

## **The Tasmanian Herbarium and Its Role in Biodiversity Research, Land Management, Conservation and Economic Development**

Gintaras Kantvilas<sup>1</sup> and Hiroyuki Kashiwadani<sup>2</sup>

<sup>1</sup> Tasmanian Herbarium, Private Bag 4, Hobart, Tasmania 7001, Australia  
(e-mail: gkantvilas@tmag.tas.gov.au)

<sup>2</sup> Department of Botany, National Science Museum, 4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan  
(e-mail: hkashiwa@kahaku.go.jp)

**Abstract** The Tasmanian Herbarium (HO) houses more than 250,000 plant specimens covering all major plant groups. It is part of a closely linked network of Australian State and Territory herbaria and represents the most comprehensive scientific record of the Tasmanian flora in the world. Non-vascular plants form a major component of the Tasmanian Herbarium, which represents one of the major repositories of lichen and bryophyte collections in Australia. The history of Tasmanian Botany and of the Herbarium are outlined briefly. The botanical collections at HO are more than heritage items or taxonomic specimens, but underpin a wide range of scientific, economic and social activities. These include: traditional systematics research and compilation of Floras; vouchers of ecological and floristic surveys, especially in habitats subject to severe modification or degradation; underpinning decisions relating to land management and development; providing baseline data on species distributions that support flora conservation; contributing to Tasmania's economic development through involvement in biochemical research, plant quarantine and weed control; and public education by providing a window to Tasmania's rich and diverse flora for all the community.

**Key words:** Tasmania, herbarium, flora, lichens, mosses, conservation.

### **Introduction: Australian Herbaria**

Australian Herbaria fall into two main categories, those managed by State and Commonwealth Government agencies, and those within universities (Fig. 1). There is also a small number of specialised, mycological herbaria that focus mainly on pathogenic fungi. University herbaria were established principally as teaching collections and are usually of relatively recent origin, smaller and with a narrower focus. The State and Commonwealth herbaria are larger and function as the major repositories of plant collections and taxonomic expertise for their respective governments (Cowley & West, 1999). They typically have diverse collections that represent all plant groups including vascular plants, fungi, algae, bryophytes and lichens. In some cases, they may have a regional or biogeographic focus relevant to the State or Territory they represent. These herbaria, which number eight, comprise the core members of CHAH, the Council of Heads of Australasian Herbaria. Other members of CHAH include single representatives from the University herbaria, from the mycological herbaria, and from the the Council of New Zealand Herbaria.

The herbaria of Australia collectively interact very closely, and consult with each other on a

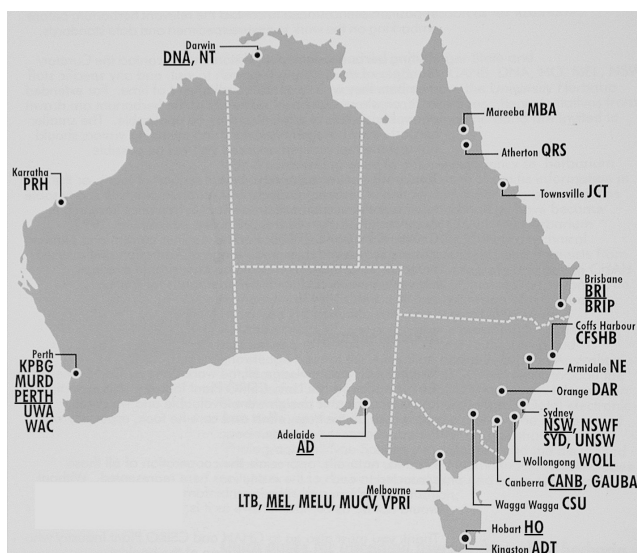


Fig. 1. Location of herbaria in Australia, taken from Cowley & West (1999). The core members of the Council of Heads of Australasian Herbaria (CHAH) are underlined.

wide range of issues, including collecting protocols, curation standards, pest management, loans and exchanges, and quarantine issues. They have also co-operated closely on several national projects:

### 1. Flora of Australia/Fungi of Australia series

This series will comprise more than 60 volumes covering all plant groups; more than 30 volumes have been published since 1981. The series is funded by the Australian Commonwealth Government through the Australian Biological Resources Study (ABRS). ABRS funds editing and publication, and offers grants that assist the revision and/or preparation of Flora accounts of selected plant groups. The Australian herbarium community contributes most of the taxonomic expertise and writing of manuscripts.

### 2. Herbarium Information Systems Committee (HISCOM)

This is an ongoing initiative that deals with the application of new technologies in herbarium management, botanical research and information delivery. It is particularly concerned with the electronic capture and exchange of specimen label data through the development of HISPID (Herbarium Information Standards and Protocols for Interchange of Data) (<http://www.rbgsyd.gov.au/HISCOM>).

### 3. Australia's Virtual Herbarium (AVH)

This most recent initiative is an on-line botanical information resource. It provides access via the Web to the wealth of data associated with all the plant specimens held in each Australian herbarium ([www.chah.gov.au/avh](http://www.chah.gov.au/avh)). The AVH provides a comprehensive resource for:

- the accurate depiction of the past and present geographic distribution of plants;
- the revision and classification of the Australian flora, including highlighting gaps in knowledge;

### The National Collection: Institution holdings (%)

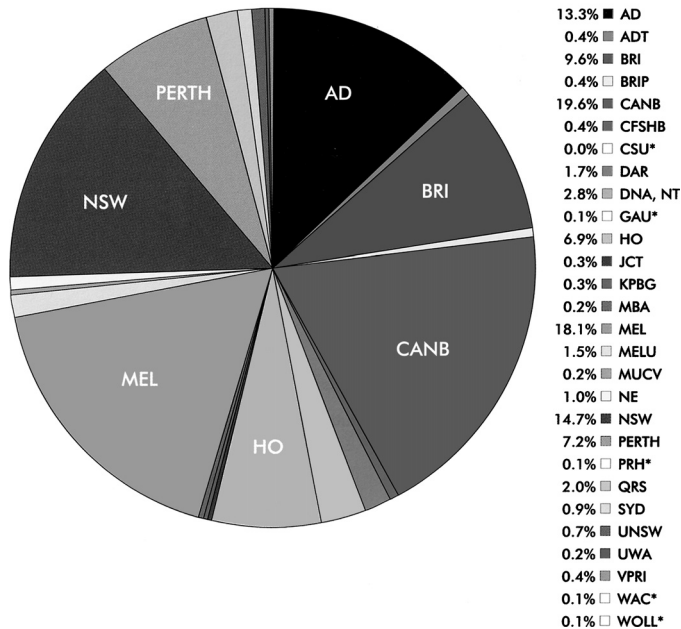


Fig. 2. Herbarium specimens in Australian institutions, taken from Cowley & West (1999).

- the interpretation of the ecology and habitat of species and vegetation types through linkages between plant specimen data and geographical information; and
- the management of herbarium of collections.

In the future, the AVH will be enhanced by images, descriptive text, identification tools and other features. The AVH is supported by the Commonwealth and State and Territory Governments to the combined value of AUD 7.8 million over the five years from 2001–2006. A further AUD 2 m is being sought from the private sector.

### The Collections of the Australian Herbaria

The total number of specimens held by the Australian State and Territory herbaria is estimated at 6.3 million. The Tasmanian Herbarium (HO) holds 255,000 or approximately 4% (Fig. 2). However, due to the geographic and, in some cases, taxonomic specialisation of each institution, mere percentages do not determine relative importance. Thus, HO represents the most comprehensive scientific record of the Tasmanian flora in the world, and similar regional significance is accorded to each institution.

Although non-vascular plants are represented in all the herbaria, their relative proportion is particularly high in HO, amounting to about 40% of the total collection (Fig. 3). This represents c. 10% of the total Australian holdings. With respect to the lichens and bryophytes, the Tasmanian Herbarium collection is even more significant nationally, representing approximately 15% of the Australian total for both groups.

### Collections of the Tasmanian Herbarium

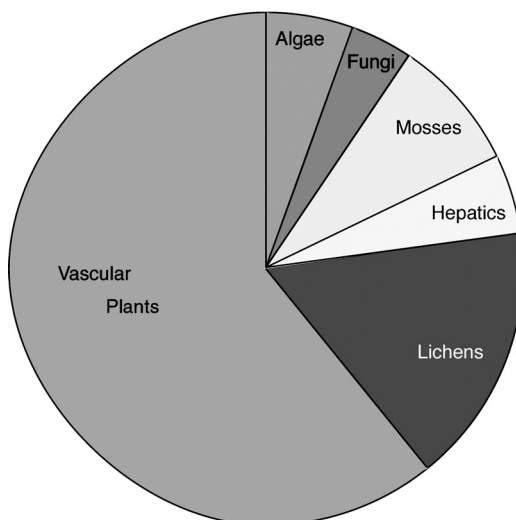


Fig. 3. Proportions of specimens of major plant groups held by the Tasmanian Herbarium (HO).

#### Brief History of Tasmanian Botany

The earliest plant collections from Tasmania date from the first European explorations into the Southern Ocean (Kantvilas, 1996). This was a period of great advance in Botany. The discovery of new floras, rich in unique species, genera and families, spurred the development of new systems of classification that could accommodate these new discoveries. Conversely, it was the development of Botany as a science, unshackled from the herbalist, apothecary and gardener, that ensured that botanists accompanied all the early voyages of discovery from the late 18th Century onwards (Morton, 1981). It is no accident that the Australian flora commemorates these early navigators in plant genera such as *Bougainvillea*, *Cookia*, *Dampiera*, *Freycinetia* and others.

Although preceded by several other voyages, the first expedition to collect substantial numbers of plant specimens from Tasmania was that of James Cook in the *Resolution* in 1777. The botanist on board was David Nelson, and it was on one of his specimens, from Bruny Island, south-eastern Tasmania, that the genus *Eucalyptus* was based (Kantvilas, 1996).

The next major plant collections from Tasmania were compiled by J. J. de Labillardière, botanist aboard the French expedition of Bruny D'Entrecasteaux in 1792–93. His specimens included the first lichens to be described from the region, including the striking *Cladia retipora* Nyl. (Kantvilas, 1983). The history of the collections is fascinating: in the course of being transported to Europe, they were seized from the French by the Dutch, and from the Dutch by the English in the course of the shifting alliances during the Napoleonic Wars, before being returned to Labillardière. The collections form the basis of the first illustrated publication on the flora of Tasmania, Labillardière's *Novae Hollandiae Plantarum Specimen*, published in 1804–1807 (Duyker, 2003).

The next highlight in Tasmania's botanical history is the visit of the renown Scottish Botanist and later Keeper of Botany at the British Museum, Robert Brown. Brown participated in the

founding of the first British settlements in Tasmania in 1804 and collected extensively at several locations (Vallance *et al.*, 2001). His major publication was his *Prodromus Florae Novae Hollandiae et Insulae Van Diemen*, published in 1810; it is one of the first significant botanical works in the world to adopt the natural classification system of Jussieu (Morton, 1981).

The third major published work on Tasmanian Botany is Joseph Dalton Hooker's *Flora Tasmaniae*, published in 1860. Hooker visited Tasmania in 1840 in the course of an expedition to Antarctic and subantarctic regions. He also collaborated closely with resident Tasmanian botanists and collectors. Hooker's book is more than a landmark in Tasmanian botanical history. In its 'Introductory Essay' (Hooker, 1855), it contains the first and most explicit published acceptance of Charles Darwin's controversial theory of evolution by a leading scientist anywhere in the world (Morton, 1981).

Thus although Tasmania is a remote corner of the world, its flora and the botanists that studied it have been very much at the centre of the world stage. Regretably, the specimens collected by these early visitors are housed predominantly in the large herbaria of Europe, and especially at the Natural History Museum in London (BM). However, a small number have been donated to the Tasmanian Herbarium in recent times and provide an important insight into the history of scientific exploration and botanical discovery in the region.

### **The History of the Tasmanian Herbarium**

The founding collections of the Tasmanian Herbarium date from the early 1830s. They were made by amateur botanists such as Robert William Lawrence, Ronald Campbell Gunn and Joseph Milligan, residents of the fledgling colony of Van Diemens Land as Tasmania was then known (Tasmanian Herbarium, 2004). In 1838, the Tasmanian Society was formed by the then Governor, Sir John Franklin, with the aim of promoting scientific enquiry in the colony. A second scientific body, the Botanical and Horticultural Society of Van Diemens Land, was founded in 1843 by the succeeding Governor, Sir John Eardley-Wilmot. The two Societies merged in 1848 as the Royal Society of Van Diemens Land (later to become the Royal Society of Tasmania), the first Royal Society to be formed outside the United Kingdom (Piesse, 1914; Winter, 1993). Botanists held prominent positions throughout the early years of the Society and donated important plant specimens. In 1928, the Royal Society of Tasmania founded a Botanical Section of the Museum under the directorship of the Honorary Government Botanist, Leonard Rodway. Subsequent years saw responsibility for the care of the collections shift between the Royal Tasmanian Botanical Gardens, the Tasmanian Museum and the University of Tasmania. It was not until 1977 that the name Tasmanian Herbarium was formally adopted and the collection transferred to the care of the Tasmanian Museum and Art Gallery (Parham, 1976). This administrative arrangement remains today, with the Museum being a section of the Tasmanian Department of Tourism, Parks, Heritage and the Arts. The collections are housed in a purpose-built facility on the campus of the University of Tasmania (Fig. 4). The current staff of the Tasmanian Herbarium are shown in Table 1. The combination in one institution of a State Herbarium, a Museum and an Art Gallery is very unusual, especially in Australia, but it makes a very diverse and dynamic union.

### **Main Activities of the Tasmanian Herbarium**

The core business of the Herbarium is the development, maintenance and management of the botanical collections of Tasmania (Tasmanian Herbarium, 2004). New additions to the collec-

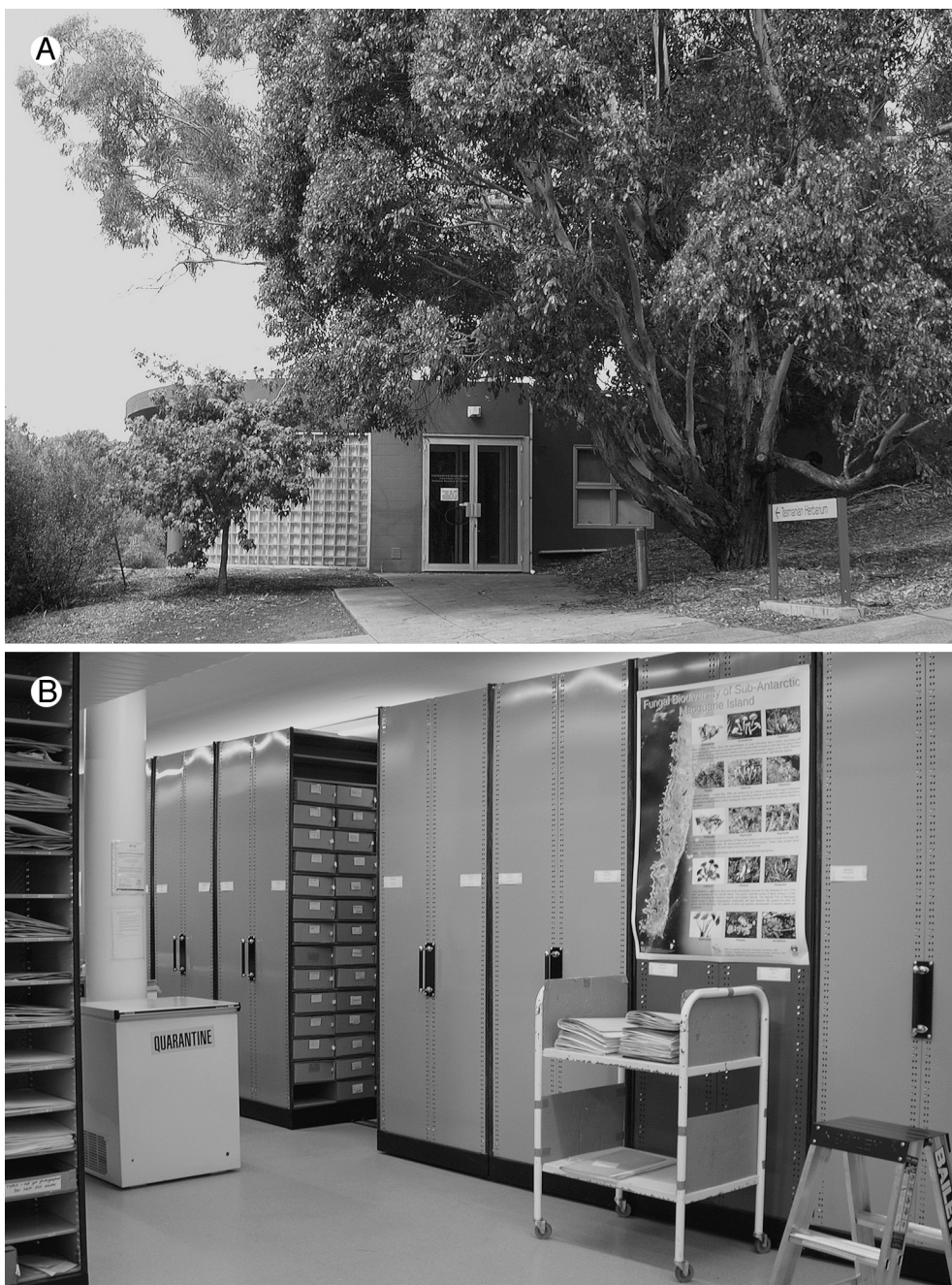


Fig. 4. The Tasmanian Herbarium building in Hobart, Tasmania. A: exterior; B: compact shelving in the specimen storage vault. Photos: J. Jarman.

Table 1. Staff of the Tasmanian Herbarium (December 2004).

---

Head of the Herbarium	Gintaras Kantvilas B.Sc. (Hons), Ph.D (Lichens)
Curators	Marco Duretto B.Sc. (Hons), Ph.D (Angiosperms) Alex Buchanan B.Sc. (Angiosperms) Matthew Baker B.Agr.Sc. (Hons) (Weeds and exotic flora)
Technical Officer	Dalia Howe Dip.Teach., B.Ed. (Cryptogams) (part-time)
Administration	Kim Hill B.A., Cert. Hort.
Temporary, externally funded appointments	Lyn Cave B.Sc. (Hons) (Manager, AVH Project) Jennifer Cooke (Technical Officer, AVH Project) (part-time) Jean Jarman B.Sc. (Hons), Ph.D. (Curator, Bryophytes) (part-time) Timothy Newlands Cert. Bus. (Data Entry, AVH Project)
Honorary Botanists	Alan Gray (Vascular plants) Dennis Morris D.Sc. (Angiosperms, esp. monocotyledons) Rod Seppelt B.Sc. (Hons), M.Sc., Ph.D. (Bryophytes)
Volunteers	Allan Bradshaw B.Sc. Sue McGuigan

---

tions are acquired through the work of herbarium staff and associates, donations from the public and other researchers, and through exchange with other herbaria. Specimens from all groups are accepted but due to lack of expertise amongst staff, material of algae and fungi is not actively pursued. The collections are more than heritage items or taxonomic reference specimens, but underpin a wide range of scientific, economic and social activities undertaken by the broader Tasmanian community. Some specific projects and activities are discussed below.

### 1. Systematics and Flora Compilation

The native vascular flora of Tasmania consists of approximately 1830 species, with some of the largest families including the Asteraceae, Epacridaceae, Myrtaceae, Cyperaceae, Orchidaceae and Poaceae ([www.tmag.tas.gov.au/Herbarium/Herbarium2.htm](http://www.tmag.tas.gov.au/Herbarium/Herbarium2.htm)). 24% of the native vascular flora is endemic. New taxa continue to be added to the flora as a result of taxonomic revision or new discoveries. Current systematics research is focussing on *Boronia* (Rutaceae), *Leptecophylla* (Epacridaceae) and certain genera of the Liliaceae s. lat. The standard manual for the Tasmanian vascular flora, *The Students Flora of Tasmania* by Winifred Curtis and Dennis Morris, was published in five parts from 1956 to 1994. It is currently being revised, with all work being undertaken in-house by staff and associates of HO.

The other major research focus is lichens. The Tasmanian flora consists of approximately 1000 species, but it is estimated that several hundred more are yet to be discovered and/or identified, especially in the crustose groups. In the last 10 years, more than 60 new species and seven new genera have been described from the Tasmanian lichen flora, and many more species have been recorded for the first time. Current research activity is focussed on the Roccellaceae, *Micarea* and *Psoroma*. There has never been a comprehensive lichen flora for Tasmania, although the Tasmanian Herbarium is contributing to the Flora of Australia lichen volumes. However, a series entitled *Tasmanian Lichens. Identification, Distribution and Conservation Status* is being

produced. The first volume, dealing with the Parmeliaceae, has been published (Kantvilas *et al.*, 2002), and work on the second, concentrating on the Cladoniaceae, is well advanced.

## 2. Ecological Research and Floristic Surveys

Ecological research is currently confined to non-vascular plants. A long-term project is underway exploring alternative methods of harvesting and regenerating eucalypts in Tasmania's wet forests, and their impacts on lichens and bryophytes, as well as other components of the forest ecosystem (Jarman & Kantvilas, 2001a, b; Kantvilas & Jarman, 2004). Work involves comparison of lichen and bryophytes floras before logging and their recovery after logging (Fig. 5). This project is closely inter-related with taxonomic studies in that it generates collections of previously unrecorded or undescribed species, especially lichens.

Floristic surveys, mostly of vascular plants, are undertaken mainly as consultancies for private, corporate or government clients. Under Tasmanian legislation, developments such as housing, water storage and reticulation of services must be preceded by assessments of botanical values and other criteria. Surveys may also be undertaken in other areas of interest, including fragile habitats of high conservation value, or in remote or under-collected areas. All surveys undertaken by Herbarium staff generate collections of voucher specimens. Non-herbarium consultants that undertake floristic surveys are also encouraged to lodge vouchers.

## 3. Conservation of Species and Vegetation Types

The conservation and reservation of species and vegetation types in Tasmania is underpinned by various Acts of Parliament including the *Tasmanian Threatened Species Protection Act 1995*, the *Nature Conservation Act 2002* and the *Crown Lands Act 1976*. The listing of threatened species under the schedules of the *Act* and the demarcation of Reserve boundaries is based to a large extent on accurate species distribution data. The databases of the Tasmanian Herbarium represent a primary source of plant information, especially because herbarium data is vouchered by actual specimens and is therefore verifiable. The Herbarium is involved in preparing or checking formal nominations of species for listing, and in confirming species identifications, nomenclatural matters and population locations.

## 4. Public Education

The Tasmanian Herbarium plays a critical role in public education on botany, especially the identification of native plants and weeds. It provides an identification service that is generally free of charge except for commercial clients. This is supported by a public reference collection. Herbarium staff also provide direct advice and assistance to professional and amateur botanists and may supervise or assist post-graduate students from the University. Herbarium Open Days that highlight its activities, interesting collections and current projects are held annually, usually in conjunction with community events such as University Open Day or Weedbuster Week. Staff also give talks and tours of the Herbarium facility to various community groups, and provide travelling displays as part of larger exhibitions.

## 5. Contributions to Economic Development

The Tasmanian economy is based heavily on the utilisation and exploitation of its natural resources, especially forestry, mining, agriculture and wilderness tourism.

Approximately 765 exotic species have become naturalised, representing 30% of the total vascular flora, and this figure increases annually as more species are introduced or detected





Fig. 5. A major project involves the study of lichens and bryophytes in wet eucalypt forest (A) and their recovery after logging and regeneration treatment (B). Photos: J. Jarman.

(Rozefelds *et al.*, 1999; M. Baker pers. comm.). The Tasmanian Herbarium is directly involved in early weed detection in Tasmania, identifying specimens of new or unusual incursions and providing specialist botanical advice on weeds. One recent case involved a vigilant farmer who noticed unusual burrs in the tails of cattle brought to Tasmania from mainland Australia. The burrs were identified as a particularly nasty weed, *Xanthium orientale*, currently not established in Tas-

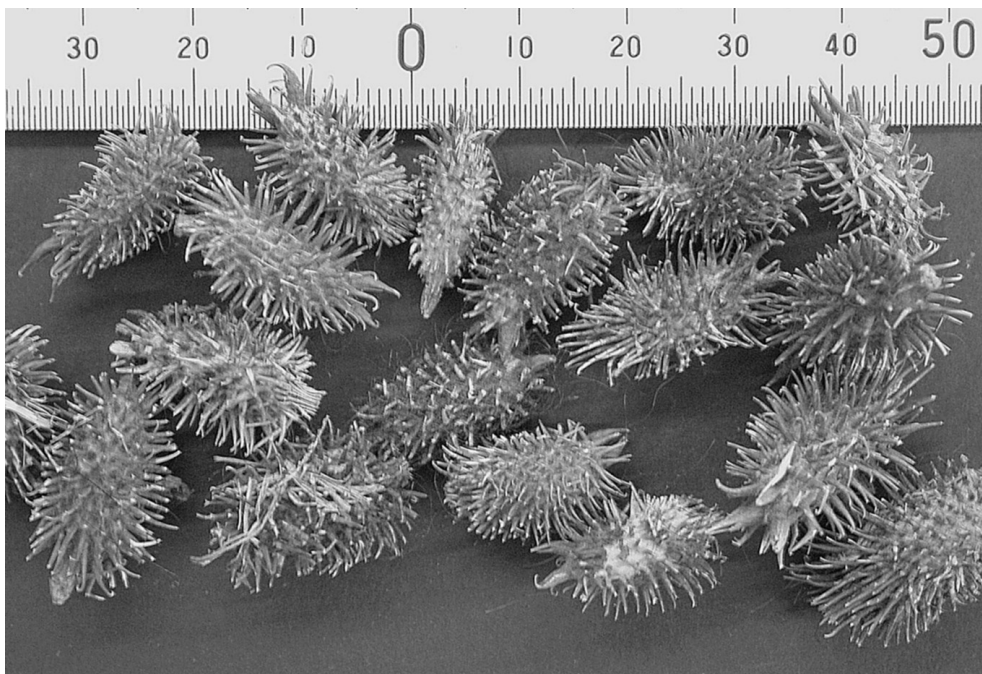


Fig. 6. Burrs of the weed *Xanthium orientale* that were brought into Tasmania attached to the fur of cattle. Photo: M. Baker.

mania (Fig. 6). Prompt action and good taxonomy prevented a potentially serious future weed problem (Hanson & Crane, 2003; M. Baker pers. comm.). Herbarium data is also used to monitor the introduction and spread of weeds, whereas the collections of specimens of exotic flora are critical for comparative identifications.

A major project in 1996–2001 saw the Tasmanian Herbarium involved with the bioprospecting company Cerylid (formerly Exgenics, formerly AMRAD). The Herbarium's contribution to the project was the collection of plant specimens, their accurate identification, their subdivision into specific organs and tissues, and the management of associated collecting information and voucher specimens. Similar smaller-scale projects continue to be undertaken with other clients as the opportunities arise.

Aspects of ecological and floristic research as described above also have a central role in Tasmania's economic development, in so far as they impact on major commercial activities such as dam-building and forestry.

### Conclusion

The Tasmanian Herbarium occupies a pivotal role in the Tasmanian community. Tasmania is endowed with an environment that is still in a relatively natural state, where opportunities for individuals to interact directly with plants and native vegetation are frequent. Whether one intends to conserve a plant species, to manage it, cultivate it, or to exploit it for its economic values, or simply to appreciate it, the correct botanical name of the plant is vital as the means of communication about it. Similarly, correct plant names have legal implications in applying laws associated with rare species, noxious weeds, patents of plant products, quarantine regulations and illicit

drugs. The Herbarium, as the custodian and manager of flora information, represents the fundamental starting point for all plant-based activities, even if public appreciation and understanding of this pivotal role is sometimes limited.

In addition, there is still much to discover and learn about Tasmania's flora, and the regular discoveries of new species indicate that it will be a long time before Tasmania's plant biodiversity is fully documented. In this and all other tasks, good collections are vital, for the collections are the vouchered, long-term, material evidence of what is already known, and the working raw materials in the quest to learn even more about Tasmania's attractive and unusual flora.

### Acknowledgements

The first author thanks Jean Jarman for preparation of the figures, Lyn Cave for assistance with generating collection statistics, and the National Science Museum, Tokyo, for financial support which enabled him to present an oral version of this paper in Tokyo at the Seventh Symposium on Collection Building and Natural History Studies in Asia and the Pacific Rim.

### References

- Cowley, K. J. & J. G. West, 1999. *Resources of Australian Herbaria*. Centre for Plant Biodiversity Research: Canberra.
- Duyker, E., 2003. *Citizen Labillardière. A Naturalist's Life in Revolution and Exploration (1755–1834)*. The Miegunyah Press.
- Hanson, C. & A., Crane, 2003. Burrs get the brush off. *Tasweeds*, **18**: 18.
- Hooker, J. D. (1855) On the general phenomenon of variation in the vegetable kingdom. In 'Introductory Essay'. *The Botany of the Antarctic Voyage. Part III. Flora Tasmaniae*. Volume 1. pp. v–xii. Lovell Reeve: London.
- Jarman, S. J. & G. Kantvilas, 2001a. Bryophytes and lichens at the Warra LTER Site. I. An inventory of species in *Eucalyptus obliqua* wet sclerophyll forest. *Tasforests*, **13**: 193–216.
- Jarman, S. J. & G. Kantvilas, 2001b. Bryophytes and lichens at the Warra LTER Site. II. Understorey habitats in *Eucalyptus obliqua* wet sclerophyll forest. *Tasforests*, **13**: 217–243.
- Kantvilas, G., 1983. A brief history of lichenology in Tasmania. *Papers and Proceedings of the Royal Society of Tasmania*, **117**: 41–51.
- Kantvilas, G., 1996. The discovery of Tasmanian eucalypts: an historical sketch. *Tasforests*, **8**: 1–13.
- Kantvilas, G. & S. J. Jarman, 2004. Lichens and bryophytes on *Eucalyptus obliqua* in Tasmania: management implications in production forests. *Biological Conservation*, **117**: 359–373.
- Kantvilas, G., J. A. Elix, & S. J. Jarman, 2002. *Tasmanian Lichens. Identification, Distribution and Conservation Status. I. Parmeliaceae*. Flora of Australia Supplementary Series No. 15. Australian Biological Resources Study: Canberra, and Tasmanian Herbarium: Hobart.
- Morton, A. G., 1981. *History of Botanical Science*. Academic Press: London, New York, Toronto, Sydney, San Francisco.
- Parham, J. W., 1976. ABRIS Tasmanian Herbarium Project. Final Report.
- Piesse, E. L., 1914. The foundation and early work of the Society; with some account of earlier institutions and societies in Tasmania. *Papers and Proceedings of the Royal Society of Tasmania*, **1913**: 118–166.
- Rozeffelds, A. C. F., L. Cave, D. I. Morris & A. M. Buchanan, 1999. The weed invasion in Tasmania since 1970. *Australian Journal of Botany*, **47**: 23–48.
- Tasmanian Herbarium, 2004. *Annual Review of Activities 2003–2004*. Tasmanian Museum and Art Gallery: Hobart.
- Vallance, T.G., D. T. Moore, and E. W. Groves, (compilers), 2001. *Nature's Investigator: The Diary of Robert Brown in Australia, 1801–1805*. Australian Biological Resources Study: Canberra.
- Winter, W., 1993. The foundation years of the Royal Society of Tasmania. *Papers and Proceedings of the Royal Society of Tasmania*, **127**: 61–66.