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Lectotypification of three species of forget-me-nots (*Myosotis*: Boraginaceae) from Australasia

Carlos A. Lehnebach

Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington, New Zealand
(carlosL@tepapa.govt.nz)

ABSTRACT: Lectotypes for the names of one Australasian and two New Zealand native forget-me-nots are selected: *Myosotis australis* R.Br., *M. forsteri* Lehm. and *M. goyenii* Petrie, respectively. The collection of the type material of *M. forsteri* by J.R. and G. Forster at Dusky Bay (South Island, New Zealand), and not in Australia, is further supported. Images of all three lectotypes are included.

KEYWORDS: R. Brown, G. Forster, J.R. Forster, J.G.C. Lehmann, D. Petrie, New Zealand flora, lectotypes, *Myosotis*.

Introduction

The genus *Myosotis* was described by Linnaeus (1753), with *Myosotis scorpioides* L., a species native to Europe and Asia, as the type species. Currently, *Myosotis* includes about 100 species (Winkworth *et al.* 2002). They are primarily found in Eurasia and Australasia, but New Zealand is the centre of diversity for *Myosotis* in the southern hemisphere and 42 species have been listed for the country (Moore 1988; de Lange *et al.* 2010). Forget-me-nots can be found by stream banks, in scrub vegetation, on limestone outcrops, in montane settings (snow tussock grassland, fellfield) and on scree in alpine environments (Mark & Adams 1973). The most outstanding features of New Zealand *Myosotis* species are the highly restricted distribution of some, the small size of each population at a single site, and the diversity in flower colour (white, yellow, blue and red/bronze) and breeding systems (Robertson & Lloyd 1991). Unfortunately, this genus is also notable for the numerous species that have conservation problems or are in need of taxonomic revision.

The most recent treatment of indigenous species of New Zealand *Myosotis* was carried out by Moore (1988). This provides a brief description of each species, distribution and habitat details, and a few comments on whether further taxonomic study is required for some species. The treatment was largely based on an earlier study of the genus also by Moore (1961), where descriptions, synonymies, distribution details and notes on taxonomic status, type localities and potential type material were provided. However, information on type specimens and type localities is lacking or is inaccurate for some species in Moore's revisions.

Uncertainty about the location and identity of the type specimens for New Zealand plant species is not restricted to species of *Myosotis*, and a similar situation has been observed in ferns. Brownsey (1979) compiled a list of putative type specimens of New Zealand ferns held at the herbarium WELT of the Museum of New Zealand, with lectotypification needed for some species names. In his list, Brownsey also mentioned Moore's personal advice regarding the information included under the heading 'Types' in Allan (1961), i.e. that the information should be considered only as a general statement to indicate a putative type specimen for each species or where the original material could be potentially found.

A new revision of *Myosotis* from New Zealand is currently underway at the Museum of New Zealand Te Papa Tongarewa. The main goals of this project are to resolve species delimitation issues, reassess taxonomic status of several named species and varieties, and describe a number of new species using both morphological and genetic data.

In order to provide a sound and accurate taxonomic background for this project, references to type material and their repository institutions for all currently accepted species have been gathered and their type status corroborated. Furthermore, several New Zealand *Myosotis* species are morphologically very variable and, therefore, the study of type material is necessary to confirm the correct application of published names. In turn, this ensures species can be accurately circumscribed and putative unnamed species recognised.

After studying these resources, it became evident that at least three of the 42 species names currently included in *Myosotis* for New Zealand require lectotypification: *M. australis* R.Br., *M. forsteri* Lehm. and *M. goyenii* Petrie. The aim of this paper is to select lectotypes for each of these species, including illustrations and the rationale supporting their selection.

Lectotypification

The three species names here lectotypified are listed below alphabetically. Images of the material designated as lectotype for each species are also provided. The selection of lectotypes was done following the recommendations of the International Code of Botanical Nomenclature (ICBN) (McNeill *et al.* 2006). Material examined by the author is indicated with an exclamation mark (!).

Abbreviations used in the text

Abbreviations used for the different herbaria follow Holmgren *et al.* (1990) and are listed below:

AK	Auckland War Memorial Museum, Auckland, New Zealand
BM	Natural History Museum, London, England
CHR	Landcare Research New Zealand Limited, Christchurch, New Zealand
E	Royal Botanic Garden Edinburgh, Edinburgh, Scotland
GOET	Universität Göttingen, Göttingen, Germany
K	Royal Botanic Gardens, Kew, England
LE	V.L. Komarov Botanical Institute, Saint Petersburg, Russia
MEL	Royal Botanic Gardens, Melbourne, Australia
P	Muséum National d'Histoire naturelle, Paris, France
S	Swedish Museum of Natural History, Stockholm, Sweden
WELT	Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand

Myosotis australis R.Br., *Prodr. Fl. Nov. Holland.*: 495 (1810)
TYPE COLLECTION: Port Jackson and van Diemen Island.
LECTOTYPE (designated here): 'Banks of Paterson River, *R. Brown* # 2934, Oct. 1804' (BM 000939408! – Fig. 1).

Myosotis australis is one of the most taxonomically challenging species of *Myosotis* in New Zealand. It appears that several unnamed species have been included under this name in New Zealand, possibly none of them matching the Australian type (Moore 1988), and a thorough morphological and genetic study of this species aggregate is needed. *Myosotis australis* has also been described as a morphologically variable species in Australia (Jeanes 1999). Aside from New Zealand, the species is found in New Guinea and Australia.

Myosotis australis was first collected in Australia by Robert Brown during his exploration voyage on the *Investigator* between 1801 and 1805. In the original description by Brown (1810), no type material or representative specimens were listed, and only the regions where it grows were recorded: Port Jackson (New South Wales, Australia) and van Diemen Island (now Tasmania, Australia). Moore (1961) stated that the type material of this species could have been collected in Australia or Tasmania.

Many of the plant specimens collected by Brown in Australia are currently found at BM, E, K and LE (Vallance *et al.* 2001). The set at BM is the largest, and has the best specimens and collection details (Vallance *et al.* 2001). There is a series of three sheets with material of *Myosotis australis* in this set (BM 000939408, BM 000939409 and BM 000939410). All three sheets have labels with collection details written by Brown and two of them with an earlier registration number '2934'. This number was assigned by Joseph Bennett – Brown's assistant – at BM, when preparing a catalogue of Brown's material (Vallance *et al.* 2001). Two of the sheets have material collected near Port Jackson (New South Wales) and the third sheet has material collected in Tasmania, at two different localities: Table Mountain (now Mt Wellington) and Lagoon Beach at Port Dalrymple. This latter sheet also has a modern label indicating this is a 'Type specimen' (Fig. 2). The material in the three sheets was provisionally labelled '*M. uncinata*' and '*M. hirta*' by Brown.

The criterion used to designate the material on the sheet number BM 000939409 as the type of *Myosotis australis*, and the author of such designation, are both unknown. It is likely that the status of type was given to this material based on the annotation 'No21 desc. [description] Mscr

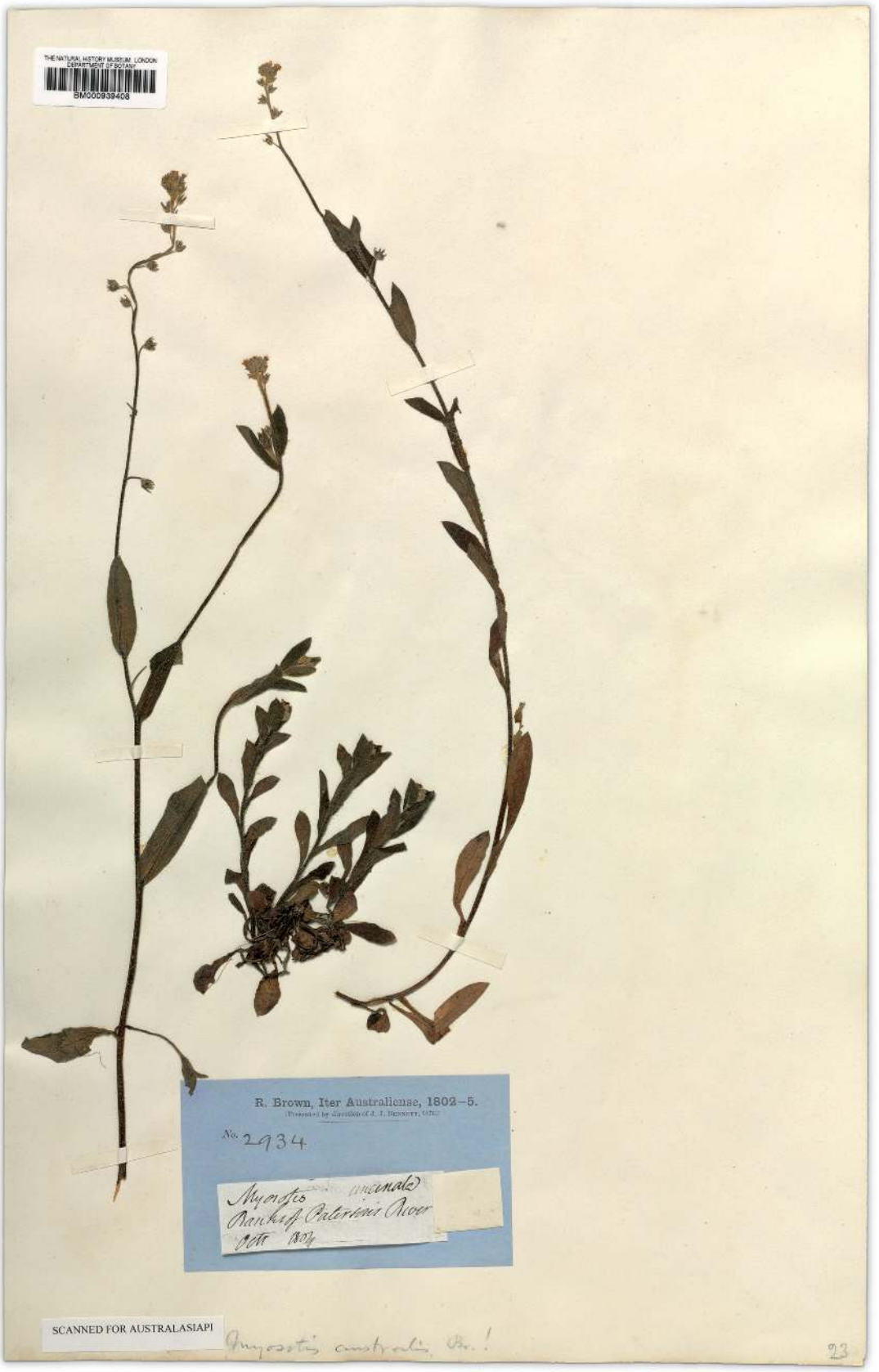


Fig. 1 Sheet BM 2934, holding the lectotype of *Myosotis australis* (photo: Natural History Museum, London, reproduced with permission).



Fig. 2 Sheet holding material of *Myosotis australis* held at BM, labelled as 'Type Specimen' (photo: Natural History Museum, London, reproduced with permission).

[manuscript] P Dalrymple' found on the reverse of Brown's label, which coincides with the notes in Brown's manuscripts. Although that feature makes this material a good candidate to be the lectotype, the specimens on this sheet were collected in different localities, Port Dalrymple and Mt Wellington, and on different dates. The first collection was made during Brown's first trip to Tasmania in January 1804, and the second possibly in mid-January or late March 1804, during Brown's second trip to Tasmania (Vallance *et al.* 2001). Unfortunately, it is impossible to identify with certainty which specimen was collected on his first trip and which on the second. This means that the material on this sheet is not a gathering made at a single locality and date, and thus does not comply with Art. 8.2 of the ICBN (McNeill *et al.* 2006). A similar situation occurs with another sheet in this series, 'R. Brown # 2934' (no BM number). This sheet consists of several specimens collected between 1803 and 1804 at Paterson River and Nepean River, both near the colony of Port Jackson (New South Wales), but again it is impossible to assign each specimen to a locality or gathering.

The last sheet in the series (BM 000939408; Fig. 1), unlike the first two, contains material of *Myosotis australis* from a single gathering, collected at the banks of Paterson River (New South Wales) in October 1804. The specimen, labelled as '*M. uncinata*' by Brown, consists of three fragments, probably all part of the same plant, including rosette leaves, stem leaves, fruits and flowers. All these structures are mentioned in the species diagnosis given by Brown (1810). I designate this specimen as the lectotype of *M. australis*. The forthcoming revision of the genus in New Zealand will deal with the application of this name to New Zealand plants.

Myosotis forsteri Lehm., *Pl. Asper. Nucif.* 1: 95 (1818)
TYPE COLLECTION: *Nova Hollandia*. Type locality in error, correct type locality: Dusky Sound, New Zealand.
LECTOTYPE (designated here): '*M. forsteri* Lehm. *Nova Hollandia,* legit *Forster*' (MEL 71187! – Fig. 3).
Myosotis forsteri was described by J.G.C. Lehmann in 1818. It is stated in the protologue that the description is based on material collected by the Forsters (Johan Reinhold Forster and son Georg) in Nova Hollandia (now Australia). No further details about the locality or the studied specimen(s) were given by Lehmann (1818).

In her flora treatments of New Zealand *Myosotis*, Moore (1961, 1988) neither mentioned the whereabouts of the type specimen(s) of *M. forsteri*, nor proposed a lectotype. However, she rectified the collection locality given by Lehmann and changed it from 'Nova Hollandia' to 'Middle Island', i.e. South Island, New Zealand (Moore 1961). The locality given by Lehmann was incorrect for two reasons. First, *M. forsteri* does not occur in Australia and, second, the Forsters never landed in Australia (Nicolson & Fosberg 2004). The Forsters visited New Zealand as scientists to Captain James Cook's second voyage to the southern oceans between 1772 and 1775. Most of their collections were made in the South Island during 1773, first at Dusky Sound (28 March–5 May) and later at Queen Charlotte Sound (19 May–7 June) (Nicolson & Fosberg 2004).

However, it is possible to infer the exact locality where the Forsters collected specimens of *Myosotis forsteri*. Historical records suggest that this species was collected at Dusky Bay, on the west coast of the South Island, and this is supported by notes on an illustration of *M. forsteri* made by G. Forster (Fig. 4), currently held at the Natural History Museum, London. The illustration depicts a specimen of *M. forsteri*, a detailed drawing of a basal leaf, two cymes and details of the calyx and flowers. The locality 'Dusky Bay' is indicated in the drawing along with the illustration number '33' and the species name '*Myosotis spathulata*'. This locality was also suggested by Nicolson & Fosberg (2004) as the type locality for *M. forsteri*.

It is important to clarify that the Forsters collected material of two *Myosotis* species during this trip: *M. forsteri* and *M. spathulata*. It appears that, initially, they were unaware of this mixture, and most of their collections were identified and labelled with one name only, *M. spathulata*, a species described in the *Prodromus* by G. Forster (1786). Nicolson & Fosberg (2004) have studied most of the Forsters' material identified as *M. spathulata* and have confirmed that many of the specimens are a mixture of *M. forsteri* and *M. spathulata*. Two herbarium sheets at two different institutions have been labelled as types by Dan Nicolson: GOET *Foster 43* (!) and BM 000528770/BM 000645865 (!). Both contain a mixture of material of *M. forsteri* and *M. spathulata*. Nicolson has also labelled the material of *M. spathulata* in these three sheets as type material for this species. Lectotypification of *M. spathulata* is probably also needed, but first further investigation is required and this is not the scope of this study.

The presence of both species in the Forsters' collections is also evident from J.R. Forster's unpublished manuscript 'Descriptiones plantarum quas in intinere ad maris Australis terras suscepto, collegit, descripsit, & delineavit' (n.d.). In

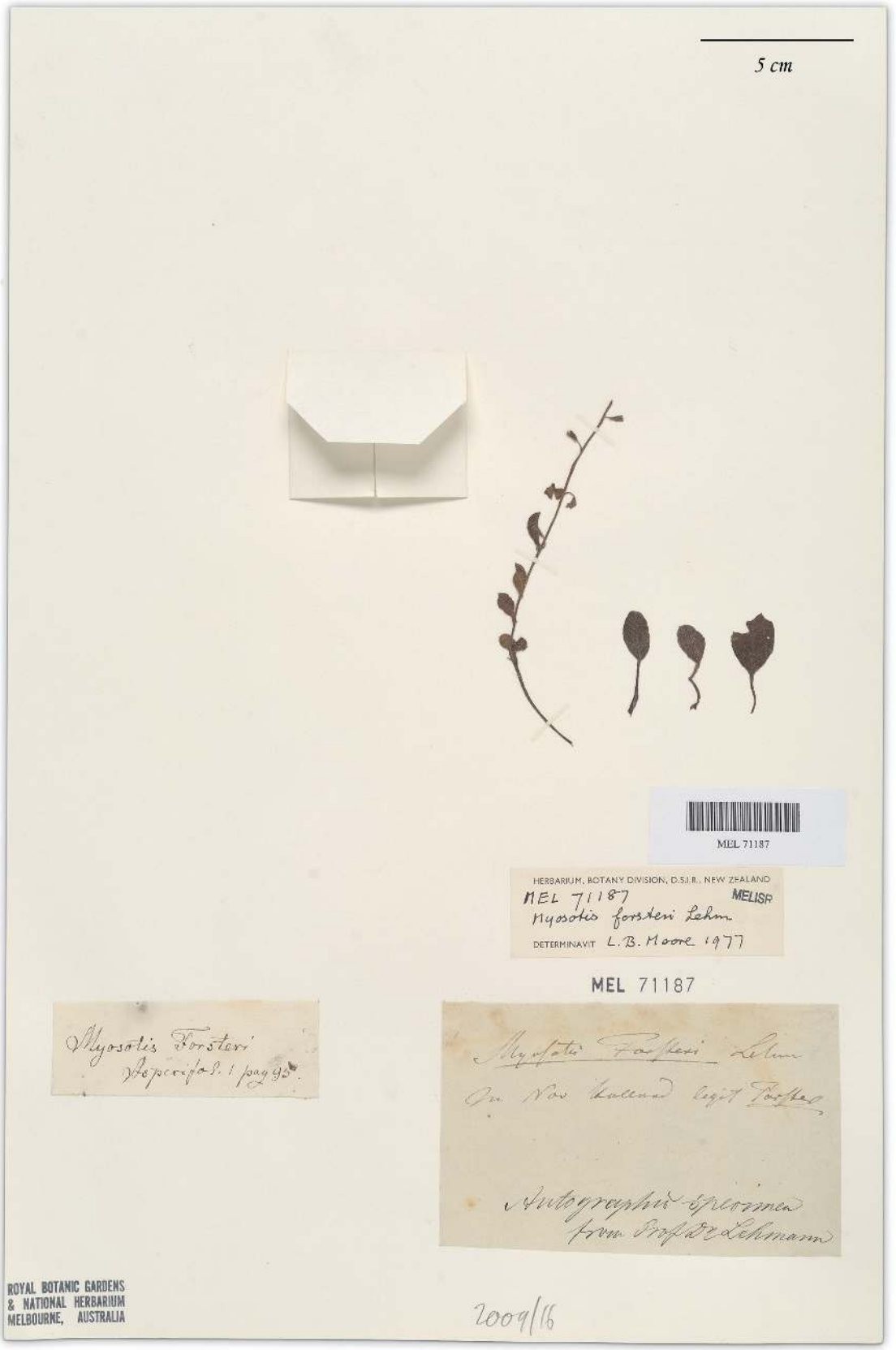


Fig. 3 Sheet MEL 71187, holding the lectotype of *Myosotis forsteri* (photo: J.C. Stahl; reproduced with permission from the State Botanical Collection, National Herbarium of Victoria, Melbourne).

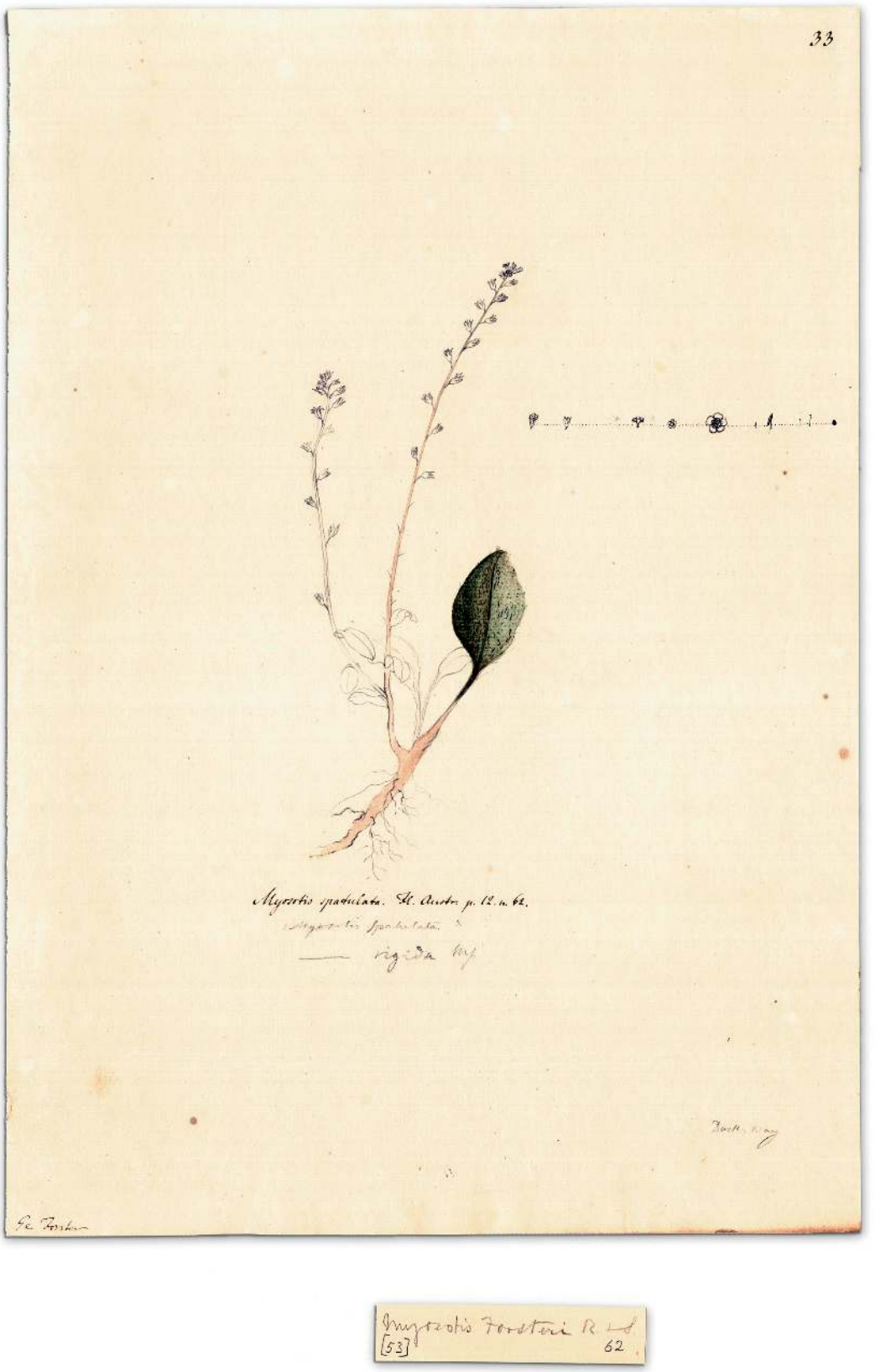


Fig. 4 Unpublished illustration of *Myosotis forsteri* collected at Dusky Sound by Georg Forster, Forster's folio number 33, held at the Natural History Museum, London (photo: Natural History Museum, London, reproduced with permission).



Fig. 5 Labels associated with *Myosotis forsteri* specimen MEL 71187, selected here as the lectotype: A, Lucy Moore's handwriting; B, Johann G.C. Lehmann's handwriting; C, Ferdinand von Mueller's handwriting; D, unknown writer (photo: C.A. Lehnebach; reproduced with permission of the State Botanical Collection, National Herbarium of Victoria, Melbourne).

it the author gives an extended description of *Myosotis spathulata* that includes the following note: 'Obs: rarius in racemum abit florescentia, communiter, pedunculus uniflorus, solitarii e foliolum superiorum axillis'. The first part of the note makes reference to one of the main differences between *M. forsteri* and *M. spathulata*, i.e. the floral arrangement. Flowers in *M. forsteri* are arranged forming a cyme, while in *M. spathulata* flowers are solitary and located in the axil of every stem leaf. Nicolson & Fosberg (2004) indicated that a couple of years after the *Prodromus* was published in 1786, the Forsters realised the mixed nature of their samples, but it is unknown whether they attempted to resolve the matter. Meanwhile, specimens of *M. forsteri* remained undescribed until Lehmann's publication 32 years later.

Neither Moore (1961, 1988) nor Nicolson & Fosberg (2004) managed to locate the specimen(s) of *Myosotis forsteri* studied by Lehmann. Most of Lehmann's types are held at the Swedish Museum of Natural History in Stockholm. Although this institution bought most of Lehmann's specimens after his death in 1860 (Nordenstam 1980; Nicolson & Fosberg 2004), the type specimens of Lehmann species of Boraginaceae are not there (Nicolson & Forsberg 2004). Historical records indicate that parts of Lehmann's herbarium were sold independently to other botanists, and that the Boraginaceae, in particular, were bought privately by O.W. Sonder, a pharmacist from Hamburg who had studied under Lehmann (Nordenstam 1980; Buys & Nordenstam 2009). Over time, Sonder's collection became too large for him to manage and he offered it to his friend the Baron Ferdinand von Mueller in Australia, who, after sorting out a number of financial difficulties, managed to raise sufficient funds to purchase most of Sonder's material for MEL (Short 1990).

A loan of *Myosotis* specimens received from MEL included several specimens of *M. forsteri* listed in Australia's Virtual Herbarium Catalogue (Council of Heads of Australian Herbaria 2010). One of these specimens (Fig. 3) has several features suggesting that it be may part of the material used by Lehmann to describe *M. forsteri*. The specimen (MEL 71187) has three labels. One is a determinavit label signed by Lucy Moore in 1977 that confirms the identity of the specimen (Fig. 5A). The second label includes two handwritten annotations made by different people: the first annotation (Fig. 5B) indicates the species name and authority '*Myosotis Forsteri* Lehm', collection locality 'In Nov Holland' and collector 'legit *Forster*'; and the second annotation (Fig. 5C) reads 'Autographed specimen from Prof Dr Lehmann'. After studying the handwriting styles and comparing them with autograph examples compiled by Burdet (1976, 1977), it became evident that these annotations were made by Lehmann and F. von Mueller, respectively. The third label on the specimen (Fig. 5D) states the name of the species and the page number of Lehmann's *Asperifoliarum* (1818) where *M. forsteri* was described. It was not possible to identify the author of this annotation, but it does not belong to Sonder (see examples of Sonder's handwriting in Buys & Nordenstam 2009) or the previously named collectors.

The specimen MEL 71187 matches the original description in Lehmann (1818), but some described structures, such as roots and the distal section of the cyme, are missing. Whether these structures broke off through handling of the specimens over the years, or whether the specimen is only a fraction of the original material, is unknown. It has been suggested that Sonder, while selling Lehmann's herbarium after his death, kept parts of many specimens or sometimes just small fragments of them. Most of these pieces were later sold to his friend F. von Mueller to be deposited at MEL (Buys & Nordenstam 2009).

Lehmann's notes on the specimen label, which are identical to those in his 1818 *Asperifoliarum*, are a strong indication that this material was studied by him when describing *Myosotis forsteri*. Therefore, this is a good candidate for lectotypification. None of the specimens labelled as type by Nicolson at GOET or BM has features like these that link them to Lehmann.

Ironically, specimens of *Myosotis forsteri* had already been collected by Joseph Banks and Daniel Solander during the first voyage of Captain Cook to New Zealand. The name Solander used for this species in his 1769–1770 manuscript 'Primitiae florae Novae Zelandiae' was *Myosotis rigida*. Duplicates of the material Solander used for the description of *M. rigida* are currently held at WELT.

Myosotis goyenii Petrie, *Trans. & Proc. New Zealand Inst.* 23: 400 (1891)

TYPE COLLECTIONS: Cardrona Valley and Lake Hawea.

LECTOTYPE (designated here): 'Lake Hawea. Steep rocky faces on track on east side of the lake *D. Petrie* (WELT SP002484!' – Fig. 6).

Petrie (1891) did not indicate a type specimen or mention any studied or representative specimens of *Myosotis goyenii* in his description. He mentioned only the localities Cardrona Valley and Lake Hawea (Otago, South Island) for the source of his material. He also acknowledged that the species had been first discovered in Arrowtown in the South Island by Peter Goyen several years before.

Most of Petrie's herbarium is housed at WELT. This collection includes five sheets of *Myosotis goyenii*, with three of them labelled by Petrie as types: WELT SP002482A, WELT SP002482B and WELT SP002482C. These specimens were collected in Arrowtown. The sheet WELT SP002482A has the date of collection written on the label as '1st December 1896'. Moore (1961) noticed that this was a later date to the publication of the protologue and thereby invalidated the type status of the specimen. However, after reconstructing Petrie's itinerary of botanical expeditions, Hamlin (1958) established that '1st December 1896' is likely to be a transcription error made by Petrie when relabelling his entire collection at the time it was donated to WELT. From the itinerary prepared by Hamlin (1958), it is clear that Petrie was collecting in the North Island in 1896, first in the Bay of Plenty in November and then on Little Barrier Island in December. Petrie's expeditions to Arrowtown and Cardrona Valley, on the other hand, were made in November and December 1890. There is material of *M. goyenii*, probably also collected during this trip, at the Auckland Museum (AK 7475) and this has been considered a potential syntype of *M. goyenii* by Herrick & Cameron (1994). Unlike the WELT material, this specimen still has Petrie's original label. The date of collection in Petrie's handwriting is 'Nov. 1890' and the locality Arrowtown. This evidence further supports Hamlin's conclusion that Petrie collected in Arrowtown during 1890 and not 1896.

Although it can be argued that the material Petrie labelled as types was collected in 1890, prior to the published description of *Myosotis goyenii*, the locality Arrowtown is not the source locality for Petrie's material but where Goyen first discovered the species. Furthermore, it is impossible after reading Petrie's work to establish whether he had seen Goyen's material discovered 'several years ago', as he mentioned in the description, and used it for the description of *M. goyenii*.

There are also two sheets of *Myosotis goyenii* at WELT collected by Petrie from Cardrona Valley and Lake Hawea. The sheet WELT SP002485 was collected in Cardrona Valley but no collection date is indicated on the label. This collection could have taken place in December 1890 (Hamlin 1958) or even earlier, for instance during 1886. In 1886, Petrie visited Lake Hawea and also the Remarkables. These localities are north and south of the Cardrona Valley, respectively. Unfortunately, records for Petrie's expeditions prior to 1889 are very scant (Hamlin 1958), and his itinerary can be neither confirmed nor rejected.

The second sheet, WELT SP002484, contains two specimens collected at Lake Hawea on February 1886, with the label reading 'Lake Hawea. Steep rocky faces on track on east side of the lake'. This description matches the protologue in Petrie (1891): 'I have gathered it … at the bluff on the east side of Lake Hawea'. This specimen is a good candidate for lectotypification: the collection locality coincides with that



Fig. 6 Sheet WELT SP002484, holding the lectotype specimen of *Myosotis goyenii* (photo: C.A. Lehnebach, Museum of New Zealand Te Papa Tongarewa, Wellington).

given in the protologue and the collection date is prior to the date of publication of Petrie's work. I designate here the specimen WELT SP002484 as lectotype (Fig. 6).

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