British entomology collections of the Manchester Museum

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"…without [collections], there could be no more Entomology, than there could be science without books…" Lubbock (1856: p.115)

Introduction

According to recent estimates (Cranbrook, 1997), the number of biological specimens held in UK museums must exceed 100 million (worldwide, over 3 billion; see Brooke, 2000), most of which are arthropods. Although university museums constitute only 4% of the UK's museum sector (University Museums, 2004), some of them, such as the Oxford University Museum of Natural History or the Manchester Museum, are recognized as internationally important depositories of natural history collections. The Manchester Museum stands outside nationally-funded collections, which are designated and supported by the state, and falls into the category of so-called 'quasi-national' museums (see University Museums, 2004). However, Manchester Museum is one of 32 museums in England with designated collections, announced by the Secretary of State in 1997 (Report 1996-97). Designation is a category given by the Government to identify non-national British museums with collections of pre-eminent importance.

Alberti (2009) provided an account of Manchester Museum's history for the first 100 years (1890 - 1990). A history of the Museum's Entomology Department was briefly outlined by Johnson (1996; see also Logunov 2010b), with more detailed information given by him on the British Coleoptera collections (Johnson, 2004 & 2009). Useful information on the entomologists associated with the department and their collections can be found in the published Museum's Annual Reports (Reports 1889 - 2003), also in Hancock & Pettitt (1981) and in a number of obituaries, such as Standen (1921) and Britten (1922a) on John R. Hardy, Hincks (1951a & 1954) on Franz Spaeth and Harry Britten respectively, Anonymous (1958) on Robert W. Lloyd, Kloet (1961) on Walter D. Hincks, Cooter & Johnson (1996) on Horace Last, Johnson (2003) on Alan Brindle, and others. The story of the Manchester Moth *Euclemensia woodiella* (Curtis) was presented by Sidebotham (1884), Cosmo Melville (1924) and Brindle (1952).

The Manchester Museum houses insects collected from all over the world and includes more than three million specimens (Johnson, 1996; see also Logunov 2010b)), which are thought to make up the third/fourth largest depository in the UK, depending on group. Amongst the notable entomology collections of the UK the undisputed pride of place goes to the Entomology Department of the Natural History Museum in London. With its holding of 28 million of specimens and over 100 staff, this museum is about equal to the rest of the 672 other British Biological Collections, which in total have fewer than 100 full/part-time curatorial posts (Garland, 1989). With regards to the size of insect collections and the staff, the Manchester Museum seems to be most similar to the Oxford University Museum of Natural History (OUMNH) (see Table 1). Compared to the OUMNH, the Manchester Museum's insect collections are younger and about two times smaller, with less type specimens and a smaller archive.

Table 1. Approximate numbers of collection objects in two entomology stores of the UK

	Total	Types*	Archives**	Oldest item	Staff
The OUMNH	6,00M	25,000	1,557	1702	3
Manchester Museum	3,00M	2,300	34	1802	2

* - A number of species represented by primary types; in total, the Manchester Museum holds some 12,000 type specimens of all categories (Johnson, 1996). ** - A number of lots (not particular items).

The origin of the Manchester Museum's insect collections dates back to the foundation of the Museum by the 'Manchester Society for Promotion of Natural History' in 1821 (Report 1889 - 90; see Alberti, 2009 for more details). This museum was acquired by the Owens College, the forerunner of the Victoria University of Manchester, in 1864. The New Museum was formally opened on 8th June 1888. The oldest insect specimens in the museum are the beetles collected by W. Kirby and described by T. Marsham in 1802 (see Johnson, 1996 & 2004).

The formal birth of the Manchester Museum's Entomology Department can be dated as January 1908, when the Museum Committee had conferred the title of a 'Senior Assistant Keeper and Curator of Entomology' on J. Hardy, the famous entomologist who had earlier (since 1881) been the first Assistant and then Senior Assistant Keeper (Report 1907 - 08; Alberti, 2009). The entomological collections however continued to be officially considered a sub-section of the Museum's Zoology Department. J. Hardy retained his title until his retirement in 1918 (see Standen, 1921). His successors, H. Britten and G.J. Kerrich, retained the title 'Assistant Keeper in Entomology'. W.D. Hincks was appointed as Assistant Keeper in Entomology in 1947, but in 1957 his title was changed to 'Keeper of Entomology' (Report 1957 - 58). The latter title existed until 2003, when it was changed to 'Curator of Arthropods' as a result of a complete restructuring of the Museum and its staff: the role of Keepers ceased and new posts of Curator were created (Report 2002 - 03). The word 'entomology' disappeared from the title because such arthropod groups as Arachnida, Myriapoda and Crustacea became the Curator's responsibilities as well. From 2004 until the present time, the staff of the Museum's Entomology Department consists of the Curator (Dr. Dmitri V. Logunov, a Russian-born and educated entomologist and a specialist on spiders) and the Assistant Curator (Mr Phillip Rispin, a keen lepidopterist), plus a variable number of Honorary Curatorial Associates and volunteers.

The particular strengths of the Manchester Museum's entomology department are such collections of international importance as F. Spaeth's collection of tortoise beetles (Cassidinae), the worldwide collection of earwigs (Dermaptera), D. Hincks & J. Dibb's world Coleoptera collection, H. Last's world collection of rove-beetles (Staphylinidae), C.H. Schill's world Lepidoptera collection, D. Longsdon's collection of Papilionidae, and the comprehensive collection of British insects (see Table 2). The collections historically fall into two sections, the British and foreign collections are kept separately. Such separation was arranged when the Entomology department moved to the Coupland building, where it is now, in December 1978 (Report 1978 - 79). The aim of the current paper is to provide a brief general account of the Manchester Museum's British insect collections only. No collections of other arthropod groups are discussed.

Two main sources of information were used for writing this report. The main one was a set of the published Manchester Museum's Annual Reports retained in the Entomology Department and in the Central Museum Archive. These reports were published under seven slightly different titles, namely: 'Report of the Manchester Museum Owens College' (1889 - 95), 'Report of the Keeper of the Museum' (1895 - 98), 'Report of the Director of the Museum' (1898 - 1900), 'Report on the progress of the Museum' (1900 - 91), 'Report of the Museum Committee' (1902 - 53), ''Report of the Committee' (1953 - 72), and 'Annual Report' (1972 - 85, 1996 - 2003). For simplicity, all the published Museum Reports are cited in the text as 'Report' followed by the corresponding years, and in the list of cited literature a single reference is given to all of them (94 Reports altogether). No Museum Reports were produced during the First World War (1917 - 1921), for the ten-year period 1986 - 95, when the achievements of the Manchester Museum were included in the University's annual reports (Report 1996 - 97: p.2), and no published Reports are produced now (they ceased in 2004).

The second source of information used alongside the Reports was the Register, volume *F* (Insects) of the Manchester Museum. The Register contains records of the majority of entomological acquisitions. The acquisition numbers (e.g., F2484, F2484, etc.) mentioned in the following text refer to the corresponding numbered records of the Register. Unfortunately, regular records in the Register started to be done from 1893 only, with gaps in the records for the periods 1897-98, 1906-10, 1916-17 and 1938 - 46. Poor earlier records in the Register are well compensated by detailed itemized lists of new acquisitions given in the Museum Annual Reports published for the corresponding years. Neither Annual Reports, nor the Register represent comprehensive sources of information, and both have been used for extracting information for the present essay (with cross-references wherever possible).

British Insect Collections

The collection of British insects in the Manchester Museum consists of over 730,000 specimens belonging to 13,853 species (see Table 2), with an average of 55% species coverage for the British fauna (ranging from 100% in Raphidioptera or Dermaptera to only 8% in Collembola). The collections of dry specimens and slides are housed in the main Entomology store in the Coupland Building of the Manchester Museum, where it was moved to after the latest Capital Development Project (1994 - 2003; see Report 2002 - 03). Historically, the British collection has been kept separately from the foreign insects, and it currently occupies 1,264 drawers in 102 wooden/steel cabinets. The Lepidoptera occupy 18 cabinets of various sizes (470 drawers), the Hymenoptera occupy 18 cabinets (180 drawers), the Diptera occupy 29 cabinets of various sizes (288 drawers), the Coleoptera occupy 23 new 15-drawer steel cabinets (306 drawers), smaller orders occupy 12 cabinets (120 drawers), and slide collections are kept in two cabinets (20 drawers). There is a substantial amount of unidentified material for Diptera and parasitic Hymenoptera or duplicates of Lepidoptera kept in 138 storage boxes (59,200 specimens; Table 3). Spirit collections of over 73,000 specimens (see Table 2) are housed in the basement store either in steel cabinets (e.g., Diptera larvae), or on a roller-racking shelving system in plastic boxes according to orders of insects.

The Manchester Museum inherited the insect collections of the Manchester Natural History Society. However, these collections "suffered so much from exposure to the light and other causes that very few specimens were in a fit state for exhibition, and it

Table 2. The size of the British insect collection at the Manchester Museum

Taxon	British fauna	MM's collection	%	Dry	Spirit	Slides
Thysanura	9	5	**56**	18	90*	10
Ephemeroptera	50	42	**84**	1,513	8,095*	12
Odonata	45	43	**96**	990	459	44
Plecoptera	36	30	**83**	1,193	13,051	39
Orthoptera	33	29	**88**	814	-	58
Dermaptera	7	7	**100**	252	6*	23*
Blattodea	9	8	**89**	176	-	18*
Psocoptera	68	35	**51**	487	477*	45
Phthiraptera	545	324	**59**	5	13*	2,823
Thysanoptera	160	58	**36**	-	1,400*	624
Hemiptera	2,000	1,078	**54**	12,558	650*	3,798
Neuroptera	65	44	**58**	1,667	101*	24
Megaloptera	3	2	**67**	55	-	-
Raphidioptera	4	4	**100**	42	-	-
Coleoptera	4,000	3,694	**92**	393,438	?	356*
Strepsiptera	20	2	**10**	4*	-	4
Mecoptera	4	3	**75**	136	-	10
Trichoptera	198	161	**81**	4,166	25,623*	200
Lepidoptera	2,708	1,653	**61**	50,275	115*	314*
Diptera	7,032	3,349	**48**	79,795	22,291	1,629
Siphonaptera	62	51	**82**	-	101*	660
Hymenoptera	7,517	3,197	**43**	42,015	-	749
Collembola	335	26	**8**	-	240	673
Protura	12	3	**25**	-	-	6
Diplura	12	5	**42**	-	-	17
Unidentified				59,200		
Total	25,054	13,853	**55**	648,799	72,712	12,136
			Total No. of specimens:		**733,637**	

*- Estimates based on old counts by C. Johnson (28/10/1996). The question mark (?) means that there is no reliable figure yet; a dash (-) means there are no specimens of that kind. If not otherwise stated, the counts of the British fauna are based on Barnard (1999), with more updated data taken from the following sources: Coleoptera (Cooter & Barclay, 2006); Diptera (Chandler, 2010); Hemiptera (British Bugs, online at: http://www.britishbugs.org.uk/systematic.html); Hymenoptera (G. Broad, pers. comm.); Lepidoptera (Kimber, 2010); Psocoptera (National Barkfly Recording Scheme, online at: http://www.brc.ac.uk/schemes/barkfly/homepage.htm); Siphonaptera (Whitaker, 2007).

was therefore necessary to commence the collection *de novo*" (Report 1890 - 94: p.16). Thus, it was J. Hardy (Figure 1) who, thanks to his enthusiasm and personal relations, commenced the original arrangement of the collection of British insects and assembled its nucleus. The first valuable acquisition to this collection was the purchase of the E.D. Collett collection of British beetles (Report 1890 - 94). In 1904, J. Hardy visited the Hope Entomological Collection in Oxford and studied their collection arrangement, which was followed at Manchester (Report 1904 - 05). However, it was H. Britten (Figure 2), the Museum's Assistant Keeper in Entomology (1919 - 1938), who was primarily responsible for building up the bulk of the extensive collection of British insects (Hincks, 1954; Johnson, 1996). H. Britten paid particular attention to the so-called 'critical groups in entomology' (parasitic Hymenoptera, Diptera, Thysanura, Phthiraptera, aquatic insects, and some others), which were entirely ignored at this time by other entomologists (see Britten, 1924). The Manchester Museum benefited strongly from acquiring Britten's personal collection of British insects, approximately 60,000 specimens, in 1951 (F2042; Report 1950 - 51) and some smaller collections donated by him earlier, for instance, over 600 named

British Diptera in 1948 (F1962; see Report 1947 - 48) or 455 British neuropteroid insects in 1948 (F1974; see Report 1948 - 49).
W.D. Hincks, “one of England’s greatest Entomologists” (Kloet, 1961), took his duty as a new Assistant Keeper in Entomology in August 1947. He immediately and actively commenced a total re-organisation of the British insects, cataloguing the entire collection and enlarging the departmental library (Report 1947 - 48). By 1961, all orders of British insects in the Manchester Museum, with the exception of the Coleoptera, had been arranged in cabinet drawers in the systematic order of the Checklist by Kloet & Hincks (Report 1960 - 61). The re-arrangement of the British Coleoptera was accomplished in 1962 (Report 1961 - 62). The beetle collection was housed in 180 cabinet drawers, of which nearly a hundred drawers came with the collection of British Coleoptera (F2411) received in July 1958 as a bequest from the late R.W. Lloyd. This important re-organization of the collections of British insects

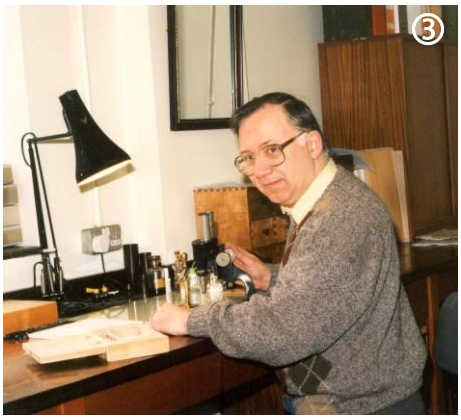

Figure 1. The Manchester Museum staff in 1898. Standing: C.B. Crampton (Geology), R. Standen (Zoology), W.E. Hoyle (Director), J.R. Hardy (Entomology), H. Murray (Botany); sitting: F.C. Ede (Printer), C. Nördlinger (Secretary).

Figure 2. Harry Britten, the former Keeper of Entomology of the Manchester Museum, at the time of being the president of the Manchester Entomological Society (1922-23).

Figure 3. Colin Johnson (mid to late 90s), the former Keeper of Entomology, who re-curated the British Coleoptera collection; the Manchester Museum.

was completed successfully by W.D. Hincks, with the aid of S. Shaw, the technician in Entomology (1949 - 1956), and later of A. Brindle, "making the Museum's Entomology Department the finest reference and study centre in the North" (Kloet, 1961); the position that the Museum still retains.

In ten years (by 1972), thanks to the deep enthusiastic commitment and energy of A Brindle, all the British insect collections, which were preserved as dried specimens, apart from Lepidoptera and with the exception of part of the Diptera and the Trichoptera, had been re-housed in standard Hill units (Report 1971 - 72). Collections of Coleoptera, Diptera and aquatic insects continued to be re-organized and re-grouped during the following years (see below).

Table 3. The size of the collection of unidentified British insects.

Taxon	Store boxes	Specimens
Lepidoptera	16	2,229
Coleoptera	1	20
Diptera	30	14,916
Hymenoptera	58	27,234
Diptera/Hymenoptera	15	6,488
Small orders	18	8,313
Total	**138**	**59,200**

Types

The Manchester Museum's collection of British insects does not contain many type specimens. The majority belong to three orders: Coleoptera (186 specimens of 16 species, mainly described by C. Johnson, but also by T. Marsham and others), Diptera (80 type specimens of 23 species, described by J.E. Collin, F.W. Edwards, B.M. Hobby, and a few others), and Hymenoptera-Parasitica (113 specimens of 33 species, described by R.R. Askew, F. Enoch, W.D. Hincks, G.J. Kerrich, D.S. Wilkinson, and others).

It is interesting to note that a decision to retain type specimens in the Manchester Museum was taken only in 1928 (Report 1928 - 29), contrary to the "well-known opinion of some naturalists that all type specimens in Great Britain ought to be preserved in the British Museum (Natural History)". The reason for that was the acquisition of the A.W. Waters collection of Bryozoa, which contained a considerable number of type specimens. The Museum Committee had a special meeting and came up with the recommendation that "the Manchester Museum should retain all type specimens now in its collection and should accept others which may be offered in the future".

According to Johnson (1996), the entire holding of type specimens, primarily in the collection of foreign insects, is some 12,000 specimens representing over 2,300 species (Table 1). However, this figure reflects the state of the Museum's insect type collections on March, 1982. The current number of types is higher and remains to be counted. An incomplete card index of the Museum's type specimens was started in 1967 (Report 1966 - 67), and its first version was completed in 1970 (contained the records of 1,706 species, see Report 1969 - 70). The first computer-based list of Manchester Museum's entomological types was produced by the Museum's Computer Catalogue Unit (led by C.W. Pettitt, Assistant Keeper of Zoology at that time; Report 1981 - 82; see also Alberti, 2009) in March 1982, and exists in a few printed copies in the Department. Although already in 1983 it was felt that "the production of printed catalogues of existing information should be the aim for the foreseeable future" (Report 1982 - 83), no up-dated and complete catalogue of the types has been prepared and published.

Coleoptera

Total holding is over 390,000 specimens, representing 3,694 species, with 92% species coverage of the British fauna (Table 2). A full account of the Manchester Museum's British Coleoptera collection was provided by Johnson (2004 & 2009).

The general Coleoptera collection (306 drawers) contains the collections of the following persons: H. Britten, E.P. Collett, J.E. Cope, E.M. Eustace, C. Johnson, J. Kidson-Taylor, R.W. Lloyd, A. Reston, J. Sidebotham, R. Standen, and many others. A significant part of the Coleoptera collections has not yet been incorporated into the main collection and is kept either in 238 storage boxes (96,796 specimens in total), or in the original cabinets in which the specimens were acquired, viz., an unsorted part of the W.G. Blatch beetle collection (F3268; 31,686 specimens; received in 1958) and J. Hardy collection (in two 12-drawer steel cabinets, 13,629 specimens of about 700 species), received in March 1953 as part of the M. Minshull collection of British Coleoptera (F2077; Report 1952 - 53). The Hardy collection consists of small glass-topped boxes with specimens mounted inside them, originally with the idea that "they can be readily examined without a risk of injury to the specimens" (Report 1899 - 1900). Specimens from both the Blatch and Hardy collections were partly incorporated into the general collection.

The Coleoptera material kept in storage boxes includes many individual collections, for instance, the G.W. Bartindale collection (F3214; received in 2002 in 29 storage boxes, partly incorporated in the general collection); H. Caiger water beetle collection (F2551; received in 1970 in four storage boxes); R.R. Uhthoff-Kaufmann collection (F2411; received in August 1958 as part of the R.W. Lloyd bequest in 10 storage boxes, restricted to Cerambycidae); and many others (for further details see Johnson, 2004, 2009). In addition, there is a spirit collection of beetle larvae and adults (not counted yet).

The British Coleoptera were first organized into one large collection comprising 2,374 species and 11,200 specimens by J. Hardy, making it equal 'to any in the country' (see Report 1909 - 10) and with 64% species coverage of the present Coleoptera collection. In 1929, H. Britten started re-curating the British Coleoptera "with a view to their arrangement in a single comprehensive collection" (Report 1929 - 30), and gradually continued to complete this task until his retirement in September, 1938 (Report 1938 - 39). When W.D. Hincks became the Assistant Keeper in Entomology (in 1947), the first task he set himself was the combining the three large collections of British Coleoptera into one (Report 1947 - 48). The task took over five years and included re-pinning every insect and the providing every specimen with a new label giving the name of the collection from which it came. Furthermore, the steady development of this collection had continued at a quick pace, for instance, in 1952 the total holding of British Coleoptera was about 50,000 specimens (Report 1951 - 52), whereas in 1957 it was already about 140,000 specimens (Report 1956 - 57). The latter figure did not include the large collection of British Coleoptera by R.W. Lloyd, which was accessioned in 1958 (F2411; Report 1957 - 58). By 1962, the Lloyd collection was fully re-organized and combined with the main Coleoptera collection (Report 1961 - 62). Since that time the beetle collection has been significantly extended (180 drawers in 1962 *vs*. 306 at present) and revised by C. Johnson (Figure 3), who worked in the Entomology department for 31 years (1961 - 2003; Report 2002 - 03), originally as an entomology technician, becoming Assistant Keeper in 1972 and the Keeper of Entomology in 1982, after the retirement of the previous Keeper, A. Brindle (see Johnson, 1996). In 2005, the British Coleoptera collection was re-housed in 23 new 15-drawer steel cabinets (Figure 4).

Lepidoptera

British Lepidoptera are reasonably well represented, currently with 61% species coverage and over 50,000 specimens representing 1,653 species (Table 2). Both figures are not final, as the comprehensive collection of micro-Lepidoptera has not yet been completely counted and databased. The basis of the general collection of British Lepidoptera is the H.N. Michaelis collection of macro-Lepidoptera acquired in May 1959 (F2414; Report 1958 - 59), plus more

specimens from him received in 1962 - 63 (F2461, F2471). However, already in 1951 H.N. Michaelis arranged a reference collection of British Lepidoptera for the Manchester Museum, which could "be consulted for ordinary purposes, instead of the historic Sidebotham Collection" (see Report, 1950 - 51).

The general collection of British macro-Lepidoptera was fully re-organized by A. Brindle in 1963-64 (Report 1963 - 64). It is full of data and contains much local material, including specimens obtained earlier from J.S. Ashmore, J. Cosmo Melville, J. Hardy, U. Eckett, H.J. McDowall, L. Nathan, E. Ridsdale, H. Worhington, and others. Some of these specimens are significant and have been published on. For instance, the Hardy collection of some 840 species of macro-Lepidoptera was mainly collected from Sherwood Forest over a period of 20 years (from March 1879 to September 1900; see Report 1898 - 90; Standen, 1921; Britten, 1922a) and served as the basis for his publication (Hardy, 1901).

Some of the British macro-Lepidoptera collections are still retained as individual collections, for instance, the R.C.R. Crewdson Lepidoptera collection received in 1978 (F2708); plus a small corresponding archive and handwritten index to this collection (see Table 5). This collection consists of three 20-drawer cabinets (Noctuidae, Geometridae & various families) (Figure 5), and a storage box of 287 unidentified specimens. The collection is fully labelled and contains lots of local material. An important collection of macro-Lepidoptera was received from R. Dennis, as three subsequent batches in 1985, 1996 and 2008 (3,787 specimens of 34 species; F2871, F3109, F3344). This collection contains long series of voucher specimens of the butterflies collected by R. Dennis to advance his work on the origin of British butterflies (Dennis, 1977) and also used for a number of his other scholarly publications (e.g., Dennis, 1982, 1984; Shreeve *et al*., 1995; etc.).

British moths and butterflies are also available in the collections of Palaearctic Lepidoptera by P. Schill received in 1901 (Report 1900 - 01), in the R. Lloyd's European Lepidoptera received in 1958 (F2412), and even in the worldwide D. Longsdon's collection of Papilionidae (e.g., 7 specimens of the English Swallowtail, *Papilio machaon brittannius*, collected from England in 1894) received in 1938 (F3219; Report 1937 - 38); none of these collections have been counted or databased.

A historically-important collection is the J. Sidebotham collection of British Lepidoptera (F3259), consisting of two 40 and 32-drawer cabinets according to macro- and micro-Lepidoptera, and was received in 1919 from his son (Hancock & Pettitt, 1981). It is a good example of the Victorian private entomological collections. Joseph Sidebotham (1824-1885) was a calico printer and JP. His interest ranged from botany and entomology through astronomy and photography. He also collected diatoms and was one of the founders of the Manchester Field Naturalists' Society (Anon, 1885 - 86). All his specimens are perfectly mounted, reliably identified and are in perfect condition. However, only a few of them are labelled (e.g., the gynandromorphic specimens of the Orange Tip, *Anthocharis cardamines*; Figure 6), though there is an incomplete locality index. This collection also contains a few type specimens, for instance, the holotype of *Elachista holdenella* Stainton, 1854 of Elachistidae (now, a junior synonym of *E. atricomella* Stainton, 1849; see Bland, 1996).

It is known that the majority of specimens in the Sidebotham Lepidoptera collection were collected in Britain in the late 19th century, but some might have originated from France. Since that time several species have already become extinct in the UK, for instance, the Large Copper butterfly (the subspecies *dispar*) represented by a series of 20 specimens in this collection. The Sidebotham collection was partly re-labelled in 2006 according to the checklist by Bradley (2000).

There are two main collections of British micro-Lepidoptera. The first one is the H.N. Michaelis collection of British micro-Lepidoptera, donated by him in 1964 (F2484; Report 1964 - 65). The collection consists of two cabinets: one 32-drawer cabinet (Tortricidae-Pyralidae), which originally belonged to H.N. Michaelis, and one 30-drawer cabinet (Tinaeoidea), originally one of

the Cosmo Melville cabinets that was given to Michaelis when he presented his macro-Lepidoptera to the Entomology department. This collection is fully labelled, with numerous specimens from Cheshire and Lancashire collected in 1910 - 1960; yet the collection is out-of-date from a nomenclatural point of view.

The second one is the great collection of micro-Lepidoptera by the late Lord Walsingham (F3260; a total of 2,289 specimens, locality labels are poor). This collection represented almost every species of British micro-Lepidoptera recorded by 1927 (Report 1927 - 28). It was received in several instalments over a period of 20 years (from 1907 to 1927) through the British Museum of Natural History (BMNH, London; see Reports 1907 - 08, 1927 - 28), as an exchange for one of the two specimens of the Manchester Moth. There is some correspondence regarding this exchange in the departmental archive (Table 5). In 1964 - 65, the collection was re-arranged in a 40-drawer cabinet, which also accommodated the specimens of micro-Lepidoptera received earlier from Rev. Canon Cremer (in 1912; Report 1912 - 13), J. Higgnett (in 1952; F2063), and L. Nathan (in 1953 and 1958; F2078, F2408).

The most famous specimen in this collection is the celebrated Manchester Moth, *Euclemensia woodiella* (Curtis, 1830), of which a single specimen is now kept in the Manchester Museum (Figure 7). The moth was described by John Curtis, the author of the eight-volumed '*Curtis's British Entomology*', in 1830. It is a tiny, inconspicuous and delicate specimen, with its wingspan of less than one centimetre. The specimen is in a rather poor condition, with most of its legs, right antenna and half of the abdomen missing, and now the right forewing is also torn apart.

Only three specimens of the Manchester Moth survived and exist today: viz., in the Curtis collection in the Melbourne Museum (Australia), the BMNH, and the Manchester Museum. The specimen kept in Melbourne is the holotype studied by Curtis (1830; see Walker, 2001). According to Sidebotham (1884), the two specimens from the BMNH and the Manchester Museum originally belonged to S. Carter, a member of the Manchester Natural History Club, and then were sold with his collection of British insects to the Museum by the Manchester Natural History Society. The insect collections of the latter institution were acquired by Owen's College in 1868. Sidebotham (1884) also mentioned a fourth specimen of the Manchester Moth which belonged to G. Crozier, another member of the Manchester Natural History Club, but its whereabouts remain unknown.

Originally, in June 1829, a series of 50/60 specimens was collected by the collector Robert Cribb from Kearsall Moor (Salford, Manchester). Unfortunately, the storage box containing the specimens was destroyed by Cribb's landlady in revenge for rent arrears. Since then, nobody else has been able to find any further specimen. The complete story of the Manchester Moth was outlined by Sidebotham (1884), Cosmo Melville (1924) and Brindle (1952); see also a brief note by an anonymous author (1924). Yet, this species remains an unsolved scientific conundrum. The validity of this species was confirmed by Koster (2002) and others (see Walker, 2001), but the question of where it lives or comes from remains completely unanswered. It is believed that this species does not occur outside Britain and is now most likely extinct (Koster, 2002), but see Lees (2005).

It is worth noting that while describing the species Curtis (1830) clearly stated that he studied a single specimen and it was a female, whereas Koster (2002), who apparently re-examined the holotype (though 'Material examined' was not provided in his re-description), referred to the male only. It may mean that the original series might have contained both sexes. Unfortunately, the specimen kept in the Manchester Museum (Figure 7) has no abdomen and thus it is impossible to verify the matter.

Visitors to the Manchester Museum are able to see this unique specimen in the store, by appointment with the Curator. Besides, there is a special little display devoted to the Manchester Moth in the new Museum's 'Manchester Gallery' opened in spring 2009.

Finally, there are also a small number of Lepidoptera specimens in spirit (Table 2), for instance, a series of preserved caterpillars purchased in four batches from H.E. Hammond in 1960 - 63 (F2118, F2428, F2438, F2452; Reports 1959 - 63), and 16 storage boxes of duplicates and undetermined specimens (e.g., from Crewdson micro-Lepidoptera) (Table 3).

Diptera

The collection of British Diptera numbers over 100,000 specimens of various kinds (dried, in spirit and mounted on slides; Table 2), representing 3,347 species with 48% species coverage of the British fauna (see Logunov, 2010a, for a detailed account). The present collection has been developed in three recognizable stages.

(1) The British specimens of Diptera (and of Hymenoptera) were first assembled together by J. Hardy (Report 1896 - 97). At that time the entire Museum's collection of British insects was relatively small, fitting in a single 40-drawer cabinet, which was purchased to accommodate it (Report 1897 - 98). In the following years J. Hardy continued to augment both collections, for instance, by adding about 50 species of Diptera and 80 species of Hymenoptera in 1903 and later on (see Reports 1902 - 03, 1909 - 10). The first revision of the Museum collections of British Diptera was commenced by J. Hardy in 1912, when he added over 40 species, mainly from his own collecting (Report 1912 - 13). In the following two years, he added over 3,000 specimens of Diptera, comprising some 300 species, to this collection (Reports 1913 - 15). The size of the entire collection of British Diptera at that time remains unknown, but it should have been around 500 species.

(2) During the period 1922 - 1929, H. Britten, the successor of J. Hardy, collected and mounted thousands of Diptera specimens, with some 200 named and new to the museum species being added annually (Reports 1922 - 29). Most of these specimens were collected by H. Britten himself from Lancashire and Cheshire, and served as the basis of a number of his published notes (e.g. Britten, 1922b). H. Britten started working on the Diptera under the influence of his friend, Dr F.W. Edwards of the British Museum, who also encouraged C.H.W. Pugh to work with the flies (Brindle, 1974). While working on the Diptera, H. Britten devised an original method of 'side-mounting' of specimens (Anon, 1954; Hincks, 1954), each with a neat handwritten label. As Grensted (1954) put it, "the speed and perfection of his setting was a joy to watch". This is why all the Diptera specimens, as well as those of other insect orders, mounted by H. Britten are easily recognisable in the collection (Figure 9). The collection continued to be developed by various means, including exchanges: e.g., an exchange of Diptera species with the University Museum of Zoology in Cambridge that added 34 new species to the Museum's collection (F1893; Report 1934 - 35). In 1934, the first revision of the British Diptera collection was carried out by H. Britten (Report 1933 - 34). Unfortunately, it was not mentioned how large the collection was at that time. A steady progress in arranging and augmenting the collection of Diptera continued in the following years (Report 1935 - 36). The most notable addition, before H. Britten retired in 1938, had been a collection of over 300 named species received from the BMNH "in return for many new and rare specimens he presented to them" (Report 1936 - 37). It is worth mentioning that the extensive information on the Diptera accumulated by H. Britten both in his museum collections and in the card-index of faunistic records based on his collecting in the north-west (see below under 'Archives') served the most important single source of data for the famous checklist of the Diptera of Cheshire and Lancashire by Kidd & Brindle (1959).

In the period from 1938 to 1962, only a few re-arrangements to the Diptera collection were made: e.g., the Culicidae were arranged and the previously accessioned families Chironomidae, Ceratopogonidae and Mycetophilidae were incorporated into the general collection; and an exchange with H. Audcent was arranged, with many species new to the collection, particularly in the family Tachinidae (Report 1939 - 40).

(3) A further big development of the Diptera collection was undertaken during the term of keepership by A. Brindle (1962 - 1982). This development included both relatively small acquisitions, such as a series of British Diptera from C. Johnson (F2469; Report 1963 - 64) or a collection of British Tachinidae from J. Kennaugh (F2483; Report, 1964 - 65), and taxonomic

revisions of particular families. For instance, C.E. Dyte and E.C.M. D'Assis Fonseca revised 850 specimens of Dolichopodidae during their work on the Handbook for the Identification of British Dolichopodidae (Report 1973 - 74); or L.N. Kidd (re)identified many specimens of Mycetophilidae while revising the British species (Report 1970 - 71).

Figure 4. The new steel cabinets for the British Coleoptera collection; the Manchester Museum.

Figure 5. Shelves with storage boxes of unidentified British insects (see Table 3), the Manchester Museum.

Figure 6. Two gynandromorphic specimens of the Orange Tip, Anthocharis cardamines*; the Sidebotham collection of Lepidoptera, the Manchester Museum.*

Figure 7. The Manchester Moth, Euclemensia woodiella*, from the Walsingham collection of micro-Lepidoptera; the Manchester Museum.*

In 1967, it was understood that a total revision of the British Diptera collection had been required, for "this collection was in need of extension, and the original lay-out was too restricted to accommodate the number of species which have been added to the British List in recent years" (Report 1966 - 67). Such reorganisation, continued for several years, was undertaken by A. Brindle and resulted in the British Diptera collection that the Museum retains now.

The basis of the present Diptera collection of dried specimens is the extensive collections of C.H.W. Pugh, made principally in Shropshire and North Wales (Lees, 1974), with much of the earlier material collected by H. Britten (Figure 10), who was a personal friend of Mr Pugh. Notable additions to this collection were also made by A. Brindle. For instance, a 40-drawer cabinet of British Diptera (over 5,000 specimens) was received from him in the late 1960s, and all specimens were incorporated into the Museum collection (Report 1968 - 69).

The large Diptera collection of C.H.W. Pugh was received in two batches: the first part in May-June 1972 as a donation (F2583, F2584), with the remainder and his archive in May 1973 (F2596; Table 5) on the death of Mr Pugh (by will). His collection was housed in nearly 60 storage boxes in which most of the collection was arranged systematically, with boxes of undetermined or partly determined material. The complete collection contained about 20,000 specimens of well over 2,000 species, and at that time "it was the finest collection of its kind existing in private ownership" (Report 1971 - 72) and "notable for its neatness" (Brindle, 1974). C.H.W. Pugh adopted the side-mounting technique of his friend H. Britten and mounted Diptera specimens on one end of a small strip of celluloid (Brindle, 1974), making all his specimens easily recognizable in the general collection. In 1972 - 1974, the main part of the Pugh collection (except Chironomidae) was incorporated into the Museum's Diptera general collection by A. Brindle (see Reports 1972 - 74). The rest of the undetermined material is still in 30 storage boxes (Table 3).

Since the late 1970s, the Diptera collection of dried specimens has been developed at a slower pace and largely benefited from the specimens collected by A. Brindle during his survey on Diptera and the smaller aquatic orders of the north-west, on the 10-kilometre recording system (Reports 1976 - 80). This survey also resulted in the assemblage of a large spirit collection of adults, mainly of the Tipulidae and other Nematocera families, and of Diptera larvae of all families (over 22,000 specimens of 540 species; Table 3).

The present Manchester Museum's Diptera collection of dried specimens still remains in the same state as it was left by A. Brindle after his retirement in 1982. In recent years, a few new acquisitions have been made, for instance, the W. Kenneth-Booker collection of British Syrphidae of 234 specimens, received in 1995 (F3078). Although some of the Diptera groups were recently revised (e.g., Mycetophilidae, see Chandler, 1991), overall, the nomenclature of the entire collection is currently in need of updating and revision.

Hymenoptera

The collection of British Hymenoptera numbers over 42,000 specimens of various kinds (dried and mounted on slides; Table 2), representing 3,134 species with 42% species coverage of the British fauna; plus over 27,000 specimens of undetermined material (Table 3).

As with other insect groups, the British specimens of Hymenoptera were first assembled by J. Hardy (Report 1896 - 97). In the following years, he augmented the collection by adding about 80 species of Hymenoptera in 1903, no specific group was mentioned (see Reports 1902 - 03), and by collecting many hundreds of the British Ichneumonidae in 1917 (Report 1916 - 17). Obviously, at that time the entire collection of British Hymenoptera was small and originally developed at a rather slow pace, mainly by relatively small acquisitions, such as: an uncertain number of Ichneumonidae and the sawflies, *Urocerus gigas* (L.) and *Sirex juvencus* (L.), were presented by members of the Manchester Entomological Society (Reports 1904 - 05, 1908 - 09); and a valuable collection of Mymaridae by the late F. Enock, of some 200 microscopic slides, which constitutes one third of the present slide collection of the Hymenoptera, with a corresponding archive (see Table 4) acquired in 1916 (Report 1916 - 17).

Since H. Britten was interested in many insect orders (Anon, 1954; Hincks, 1954), he also contributed to the development of the Hymenoptera collection, primarily, the sawflies and Aculeata. For instance, in 1924 he added a large but non-specified number of species to Aculeata and identified most of the Museum's British sawflies (Report 1923 - 24). By 1928, he had completed the first revision and re-arrangement both of the Hymenoptera-Aculeata and of the Hymenoptera-Symphyta (Reports 1925 - 26, 1927 - 28); unfortunately, the size of these collections was not mentioned. Of other groups of the Hymenoptera, an extensive collection of British Ichneumonoidea was purchased from L.A. Carr of Lichfield in 1925 (Report 1925 - 26), and a number of parasitic Hymenoptera were successfully reared by H. Britten from various larvae of Lepidoptera and Diptera (Reports 1924 - 25, 1938 - 39). By 1928, the collection of British parasitic Hymenoptera had been completely re-mounted and labelled in preparation for further re-arrangement (Report 1927 - 28), and by 1938, the Ichneumonidae had been sorted by H. Britten to genera and tribes (Report 1938 - 39). Further progress in the development of the British Hymenoptera was made by H. Britten until his retirement in 1938, including a number of small acquisitions: e.g., 19 specimens of parasitic Hymenoptera received from J. Murray, and a collection of British species of Ichneumonoidea (135 species), Aculeata (15), Symphyta (22) and nine other Hymenoptera, received from A.E. Wright (Reports 1935 - 36, 1938 - 41).

After the retirement of H. Britten, the next Assistant Keeper in Entomology was G.J. Kerrich (1938 - 1947), a recognized authority in certain groups of the parasitic Hymenoptera. Unfortunately, because of the Second World War he was seconded to the Department of Agricultural Entomology, Manchester University to assist with advisory work for the war effort (Noyes, 2003; Report 1940 - 41). The development of all insect collections of the Manchester Museum, including the Hymenoptera, stagnated for almost five years. Annual reports from that period largely contain references to removing verdigris and cleaning mould from parts of the collections. Only in October 1945, did G.J. Kerrich returned to his taxonomic research and made some progress with determination and checking of the parasitic Hymenoptera, in particular, of the Diplazonini and Pimpini which were re-arranged. However, the naming of the whole collection of the parasitic Hymenoptera was checked by him (Report 1946 - 47). At the same time a few small acquisitions of the Hymenoptera were made, for instance, several specimens of gall-wasps and sawflies received from H. Britten (Report 1944 - 1945), four boxes of unnamed parasitic Hymenoptera from A.E. Wright, reared parasitic Hymenoptera from B.B. Snell, a number of Ichneumonidae from H.N. Michaelis and D.P. Murray, and others (Reports 1945 - 47). G.J. Kerrich departed from the Museum in 1947, following a career at the Commonwealth Institute of Entomology at the BMNH (Johnson, 1996; Noyes, 2003), and W.D. Hincks succeeded the post of Assistant Keeper in Entomology in August 1947.

As already mentioned above, W.D. Hincks commenced a total re-organisation of the British insects in the Museum, including the Hymenoptera. For instance, a revision of the British fairy-flies (Mymaridae), based on the Museum holdings, was completed in only one year (Report 1947 - 48), and by 1953 all the British saw-flies had been re-arranged and (re)identified by G.S. Kloet (Report 1952 - 53). A number of acquisitions made at that time included: the parasitic Hymenoptera bred from Lepidoptera by N.H. Michaelis; tenanted cells of the leaf-cutter bees (*Megachile* sp.) received from J. Armitage (Report 1947 - 48); type specimens of the species described by W.D. Hincks himself (Report 1951 - 52; see Hincks, 1951b, 1952); and others.

Further steps of the development of the British Hymenoptera collection were undertaken by A. Brindle, a universal entomologist and the next Keeper of Entomology, who revised the collection in accordance to newest checklist of British insects (Report 1979 - 80). Some of the museum Hymenoptera collections were revised by leading authorities on the group, for instance, I.D. Gauld, of the Commonwealth Institute of Entomology, who (re)examined some parasitic Hymenoptera (Report 1977 - 78). However, the Hymenoptera collection especially benefited from the expertise of R.R. Askew, of the Zoology Department of the University, who was working in his capacity as Honorary Keeper of Hymenoptera from 1974 to 1977 (Reports 1974 - 77). R.R. Askew identified and arranged the Museum's collection of the Chalcidoidea, and published a series of seven papers in the *Entomologist* based on the museum collections

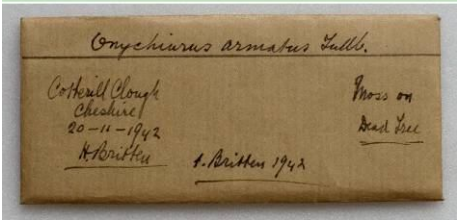

Figure 8. The Crewdson collection of British Lepidoptera, two of the three available cabinets (top) and a drawer with Noctuidae (bottom); the Manchester Museum.

Figure 9. A specimen of Limonia flavipes*, mounted and labelled by H. Britten; the Manchester Museum.*

Figure 10. Left to right: Alan Brindle, Colin Johnson and Tom Goss (mid 80s); the Manchester Museum.

Figure 11. Microscopic slide preparations are stored in individual paper envelopes, following the original method suggested by H. Britten; the Manchester Museum.

(Report, 1964 - 65; see Askew, 1962ab, 1964, etc.). Some of his types and those of other entomologists (e.g., the three paratypes of *Achrysocharoides carpini* Bryan, 1980) were acquired by the Museum from R.R. Askew (Report 1979 - 80). As with the Diptera collection, the present Museum's Hymenoptera collection of dried specimens remains almost in the same state as it was left by A. Brindle after his retirement in 1982. A few new acquisitions were made in recent years, for instance, the notable W. Kenneth-Booker collection of British Hymenoptera-Aculeata of 1963 specimens received in 1995 (F3076). Yet, the entire Hymenoptera collection is now in need of updating and a revision. Some groups of the parasitic Hymenoptera have already been revised (e.g., the genus *Ooctonus*; see Triapitsyn 2010), or are being revised at present by S.V. Triapitsyn (USA), for instance, all the material on the genus *Polynema* (Mymaridae; 743 specimens altogether).

Hemiptera

The collection of British Hemiptera numbers over 17,000 specimens of various kinds (see Table 2), representing 1,078 species with 54% species coverage of the British fauna.

The present collection occupies three standard Hill units, with the Heteroptera taking 20 drawers and the Homoptera taking 10 drawers, plus 5 drawers of microscopic slides (one drawer is partly loaded with the Coccidae and four with the Aphididae). The majority of Hemiptera specimens were either received from H.R.P. Collett (Reports 1934 - 35, 1958 - 59), or collected by H. Britten. Only a few acquisitions were arranged during the term of J. Hardy, for instance, a non-specified number of scale insects received in 1908 from Professor T.D.A. Cockerell (Report 1907 - 08). A noticeable number of Heteroptera specimens were also added to the collection by W. Hincks, A. Brindle, and C. Johnson.

The H.R.P. Collett collection was received in two batches. The collection of British Homoptera was donated in 1935 (F1891) and 'formed a good nucleus for a collection of these insects in the Museum' (Report 1934 - 35); unfortunately, its size was not indicated. The collection of British Heteroptera and a small archive were received from Mrs Collett (F2113; Report 1958 - 59), following the death of H.R.P. Collett in 1956.

H. Britten 'collected assiduously Aphididae [...] and made a large series of microscopic preparations, most of which await determination' (Report 1924 - 25). Much taxonomic research on the aphids (and on Mallophaga) were undertaken by him two years later (Report 1926 - 27). Besides his own collecting, H. Britten apparently kept some duplicates taken from unsorted Hemiptera collections sent to him for identification: e.g., collections of Psyllidae and Aphididae from the Glasgow University expedition to the Isle of Canna in 1936 - 37, or a large personal collection of Aphididae by R.J. Spittle (Report 1937 - 38). Otherwise, H. Britten regularly acquired particular species of British Hemiptera new to the collection from various collectors, such as B.S. Williams, P. Harwood and others (Report 1937 - 38). Finally, H. Britten sent a part (some 130 specimens) of his fine collection of British Hemiptera as a gift to the Museum in 1949 (F1990; Report 1949 - 50).

When W.D. Hincks took his duty as Assistant Keeper in Entomology in 1947, he started a revision of all the collections of British insects, including the Hemiptera. By 1950, for the first time, the collection had been assembled in two new cabinets, which were put aside for them, and their systematic arrangement had been completed (Reports 1949 - 51). Of the various small acquisitions of Hemiptera arranged by W.D. Hincks, it is worth noting the one of over 140 specimens of Corixidae he received from E.J. Popham (F1996, F2023; Report 1950 - 51), collected from the Blackburn district, Lancashire, and used in the ecological experiments by the donor (e.g., Popham, 1952).

Further development of the Hemiptera collection resulted from useful small additions by A. Brindle and C. Johnson as a result of their field-works in the north-west (Reports 1972 - 79), and small acquisitions from various individuals, for instance, from A.M. Massee who presented five species of the British Hemiptera not represented in the Museum collection (F2514, F2527; Reports 1965 - 67). The latest small addition to the collection was a donation from D. Mann of

the OUMNH in 2004, who presented four specimens of the *Tamarix* feeding *Tuponia brevirostris* (Miridae) taken from the third British locality (see Mann, 2004) and a specimen of *Opsius stactogalus* (Cicadellidae) (F3220).

Smaller orders

The information about the British collections of smaller orders is much scarcer and incomplete in the Museum's Annual Reports compared to the groups discussed earlier. There are two general features regarding these collections. The first one is that the majority of smaller orders are well- or reasonably represented. For instance, the collections of aquatic groups and Orthoptera account for 56 - 100% of species coverage of the British fauna (Table 2). The Psocoptera, Thysanoptera, Protura and Diplura are reasonably represented (25 - 43% of species coverage). Two groups, Collembola and Strepsiptera, are poorly represented, which is hardly surprising as, for example, the slide collection of springtails contains many undetermined specimens. The second common feature is that external acquisitions played a less important role in developing these collections than personal field-collecting by the Museum's staff, particularly by H. Britten and A. Brindle.

The British Plecoptera and Neuroptera collections of dried specimens were first arranged in order by H. Britten in 1923 (Report 1923 - 24). Two years later, he collected and mounted many hundreds of Ephemeroptera, Odonata, Plecoptera, Neuroptera and Mecoptera, and incorporated them into the existing museum collection, making it 'readily available for students interested in these groups' (Report 1925 - 26). Later, a collection of over 600 specimens of several smaller insect orders, including the Neuroptera, was added to this collection by H. Britten (F1974; Report 1947 - 48). Yet, a more important addition to the Museum was the collection of British Trichoptera, Plecoptera and Neuroptera received in a 40-drawer cabinet from A. Brindle at the time when he became the Keeper of Entomology (Report 1961 - 62). After this, only a few more smaller acquisitions were received until the early 1970s: namely, two small collections of caddis-flies received from H.N. Michaelis and C. Smith (F2534, F2535; Report 1968 - 69) and a spirit collection of British Plecoptera donated by J. Spittle (F2479; Report 1963 - 64).

During 1970 - 72, A. Brindle completely re-arranged and re-housed the dry collection of all British aquatic orders, Ephemeroptera, Plecoptera, Trichoptera and Odonata, in standard 10-drawer Hill units (Reports 1970 - 72). However, it was only the beginning of a further quick and steady development of this collection over the next decade. During the first half of 1972, A. Brindle started a complex entomological survey, mainly of Diptera and the smaller aquatic orders, over the north-west, on the 10-kilometre recording system (Reports 1972 - 73). This survey resulted in additions of thousands of specimens (both adults and larvae), all of which were mounted/preserved, identified and incorporated into the general collection (Reports 1972 - 80). The Manchester Museum should be deeply grateful to A. Brindle for assembling such a fine collection of the smaller orders of British insects.

The collection of Orthoptera occupies seven drawers of a standard Hill Unit, and consists of 844 specimens of 31 species, with 93% coverage of the British fauna. The basis of this collection is the specimens either collected by W.D. Hincks or acquired during the period of his keepership (1947 - 1961). It is hardly surprising, given that it was W.D. Hincks who wrote the Handbook on the British Orthoptera for the Royal Entomological Society's series (see Kloet, 1961). The collection of British Orthoptera was first brought together as part of the total re-organisation of the Museum's insect collections stated by W.D. Hincks (Report 1947 - 48). A nucleus of that collection included some 300 specimens of British Orthoptera collected by W.D. Hincks (F1937, 1985, etc.) and the material collected earlier by H. Britten, with a number of relatively small acquisitions that were worked into the main collection: e.g., the 15 partly named Orthoptera from Somerset presented by J. Cowley (F1926); Orthoptera specimens donated by P.M. Butler (F1933); two females of the grasshopper *Chorthippus brunneus* (Thunb.) from D. Sanderson (F1986); 26 Orthoptera from the Channel Islands from T.B. Kitchen (F2000; Reports 1947 - 50); and some others. More material was added by A. Brindle, as a result of his entomological survey of the north-west (see above).

Each of the orders Dermaptera and Dictyoptera occupies one drawer of a Hill Unit. It is interesting to note that almost all specimens of the three native cockroach species were collected by A. Brindle, whereas cockroach pests came from various sources (some of them were identified by B. Uvarov in 1934 - 35).

The collection of Collembola (spingtails), both British and foreign, contains a number of type specimens of species described by a former Keeper of the Museum, G.H. Carpenter (Report 1975 - 76). During his term as the Keeper of the Museum (1923 - 34), Dr Carpenter regularly received consignments of springtails for identification from many parts of the world. From duplicates in these consignments a representative collection of the order was secured for the Museum (Report 1933 - 34).

A few words need to be said separately about the collections of microscopic slides and the spirit collections of British insects.

The collection of microscopic preparations contains material of almost all insect orders (both British and foreign), but the majority belong to the Aphididae and Phthiraptera (Table 2). The first Museum collection of microscopic slides was that of Phthiraptera. In 1911, R. Standen (Assistant Keeper) registered and arranged an extensive collection of 300 microscopic slides of Acari, Anoplura and Mallophaga, made by the late G.W. Chaster (Report 1910 - 11). This collection was amalgamated with a similar collection acquired earlier (in 1909 - 10) from J. Hardy. In the mid-1920s, H. Britten assembled the slide collection of the Thysanoptera, which remained undetermined at that time (Report 1924 - 25), and re-arranged the collection of the Mallophaga (Report 1926 - 27). The present collection of over 12,000 preparations (mites and ticks not included) is deposited in a rather unique way, with each slide being stored in an individual paper envelope (Figure 11). In such envelopes slides remain clean and dust-free. This method, which seems to be restricted to the Manchester Museum, was initiated by H. Britten and then followed by A. Brindle (see Report 1964 - 65). The collection of microscope slides has not been significantly extended or re-arranged during the last few decades. However, in 2008, the entire collection of Siphonaptera (660 slides) was re-examined and re-identified by R.S. George, the national recorder of fleas and the author of the latest atlas of the British fleas (George, 2008).

Originally, the Manchester Museum's spirit collections of insects consisted mainly of the Carpenter Collembola collection, but now they include the immature stages of most orders, and also adults of certain orders, of insects (Report 1967 - 68). The collection of only three insect orders (Ephemeroptera, Plecoptera and Trichoptera) numbers over 46,000 specimens (Table 2). The pride of assembling such a fine collections goes to A. Brindle, who, as mentioned earlier, started a systematic survey of Diptera and aquatic insects of the north-west in 1972 (Report 1971 - 72), and continued this fieldwork until his retirement in 1982. Collections of immature stages were made in numerous sites, and this enabled the department to increase the existing collections of the surveyed groups considerably (Report 1971 - 72). A particular emphasis was placed by A. Brindle on the immature stages of Trichoptera, because their identification presented problems, and already by 1976, over half the British species were represented in the Museum's larval collection (Report 1975 - 76).

Collection of imported insects

Alien insects are continuously introduced to the UK, both deliberately and accidentally, and some of them are capable of establishing a population here. According to Manchester & Bullock (2000), at least 340 phytophagous insects have been recorded as non-native insects of the British Isles. The Manchester Museum's collection of imported insects contains only the species that were occasionally brought to the UK with foodstuffs or plant-based products. The collection contains 463 specimens of 57 species (Table 4), and occupies a 15-drawer cabinet.

Table 4. The size of the collection of imported insects
*- Only identified species are counted.

Taxon	Species*	Specimens
Orthoptera	9	65
Dermaptera	7	107
Blattodea	14	95
Hemiptera	5	32
Coleoptera	5	55
Lepidoptera	15	100
Diptera	2	9
Total	**57**	**463**

Although various imported insects were occasionally acquired from the beginning of the 20th Century, for instance, *Monochamus sartor* (Fab.) imported with timber (Report 1906 - 07) or the Cockroach (*Nyctibora* sp.) found in imported bananas (Report 1928 - 29; see also Britten, 1931), the need for assembling such a collection was first recognized by W.D. Hincks. He said that 'the need has been left for a reference collection of the adventive insects imported into this country in stored products, timber and fruit' (Report 1950 - 51), and such a collection was first assembled in 1951, and has been slowly expanding since then. For this reason a collection of Coleoptera (95 specimens) associated with stored products in the Manchester area received from J.D. Norris was acquired (F1966; Report 1948 - 49). It is a bit unclear what happened to this acquisition, as the present collection contains only 55 beetle specimens of which only five are named (Table 4).

However, the main source of imported insects has always been the specimens acquired via enquires: e.g., specimens of the bruchid *Zabrotes subfasciatus* (Boh.) from Salford (F1949; Report 1947 - 48), the imported locust received from Manchester market (F2075; Report 1952 - 53), the Indian bed-bug, *Cimex hemipterus* (Fab.), found in imported poppadums (Report 1971 - 72), and others. More recent additions to this collection include: the bamboo borer, *Chlorophorus annularis* (Fab.), received in 2007 (F3313), a beetle having the potential to establish in Britain (see Ostojá-Starzewski & Hammon, 2008); three specimens of the black maize beetle *Heteronychus arator* (Fab.) imported to Tilbury from Uruguay in March 2009 (F3356); the specimen of the katydid *Neoconocephalus* sp. found in a bag of watercress in Tesco, Manchester in 2010 (F3368; see M.E.N., March 12, 2010, for media interest this discovery generated); and a few others. There is a small display devoted to the imported insects in the new Museum's 'Manchester Gallery' which opened in April 2009.

Educational collections

The Manchester Museum's Entomology Department retains a limited amount of educational material, namely: (1) old exhibits; (2) cased objects from the Museum's Education Department; (3) small display boxes assembled for various outreach programmes and museum public events; and (4) 3-D insect models. Besides, there are 42 storage boxes of ex-display material, mainly with showy foreign insects but also with sets of British species.

(1) Old exhibits in 232 small display boxes mostly contain specimens of Hymenoptera, Coleoptera, Lepidoptera and Diptera, both British and foreign. Some of these exhibits were assembled at the beginning of the 20th Century (in 1902 - 06) by J. Hardy. For instance, J. Hardy mounted many sets illustrating the life histories of various insects: e.g., the Pine Weevil *Curculio abietis* (L.), the Bean-beetle *Bruchus rufimanus* Boh., the Ash-bark Beetle *Hylesinus fraxini* (Panz.), and many others (Reports 1902 - 03, 1906 - 07). It is impossible not to mention the nice glass-topped wooden box containing eggs of 69 species of British Lepidoptera, nicely assembled by H. Britten in 1948 (F1961). Yet, the entire collection of old displays requires urgent conservation measures.

(2) Educational sets with insect nests, which were moved to Entomology from the Museum's Education Department in 2008, include a number of very impressive specimens. For instance, the large nest of the Common Wasp, *Vespula vulgaris* (L.) (Figure 12) that was presented by Prof W.S. MacKenzie, Dep. of Geology, UoM (F2676; Report 1977-78), or an unusually large nest of the bumblebee (*Bombus lucorum*), received from Mr Jones of Middleton (F2701; Report

1978 - 79). There are 10 such nests, all are kept in perspex display boxes and represent ideal educational or display material.

(3) Small display boxes specially assembled for various outreach programmes and museum public events, for instance, a set of nine boxes with common British garden insects. These boxes, alongside some other objects (e.g., large images of the Oribatida), were originally assembled and used for the temporary exhibition 'Urban Gardening' at the Urbis, Manchester (April - September, 2008), which attracted over 50,000 visitors.

(4) Of the modern educational material to mention here, there are five large 3-D models of various insects produced by the ECOFAUNA (online at http://www.ecofauna.com). Models of this kind were once classified as 'static media of communication' in public understanding of science (Miles & Tout, 1994), for they give the observer a chance to see what otherwise cannot be seen other than by means of a microscope. Insect models help to generate an emotional response of visitors, especially of children (Figure 13), and thus are effective promoters of public engagement with science.

A historical collection of lantern-slides, which is also worth mentioning, consists of about 1,400 coloured and monochrome images on glass (Figure 14), and is of great historical importance. Lantern slides used to be the standard means of illustrating lectures during the 19th Century up to the 1930s, via the so-called magic lanterns (lantern slide projectors). Most of the slides are 8 cm square (that was the English Format), but a hundred of them are larger (17x12.5 cm). These slides illustrate insects of various orders. The majority of them (c. 960) belonged to the late G.H. Carpenter, Keeper of the Museum in 1923 - 34 and were donated to the Department by his son, Rev. G.K. Carpenter in 1938 (Report 1938 - 39). About 180 of the slides contain images of the Mymaridae and used to be an educational tool of F. Enock (1845 - 1916), the authority of the fairy-flies, who was perhaps best known to his generation as a popular lecturer on entomological subjects (Adkin, 1916; Anon, 1916). A collection of 80 lantern-slides was received from G.F. Woods (Report 1962 - 63). The collection of larger lantern-slides is of unknown origin. Besides, there are three boxes of 443 slides (5x5 cm) produced by the Shell Photographic Unit (London, no date), and two storage boxes of over 1,000 standard modern slides with images of British and foreign insects.

Entomology archives

As with every natural history museum collection, the Manchester Museum's entomology department houses a great deal of paper-based material (additional to specimen labels and the specialized library of books and reprints), which consist of 34 collections and are arranged by associated collectors (Table 4). Following Fisher & Warr (2003), these resources can be broadly divided into archival material (correspondence files, field notebooks, diaries, photographic records, card indexes of related collections, etc.), manuscripts of (un)published papers and lectures, and original artworks. These archival holdings are of the great historical importance, and beyond doubt their value increases as time passes. Currently, the archive is under a complete re-arrangement. All the archival collections have been moved to special archive-quality Solander boxes (Figure 15), and all individual items in each collection are now being recorded and listed. As the re-organization of the archive has not been completed yet, only brief descriptions of each archival collection are given in Table 5. Archival holdings regarding spider collections (three collections) are not mentioned here.

Surprisingly, there is no archive or singular archival items (e.g., correspondence) of J. Hardy, the first Assistant Keeper in Entomology of the Manchester Museum. Brief information about him and his activities can be found in Standen (1921), Britten (1922a), and in Annual Reports (Reports 1889 - 1917).

The Manchester Museum also retains the famous and valuable card-index of the faunistic records of insects of Lancashire and Cheshire (in 21 drawers), prepared by H. Britten (Hincks, 1954). These cards include both the published information of other workers and the extensive records of H. Britten himself, based on his collecting from 1920 until his death in 1954 (Kidd &

Figure 12. The large nest of the Common Wasp, Vespula vulgaris *acquired in 1978 (F2676); the Manchester Museum.*

Figure 13. Looking at the model of the Southern Wood Ant, Formica rufa*; the Bug Day in the Manchester Museum (21.06.2008).*

Figure 14. The wooden cabinet with lantern-slides (left), and two examples of the coloured lantern-slides (right); the Manchester Museum.

Figure 15. The Manchester Museum's Entomology archive.

Brindle, 1959). Two published checklists of the fauna of Lancashire and Cheshire (Lawson, 1930; Kidd & Brindle, 1959), largely based on these record cards, may give one some idea about the comprehensiveness of this unique data-set.

Regrettably, the historical resources of Manchester Museum's entomology department remain largely unstudied and still await their investigators. From time-to-time the entomology archive is used for extracting data for local synopses on various groups of British insects, for instance, for an account of the craneflies of Shropshire by Boardman (2007), dedicated to C.H.W. Pugh whose collections and archive are retained in the Manchester Museum.

Table 5. Archival holdings of the Manchester Museum' Entomology department

Name	Items	Brief Description
Aubrook, Edward W.	415	In one box. Correspondence with H. Britten, C. Johnson, P.M. Hammond, E.J. Pechge, G.E. Woodroffe, and others (1948 - 90, 372 items); photographs of E. Aubrook and his colleagues; seven notebooks (1945 - 90); various species lists and reports, mostly on Coleoptera.
Bartindale, Guy W.	260	In three boxes. Correspondence with H. Britten, A.P. Fowles, F. Balfour-Browne, M.J. Morgan, and others (1936 - 76, 89 items); 12 notebooks and various species lists regarding British Coleoptera; three boxes of index cards for Bartindale's collection; etc.
Blatch, William G.	21	In one box. Handwritten and typed catalogues of Midland Coleoptera; photocopies of Blatch notebooks (12 volumes).
Bowested, Stanley	1	In one box. Field notebook, with entries from 1963 to 1970.
Brindle, Alan	599	In five boxes. Correspondence with H.G. Briggs, I.M. Robson, H. Robertson, T. Cekalovic, T.R.S. Nathan, G. Kerrich, and others (1933 - 84, 165 items); '*Insect records*' (10 volumes, 1930 - 82); species records of aquatic insects in the museum collection, plus locality list; reprint collection (346 items); index records; typed and handwritten lists of insect species; Lepidoptera records; various keys; address books; visitor book; Diptera larvae catalogue; etc.
Britten, Harry	69	In one box. Eight personal diaries (1940 - 50); Correspondence with W.D. Hincks, B.M. Hitching, T.H. Green, and others (1928 - 53, 30 items); field records of Lepidoptera and Siphunculata/Mallophaga; photos; handwritten insect lists and field notes. Besides, the card index of the faunistic records of insects of Lancashire and Cheshire (in 21 drawers), separate from the main archive.
Caiger, Hugh	7	In one box. Notebooks/nature notes (1937 - 59, 1962 - 69).
Collett, Henry R.P.	22	In one box. Correspondence with A. Brindle and B. Gibson (nine items); species lists; copies of Annual Reports of the Manchester Entomological Society (1931 and 1934); manual records; manuscript by Collett on Corixidae; reprints; etc.
Cooke, Brian D.	10	In one box. Notebooks on Coleoptera; notebook entitled '*Hemiptera Heteroptera*'; diaries 1953 - 58 and 1959 - 60; manuscripts, drawings and colour paintings of Chrysomelidae; reprints.
Crewdson, Robert C.R.	12	In one box. Hardbound and handwritten record books on Lepidoptera; various lists relating to Lepidoptera.
Edmonds, Thomas H.	13	In one box. Field notebook on Coleoptera; list of contents of and two typed reports on Edmonds' insect collection; there letters (1803, 1806, 1827); county records of Devon Coleoptera; two preparations of plants with written notes.
Enock, Frederick	228	In one box. Notebooks: 'Names of Mymaridae', 'Life histories of parasitic Mymaridae' and 'Index of micrographs'; correspondence with C.O. Waterhouse (1910 - 15, 133 items); handwritten lists of illustrations and comments on British Mymaridae; original pencil figures of Mymaridae; handwritten manuscripts on 'Life histories', 'New genera of British Mymaridae' and Enock's popular lecture; leaflet about Enock's popular lecture on fairyflies in London (session 1914 - 15); four reprints by Enock; original photographs and photographic plates of Mymaridae (80 items). Besides, there are seven boxes of uncounted number of photographic plates and negatives of the Mymaridae.
Eustace, Eustace M.	4	In one box. Ordinance Survey Map of the Cairn Gorms (August 1934); notebooks on Eustace's Coleoptera collection (two volumes); entomological notes.
Griffith, Charles F.	96	In one box. Correspondence with H. Britten, R. Crewdson, N.J. Armes, and others (1947 - 86, 49 items); research notes; species lists; manuscripts; 1970 diary with some notes and figures; card index Coleoptera.
Higgnett, James	29	In one box. Field notebooks on Coleoptera records; handwritten list of Lepidoptera species; various lists of insect records; published list of Mr Donisthorpe's publications (1933); Coleoptera catalogue; typed manuscript on Lepidoptera; correspondence with F. Balfour-Browne, B.A. Cooper, and others (1934 - 25, 1946 - 52, 16 items).
Hincks, Walter D.	611	In five boxes. Original figures for Dermaptera monograph (383 cards); published papers by Hincks (94 items); reprints Hymenoptera Parasitica

		and others; address and field notebooks (26 items); notes on Dermaptera and manuscripts on Passalidae; diaries (1948 - 49, 1956); correspondence with F. Spaeth, J.T. Salmon, M. Burr, W. Junk, and others (453 items).
Johnson, Colin	2092	In 17 boxes. Primarily correspondence consisted of several thousands of letters (1962 - 2005); correspondence by A. Brindle (124 items; 1963 - 80); manuscripts; species lists; appointment diaries (1981 - 2004); notebooks; computer printouts; documentation relating the 'Alderley Edge' project; etc.
Kenneth-Booker, W.B.	93	In one box. Ainsdale NNR species lists (Hymenoptera; 1976 - 78); two field notebooks (1975 - 81); a set of 29 works (books and reprints) on Hymenoptera-Aculeata; record cards on British Hymenoptera; 17 leaflets by '*Nature Conservancy Council*'; card index of Aculeata records; insect data labels; three photographs; materials on Diptera recording scheme; collecting permits (1977 - 78); Hymenoptera relating correspondence with G.R. Else (1975 - 86, 24 items); four BWARS Newsletters; handwritten manuscript by P. Japson on '*Darwen Valley & Ewood*' (no date).
Kidson-Taylor, John	22	In one box. Handwritten record book of British Coleoptera; British Coleoptera checklists (1904, 10 items); card index of Coleoptera records (1901 - 02); handwritten copies of some Donisthorpe's works (1896 - 1901); three field notebooks.
Last, Horace R.	273	In five boxes. Field notes on and typed descriptions of the African genus *Zyras*; *Catalogue of the British Coleoptera* by T.H. Beare (1930); lists detailing specimens in Last's collection; address book; ten diaries (1958 - 67); ring bound notebooks, *'Key to New Guinea Specimens'*; lists of *Philonthus* and *Hesperas* from New Guinea; '*General Entomology'* - entomological observations (1932 - 1937); '*Lepidoptera-Breeding Log No S. 1. to 138'* - Field Notebook (1936 - 1939); various papers and manuscripts on Staphylinidae (95 items, 1945 - 1993); letters from N. Berti, B.A. Cooper, R. Danielsson, Z. Kaszab, J. Klimaszewski, M. Uhlig, etc. (1937, 1970 - 1985); collection of '*The Entomologists' Bulletin'* (1937 - 1944); card index; photograph of Horace Last; correspondence regarding Last's collection (2005).
Lloyd, Robert W.	12	In one box. Photograph album of Trypetidae wings; filed notebooks; lists of specimens; Anthomyidae of Europe (volumes II & III); list of British Aculeata and Chironomidae (volume VI); *Times* obituary.
Longsdon, David	251	In one box. Papilionidae species lists from various zoogeographic regions; butterfly dealers' pricelists (e.g., from E. Swinho and W.F.H. Rosenberg); correspondence between R. Sayce, Keeper of the Museum, and Longsdon' solicitors; correspondence with insect dealers O. Staudinger and A. Bang-Haas (1904 - 38); invoices.
Leverton, Roy	1	Photocopy (made in February 1998) of Leverton's notebooks of British macro-Lepidoptera captures (from Salford and surrounding districts), dating from 1957 - 68.
Mixed archive	741	In four boxes. The former archive of the Manchester Entomological Society: extensive correspondence regarding purchase, donation or exchange of insect collections, bequest of butterflies and moths, identifications, the creation of the Manchester Entomological Society, etc. (509 items, 1891 - 1950, 1990); ten field notebooks (1939 - 69) and nine lists of specimens by H.L. Burrows; photograph album by H. Britten; obituaries of various entomologists (66 items); photographs of various entomologists; addresses at Entomological Society of London (1903 - 04); Lepidoptera reports (1957 - 69).
Morley, Thomas	2	In one box. Collection notebook '*British Coleoptera Localities*' combined with 'British Coleoptera' by G.R. Crotch; the ms on Coleoptera of Cambridgeshire.
Patton, Walter S.	38	In one box. Handwritten notebook on Tenthredinidae; typed ms on Cornish Hemiptera; three colour plates with illustrations of various insects, plus a letter to C. Johnson (1988) from the John Rylands University Library; correspondence to and from H.W. Kumm (1934 - 35, 34 items).
Pugh, Wallace C.H.	733	In five boxes. Correspondence from E.A. Wilson, H.W. Andrews, H.P. Moon, E.A. Fonseca, K.G.V. Smith, and others (1943 - 61, 274 items); typed and handwritten manuscripts on various groups of Diptera; reprints on Diptera; selected issues of several entomological journals (1895 - 96, 1939 - 56), insect survey's species lists (1929 - 41); various lists and

		diagrams; notebooks.
Reston, Arthur	6	In one box. Collection notebook; pocket catalogue 'British Coleoptera'; correspondence regarding beetle collection by A. Reston (1903, 4 items).
Schill, Charles H.	10	In one box. Lepidoptera Catalogue & Index; label list; collection correspondence with the Museum Keeper (1904, 1923-25, 8 items).
Simms, Harold M.	6	In one box. List of Indo-Australian Rhopalocera in Simms' collection; envelope containing photographs of Butterflies and two glass plate negatives; postcard; letter and article from J.D. Gunder (15.10.1927); a copy of *Ento News* dated May 1927; paper by M. Fountain '*Larvae and pupa of some S African Butterflies*'.
Spaeth, Franz	?	In six boxes. Notebooks, collection card index and various material regarding the tortoise beetles: Cassidinae 1898 - 1925 & 1926 - 1943, bound in two volumes, various paper by Spaeth describing new species and keys to species; Cassidinae Indo-Australian-Palaearctic - Spaeth's manuscript of old world Cassidini (in box file); papers referring to Spaeth collection of Cassidinae; Cassidinae various figures and species lists; '*Madagascan Cassidinae*' by W.D. Hincks, part 2, text and figures; Spaeth's manuscript on Physonotini; key to old world genera; Spaeth's papers, notes and manuscripts on Africa; Cassidinae South America + new species; correspondence related to Cassidinae with G.H. Arrow, K.G. Blair, A.R. Mold, J. Ferrant, R.C. McGregor, and others (1911 - 34, 319 items).
Stevens, Herbert	4	In one box. Typed '*List of the Dragonflies (Odonata) of India*'; typed and handwritten lists of Odonata collection.
Tomlin, John R. le B.	14	In one box. Photocopies of catalogues and various notebooks of British Coleoptera; papers regarding Coleoptera from Africa and Asia Minor; a copy of '*Sicilian Beetles, 1911*'; collection notes; two letters from S.A. Newbury (1906-07).
Walsingham, Lord Thomas de Gray	44	In one box. Collection correspondence with W.S Hoyle, J.H. Durrant, M. Lattersall, H.W. Freston, and others (1899 - 1918, 40 items), partly relating to the Manchester Moth.

The question mark (?) means that a number of items in this archive have not been recorded yet.

Conclusions

The present paper presents a brief account only on the Manchester Museum's British insect collections, and does not substitute for a full history of the Museum's Entomology Department. Despite the fact that Manchester Museum's comprehensive insect collections constitute an important part of the national taxonomic resources, for various reasons they remain largely under-publicized and under-used. It is my hope that this paper will encourage fellow-entomologists, both professional and amateur, to use the Museum's insect collections and associated archives more intensively. The collections are fully accessible for anybody willing to study them and can be searched from the museum's website: <http://www.museum.manchester.ac.uk/>.

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Photographs: Dmitri Logunov and the Manchester Museum

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