections have been found at BORD (fide SAYRE in GEISSLER, 2000).

The rest of the Duby herbarium collection (the exotic and some European mosses), which included the Hedwig-Schwägrichen herbarium, was bought by William Barbey, son-in-law of the late Edmond Boissier. Barbey integrated his herbarium collection, including the newly acquired Duby specimens, into the Boissier herbarium (BRIQUET, 1940) resulting in the Barbey-Boissier herbarium collection. On the death of Barbey in 1914 the Barbey-Boissier herbarium was given to the University of Geneva. In 1943 the collection at the University of Geneva was merged with that of the municipal herbarium based at *Conservatoire et Jardin botaniques de la Ville de Genève* (CJBG) (GEISSLER, 2000).

Duplicates of the Hedwig material, exchanged by R. Hedwig with A.-P. de Candolle, arrived independently to G in 1921 just after the death of A.-P. de Candolle. His herbarium was donated to the CJBG (Herbarium Genavense – G) by the de Candolle family. The phanerogams were housed in G-DC and the bryophyte collections were integrated into the general bryophyte herbarium of G. The Hedwig collections received by de Candolle are distinctive, since they are marked with the species name and 'Hedwig' in the hand of A.-P. de Candolle (see Fig. 82).

The Hedwig-Schwägrichen collection: sheets and specimens

Although the Hedwig-Schwägrichen herbarium was thought to have first arrived in Geneva as early as 1853 after its purchase by Duby, its incorporation into the general herbarium of G was not begun until 1958. At this time the original sheets of Hedwig, many of them still in the blue covers, were placed inside large herbarium packets, which were pinned onto the standard format herbarium sheets used in G. These sheets were then filed within the general bryophyte collection at the beginning of the taxon name that they represented. The original sheets of the Hedwig-Schwägrichen herbarium are distinctive both in their standard format and specimen presentation (Fig. 1). Herbarium techniques have changed over time, and although nowadays these specimens seem rather sparse and insufficiently labelled, Hedwig's original bryophyte collection may be considered quite advanced for its time in both organisation and presentation.

Compared to today's standards, a great majority of the Hedwig labels lack detailed (or in some cases any) locality information. Most labels lack information on the collector of the particular specimen, or specimens, a collection number and any indications of the date of the collection. Some exceptions are the collections of Olof Peter Swartz from Jamaica and Sweden and Rev. Gotthilf Heinrich Ernst Mühlenberg (known as 'Henry Muhlenberg') from North America: mostly Lancaster in Pennsylvania. Jules Cardot in his 1899 publication *Etudes sur la flore bryologique de l'Amérique du nord. Révision des types d'Hedwig et de Schwägrichen* details the Muhlenberg specimens from North America contained within the Hedwig-Schwägrichen collection. He includes protologue and label information for them and more detailed discussions of some of the taxa where he found problems with either specimen determinations or with multiple species being present on an individual sheet. A list of collectors cited on the Hedwig labels is given by GEISSLER (2000: 17).

Information written on the labels and that of the protologue in SMF do not always correspond. On his labels Hedwig placed much more emphasis on recording the author and citation of the earlier names used for each of the taxa he described within SMF. Many of the original Hedwig labels contain references to these earlier works, specifically BRIDEL (1778 – '*musc.*'), DILLENIUS (1741 – '*Dill.*' '*H. M.*,' *H. Musc.*,' '*Hist. M*' or '*Hist. Musc.*'), LINNAEUS (1753 or 1762 – '*Linn.*' '*Sp. pl.*,' '*Spec.*,' '*Spec. pl.*' or '*Spec. plant.*' volumes I and II), and to earlier works of Hedwig himself (1787-1797 – '*Stir. Crypt.*,' ' *St. crypt.*' or '*St. Cr.*'). He also included space for the addition of the pages, tables and plates in SMF, presumably to be filled on the herbarium labels by him after the publication of the book. The details have instead been completed by Schwägrichen. The volume/page/figures additions by Schwägrichen are not marked as such on the label information given in this catalogue.

The presentation of the specimens in the Hedwig-Schwägrichen herbarium differs considerably from current practice. Single, multiple or groups of stems were pressed before being arranged and glued onto a single herbarium sheet. When multiple stems or groups of stems are attached to a sheet they are assumed to have been placed there either for comparative purposes or to represent variation in the species. Sometimes two or three different species, based on modern species concepts, can be found on the herbarium sheets (see PURSELL, 1986, for examples from the genus *Fissidens*). They were presumably included under a wider concept of the species than the present day concept (see GEISSLER & FRAHM, 1995, for an example using *Barbula ruralis* Hedw.), as an example for comparison, or those particular plants were incorrectly determined at the time (PURSELL, 1986).

In many cases specimens were added to the Hedwig sheets by Schwägrichen, also presumably to show variation in species or for comparative purposes (PRICE, 2002), or as he described species for the publication SMF, and its supplements. He has annotated his additions to the sheets although many of his annotations are difficult to decipher. The handwriting of Hedwig (Fig. 3a) and that of Schwägrichen (Fig. 3b) are quite distinctive so mostly it is easy to distinguish between them. On sheets where the label is originally written by Hedwig the stems, presumably added by Schwägrichen, are marked with letters corresponding to similarly lettered annotations written by Schwägrichen on the specimen label. This makes the identification of any additions to the herbarium sheets by Schwägrichen somewhat easier. Any annotations by Schwägrichen have been written directly onto Hedwig's original label or onto the sheets themselves. A certain number of specimens for the Hedwig moss names contain only the handwriting of Schwägrichen. In these cases the species name and any other information is written directly onto the sheet (for example, all sheets of Polytrichaceae species present in G have been labelled by Schwägrichen). We can presume that these particular sheets and most probably also the associated descriptions were prepared and/or finished by Schwägrichen before the publication of the work SMF in 1801. Therefore the herbarium sheets of Hedwig moss names with solely the handwriting of Schwägrichen must not be discounted as potential type material for that name. Careful attention must be paid to the annotations of Schwägrichen to check that if a collection year is given for a particular specimen it pre-dates the publication of SMF.

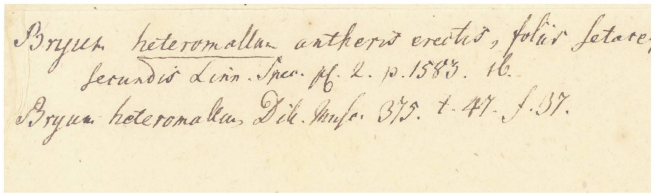

Fig. 3a

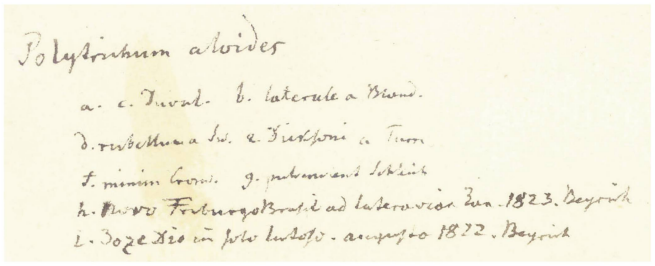

Fig. 3b

Designation of SMF as the starting point for moss names

During the 1910 International Botanical Congress in Brussels a group of bryologists made a proposal to adopt Johannes Hedwig's 1801 publication SMF as the starting point of moss names, excepting *Sphagnum* L., and this proposal was generally accepted by the committee during the congress (DIXON, 1933; FLORSCHÜTZ, 1960). All names (except for those of *Sphagnum*) published in SMF were thus automatically ascribed to Hedwig. This ruling led to the need to typify Hedwig's species and genera to ensure the correct application of these names (KOCH & CRUM, 1956; GEISSLER, 2000). The Hedwig-Schwägrichen herbarium at G thus became an important reservoir of material critical for the ensuring the correct application of names for those mosses in SMF.

Typification of material in the Hedwig-Schwägrichen herbarium

A total of 372 species names, including four varieties, of mosses were described in SMF and although most of these species were from Europe and/or North America, some were tropical in origin. Hedwig described 75 new species in SMF. The remaining species described by Hedwig in SMF were based on names and descriptions from earlier publications, such as BRIDEL (1778), DILLENIUS (1741), and LINNAEUS (1753, 1762), or from Hedwig himself (1787-1797). Of the 372 Hedwig moss names in SMF (369 with the three *Sphagnum* species excluded) 325 have either type or possible type material in G. A total of 43 specimens representing potential types have been published as, or are now known to be, missing from the Hedwig-Schwägrichen collection. This number includes three specimens (*Weissia controversa*, *Weissia rutilans* and *Weissia microstoma*) that were recently lost while on loan. Published lectotypes or general typifications (holotype, neotype, or other designations) have been located for 210 of the Hedwig moss names, including 6 for Hedwig plates.

The importance of the Hedwig-Schwägrichen herbarium for the nomenclature of mosses has been discussed by GEISSLER (2000). In the light of the often sparse material, multiple stems or groups of stems per herbarium sheet (which may have been attached at different times), scant information on the specimen labels, and the frequent incompatibility of label information with the protologue, careful consideration of the possible type material is needed, and in many cases lectotypification is necessary to establish the correct use of the name. MARGADANT (1968) in his work *Early Bryological Literature* gives information on SMF and on the decision to adopt SMF as the starting point of names. He also discusses some of the problems encountered when typifying Hedwig moss names. KOPONEN (1979) outlined several possibilities for the typification of species names in the Hedwig-Schwägrichen herbarium, and the problem is further discussed by PURSELL (1986), HEDENÄS & GEISSLER (1999), GEISSLER (2000) and PRICE (2002). GEISSLER (2000) gives an example for use when lectotypifying names from the Hedwig-Schwägrichen herbarium, along with indications of the important points to consider when lectotypifying Hedwig specimens.

The process of designating type material from the Hedwig-Schwägrichen herbarium is made difficult by the differences between the practices at the time and modern herbarium standards and rules for correctly establishing type material (GREUTER, 2000). The manner of presentation of specimens, often sparse material, later additions and annotations by Schwägrichen, discrepancies between labels and protologues, and scant label information seen in the Hedwig-Schwägrichen herbarium must all be carefully considered when typifying material. Although there have been efforts to typify Hedwig names, many of Hedwig's names, especially for tropical species, remain in need of typification (GEISSLER, 2000). For a rather surprising total of 162 of the Hedwig moss names a published typification or lectotypification was not found.

Efforts have been made to typify or lectotypify the Hedwig moss names from the Hedwig-Schwägrichen herbarium (for example, BEDNAREK-OCHYRA & OCHYRA, 1994; CARDOT, 1899; FIFE, 1996; FRAHM & GEISSLER, 1985; FRISVOLL, 1984, 1986; GEISSLER & FRAHM, 1995; GEISSLER & MAIER, 1995; HEDENÄS & GEISSLER, 1999; KOPONEN, 1979, 1980; LEWINSKY-HAAPASAARI & ISOVIITA, 1999; PURSELL, 1986; PRICE, 2002) because of the significance of these collections to moss nomenclature (GEISSLER, 2000). A common mistake associated with the annotation of specimens from the Hedwig-Schwägrichen herbarium is the inclusion of an annotation label that indicates the presence of the 'holotype' for the species in question, but that fails to indicate precisely on which stem or individual group of stems (where multiple stems / groups of stems are present on the herbarium sheet) the designation was based on, i.e. which specimen from amongst the material was thought to have been originally used by Hedwig (or Schwägrichen) in the description and/or illustration of the species. In some cases, plants used for the illustrations in SMF can be identified from the herbarium sheets (see PRICE, 2002, see within Fig. 1, upper left specimen and Fig. 2, upper half of plate). The designation of 'holotype' by the author of a name is a practice that has only come into wide use in modern times in accordance with the development of the International Code of Botanical Nomenclature. A holotype constitutes the one specimen or illustration used by the author, or designated by the author as the nomenclatural type (see St. Louis Code, GREUTER, 2000). A lectotype is a specimen that is designated, from the original material if, no holotype was indicated at the time of publication, no holotype has been found or if the supposed holotype is found to belong to more than one species (see St. Louis Code, GREUTER, 2000).

The material in the Hedwig-Schwägrichen herbarium collection for the Hedwig moss names

The moss names published by HEDWIG (1801) are listed by basionym (**BN**). The current use for each basionym, its current name (**CN**) or synonym (**SY**) according to CROSBY & al. (1999), and recent revisions, is included under each basionym. After each basionym the page number and number of the plate (if present) from SMF are given. The protologue (**PL**) information from SMF is also listed. All information on the herbarium sheet label (**LI**) is given for each basionym when material is present in G.

On those labels annotated by Schwägrichen his handwriting is indicated by and included within square brackets [..]. His writing can be very small and difficult to read and where it cannot be interpreted with confidence *illegible word* is included in place of the word. This method is also employed for un-interpretable words written in Hedwig's hand. Details of a published lectotypification or typification (**LT**) for each basionym were researched and are recorded when found. This information includes the author/s and year of the article, and the page of the lectotype designation. The typification status (**TY**) and location of the type specimens is also given. Under this section the nature of the designation is as follows: HT = Holotype; IT = Isotype; LT = Lectotype; NT = Neotype ST = Syntype; and T = no specific designation. When known the location of the material is indicated by the herbarium acronym (such as LT in G, LT in BM). The term 'not in G' is used when no material has been found within the herbarium and the term 'in G' is used when material is present but no published typification was found. Specimens that were previously known to be missing from G, or that were recently confirmed as not being present in the holdings at G are included separately at the end of the main listing with more detail on the locations of type material, if known, included for each name.

The section **Notes** is used for any additional information pertaining to the basionym, current name, herbarium specimen/s, or typifications for that particular entry.

Images of the herbarium sheets were captured using a desktop scanner at 600 dpi. The resultant scans were then cropped around the edges to enhance the presentation of the specimens and reduced to be a standard 12 cms in width, except where sheets had been altered already. Variation in apparent sheet size seen in this catalogue is a facet of the amount of trimming of the original scan and/or whether the Hedwig herbarium sheet had been altered at some point in the past. Standard sheets in the Hedwig herbarium are 17 x 21 cms, except where they have unfortunately been cut down in size. **Figure** lists the number of the figure for the herbarium sheet, or sheets, as presented in this catalogue.

An on-line version of this catalogue (Price & al., 2004) is available through the website of CJBG. Current website address: http://www.ville-ge.ch/cjb/bd/hedwig/index.php.