



A phenetic analysis of morphological variation in *Acacia genistifolia* (Fabaceae subf. Mimosoideae), with recognition of three subspecies

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Introduction

Acacia Mill. is Australia's largest plant genus with more than 1,000 species (Maslin 2020). *Acacia* dominates an array of vegetation types and is particularly prominent in the arid zone (Murphy *et al.* 2010). It is unsurprising that research into this genus and the diversity of its members has been extensive, resulting in increasingly refined phylogenies (e.g. Miller *et al.* 2002; Brown *et al.* 2010; Murphy *et al.* 2010). Despite growing confidence in species delimitations across *Acacia*, questions remain about infraspecific variation within species like *Acacia genistifolia* Link. Whilst this species is relatively common throughout its range, two distinct morphotypes have been identified (Court 1972; Maslin 2001a), that have not yet been formally recognised.

Acacia genistifolia commonly forms a straggly, erect to spreading shrub. It has pungent, more-or-less 4-angled phyllodes ranging from virtually flat and oblong to terete and linear. Its flowers form globular, cream to bright yellow heads on relatively long, slender peduncles (Maslin 2001a; VicFlora 2020). Its range includes South Australia, where it is recorded with three collections from one location near Mintaro, north of Adelaide, and an unprocessed fragment from Angaston (M. O'Leary (AD), pers. comm.). No collections have been made in those areas since

Abstract

Acacia genistifolia Link displays morphological variability across its geographic range. To test if this species should be divided into distinguishable taxonomic groups, phenetic analyses of 12 scored characters from 139 specimens were conducted. Three distinct ordination clusters suggested division of the species into three groups. Dendrogram assemblages and geographic distribution patterns supported this distinction. Accounting for overall similarity across the groups, this study resulted in recognition of three discernible entities within *A. genistifolia*, here treated as *A. genistifolia* subsp. *genistifolia*, *A. genistifolia* subsp. *attenuata* A.T.Webb, subsp. nov. and *A. genistifolia* subsp. *platyphylla* A.T.Webb, subsp. nov. A lectotype is selected for *Acacia genistifolia*.

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1990. It is more widespread in New South Wales and the Australian Capital Territory, where it is mostly scattered along the Great Dividing Range, from Dubbo south to Nadgee Nature Reserve. It is also prevalent in Victoria, occurring through the Grampians, central Victoria, Melbourne and near-coastal Gippsland. In Tasmania, it occurs primarily in the east, with a few records in the north and northwest of the state, including the Furneaux Group (Figure 3) (Maslin 2001a).

Within its range, *Acacia genistifolia* is perhaps most easily confused with *A. aculeatissima* J.F.Macbr., *A. brownii* (Poir.) Steud., *A. siculiformis* A.Cunn. ex Benth. and *A. ulicifolia* (Salisb.) Court. Each of these species have sharp-tipped phyllodes with four longitudinal nerves and simple, globular inflorescences. *A. genistifolia* can be distinguished from *A. aculeatissima* by its strongly ribbed, glabrous branchlets, from *A. brownii* and *A. ulicifolia* by its longer phyllodes, and from *A. siculiformis* by its longer peduncles and 4-merous flowers (Maslin 2001a).

Acacia genistifolia was first described in 1822. Later that year an additional two names, *A. diffusa* Ker Gawl. and *A. prostrata* Lodd., G.Lodd. & W.Lodd. were erected, both of which are now treated as synonyms of *A. genistifolia* (Court 1972; Maslin 2001a). *Acacia diffusa* was subsequently the most commonly used name for the species (e.g. Rodway 1903; Ewart 1930; Willis 1973) until Court (1972) established that *A. genistifolia* is the correct name for it under its current circumscription (Maslin 2001a). However, multiple forms are encompassed within the current circumscription of *A. genistifolia*, some of which have been previously recognised as separate taxa (see Discussion and synonymy of taxa).

Acacia genistifolia has been included in molecular phylogenetic studies focused on reconstructing broad relationships within *Acacia* (Murphy *et al.* 2003; Brown *et al.* 2010; Miller *et al.* 2011). These studies suggest close relationships of *A. genistifolia* with *A. melanoxyton* R.Br. and *A. verticillata* (L'Hér.) Willd., forming a clade sister to the '*Acacia longifolia* group' and its allies. However, this is the first known phenetic study concentrated on this species and involving a sample set covering most of its geographic range and known morphological variation. Through phenetic analysis of variable morphological characters, this study assesses *A. genistifolia* for distinct subgroupings. Taking historical classification and modern observations into account helps to guide

hypotheses regarding groups that warrant taxonomic recognition.

Methods

This study utilised 139 herbarium specimens of *Acacia genistifolia*, housed in the National Herbarium of Victoria (MEL), where the authors were based. This allowed relatively even coverage across most of the known distribution of *A. genistifolia*, with 15 specimens from New South Wales and the Australian Capital Territory, 94 from Victoria and 30 from Tasmania (Figure 1). No South Australian material was housed at MEL and so no material from the region could be incorporated into the analyses. This was thought unlikely to alter the outcomes of analyses as South Australian specimens appear similar to the typical *A. genistifolia* from Victoria that were incorporated within the analyses (M. O'Leary, pers. comm.). Initially, it was not certain whether the South Australian occurrence was natural or an introduction, prompting some concerns about including any of that material, however, subsequent information suggests that it is native to South Australia, though now likely extinct or at least functionally extinct in that state as the only well-known specimen, collected from three times, is now dead (M. O'Leary, pers. comm.). The sampling for this study covered previously noted forms from south-east New South Wales and eastern Victoria (long, slender phyllodes) and Tasmania (short, broad phyllodes), and subsequent comparisons with typical plants (Bentham 1853; Maslin 2001a; VicFlora 2020). Each specimen was treated as a separate operational taxonomic unit.

To assess infraspecific variation in *Acacia genistifolia*, 24 morphological characters were scored (Table 1). Character selections were based on characters used to score a related, recently described Victorian *Acacia* species (Orel *et al.* 2020), and which have proven useful in other studies (Conn & Tame 1996; Gardner *et al.* 2005; Ariati *et al.* 2007) and personal observations. Variation within *A. genistifolia* manifests primarily in phyllode morphology. To reflect this variation, seven quantitative and seven multistate characters were initially surveyed. Ultimately, six quantitative phyllode characters (Table 1: 2–7) and an additional two multistate characters addressing phyllode shape (Table 1: 8, 9) were included in analyses. To standardise measurements and eliminate variation associated with plant maturity,

the 7th phyllode on each branchlet was used to score characters except for characters 4 and 6. Character 4 was the longest phyllode and character 6 was the distance between nodes, standardised by measuring between the 7th and 8th nodes and representing mature but non-senescent growth. Phyllode width represents the broadest dimension of phyllodes, which becomes more pronounced in flattened phyllodes displayed by some specimens of *A. genistifolia*. All quantitative measurements were made with five phyllode replicates. Phyllode shapes were defined as: narrow-linear (length >20× width); linear (length 10–20× width); narrow-oblong (length to 10× width); narrow-ovate; sub-falcate (inner margin concave, outer margin convex); subulate (base slightly broader than apex). Phyllode cross-section shapes were defined as: terete (Figure 4, A); subterete (slightly flattened); rhombic (Figure 4, B); flattened (Figure 4, C) (Maslin 2018).

Several inflorescence and fruiting characters were surveyed to support variation present in phyllodes (Table 1). However, insufficient representation in

most specimens led to the omission of some of these characters from analyses. This left four inflorescence characters (three quantitative and one binary; Table 1) for inclusion in analyses. For characters 15 and 16, five inflorescence replicates were chosen at random and scored, provided they were at anthesis (anthers exerted) to maintain consistency. Character 17 required that mature buds were counted to provide an accurate estimate of flower number. Flower colour (character 18) was derived from collecting notes only.

Mean values were calculated for all quantitatively scored characters for use in analyses. Classification and ordination analyses were completed using PATN v4 (Belbin 2018). This first generated a matrix of dissimilarity utilising Gower's coefficient (Gower 1971), which allows for equivalent treatment of discrete and continuous measures through range-standardisation of values. Dissimilarity values were subsequently used to generate a dendrogram using agglomerative hierarchical fusion, with the flexible unweighted pair-group method with arithmetic mean (UPGMA) and a beta value of -0.1. A

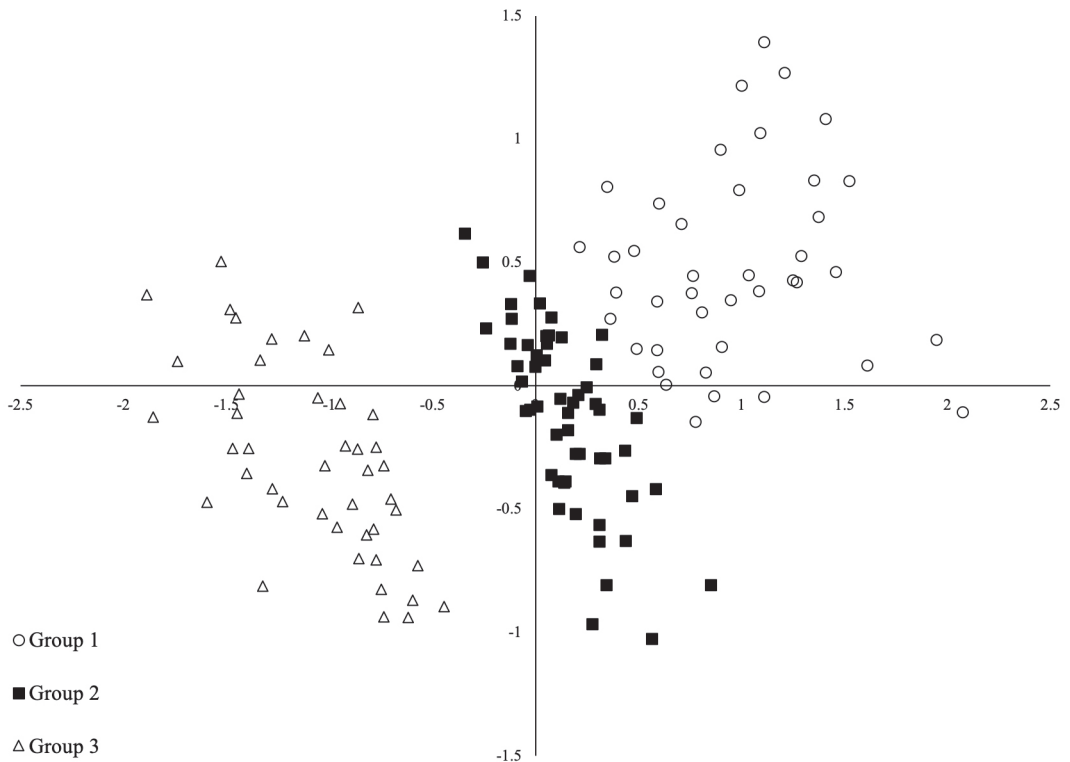


Figure 1. Two-dimensional ordination obtained using SSHMDS (maximum 100 iterations, stress: 0.1502), displaying subgroupings within *Acacia genistifolia*.

two-dimensional ordination was generated with the same matrix, using semi-strong hybrid multidimensional scaling (SSHMDS), based on ten random starts and 100 maximum iterations. How well data points were represented on the plotted ordination was given by a stress value, where lower stress indicated better fit (Kruskal 1964). Kruskal-Wallis (KW) values provided a numerical indication of character significance, where proximity to 100 was most significant (Table 1).

Results

Phenetic analyses resulted in three distinct groups, displayed in Figures 1, 2 and 3. The two-dimensional ordination (max. 100 iterations, stress: 0.1502) resulted in three distinct clusters, here named groups 1, 2 and

3, that did not overlap (Figure 1). The group 3 cluster was clearly separated from a cluster including groups 1 and 2. Groups 1 and 2 were separate except for one specimen in group 2 (MEL672060, north-central Victoria) approaching one from group 1 (MEL673656, NSW, Nadgee) (Figure 1).

The dendrogram distinguishes between group 3 and groups 1 and 2 (Figure 2), displayed at the first branching point. Within the core branch encompassing groups 1 and 2 was a divergence of ten group 1 specimens, which originated from across Gippsland. The remaining samples in both groups placed together in a large cluster, split into two fundamental branches which contained either the majority of remaining group 1 or group 2 specimens. Some overlap then existed within each of these branches, with MEL595015 (Victoria,

Table 1. Characters scored for phenetic analyses, with Kruskal-Wallis values presented as an indication of significance of characters included in analyses.

1. Indumentum: glabrous (0) present (1)	.....
Phyllode characters	
2. *Width of phyllode (mm)	89.402
3. *Length of phyllode including mucro (mm)	79.202
4. *Length of longest phyllode (mm)	79.704
5. *Distance from pulvinus to the gland (mm)	43.574
6. *Distance between nodes 7 and 8 (mm)	22.255
7. *Angle of phyllode from stem at 3 mm from node (degrees)	44.804
8. *Shape of phyllode: narrow-linear (0) linear to sub-falcate (1) subulate (2) narrow-ovate to narrow-oblong (3)	81.185
9. *Shape of phyllode in cross-section: flattened (0) rhombic to terete (1)	89.571
10. Ratio of phyllode length to thickness	.....
11. Internerve indumentum: glabrous (0) present (1)	.....
12. Primary nerve indumentum: glabrous (0) present (1)	.....
13. Curvature of phyllode: straight (0) slight to moderate (1) moderate to strong (3)	.....
14. Hairs (appressed) on phyllode margins: glabrous (0) present (1)	.....
Inflorescence characters	
15. *Peduncle length at anthesis (mm)	5.8287
16. *Capitulum diameter at anthesis (mm)	6.7699
17. *Maximum number of flowers per capitulum (no. mature buds)	2.5133
18. *Flower colour: yellow (0) cream to white (1)	0.2527
Pod characters	
19. Length (mm)	.....
20. Width at narrowest point (mm)	.....
21. Width at widest point (mm)	.....
22. Distance between seeds (mm)	.....
23. Curvature: straight (0) curved (1) coiled (2)	.....
24. Hair density: glabrous (0) sparse (1) moderate (2)	.....

* Denotes character included in analyses.

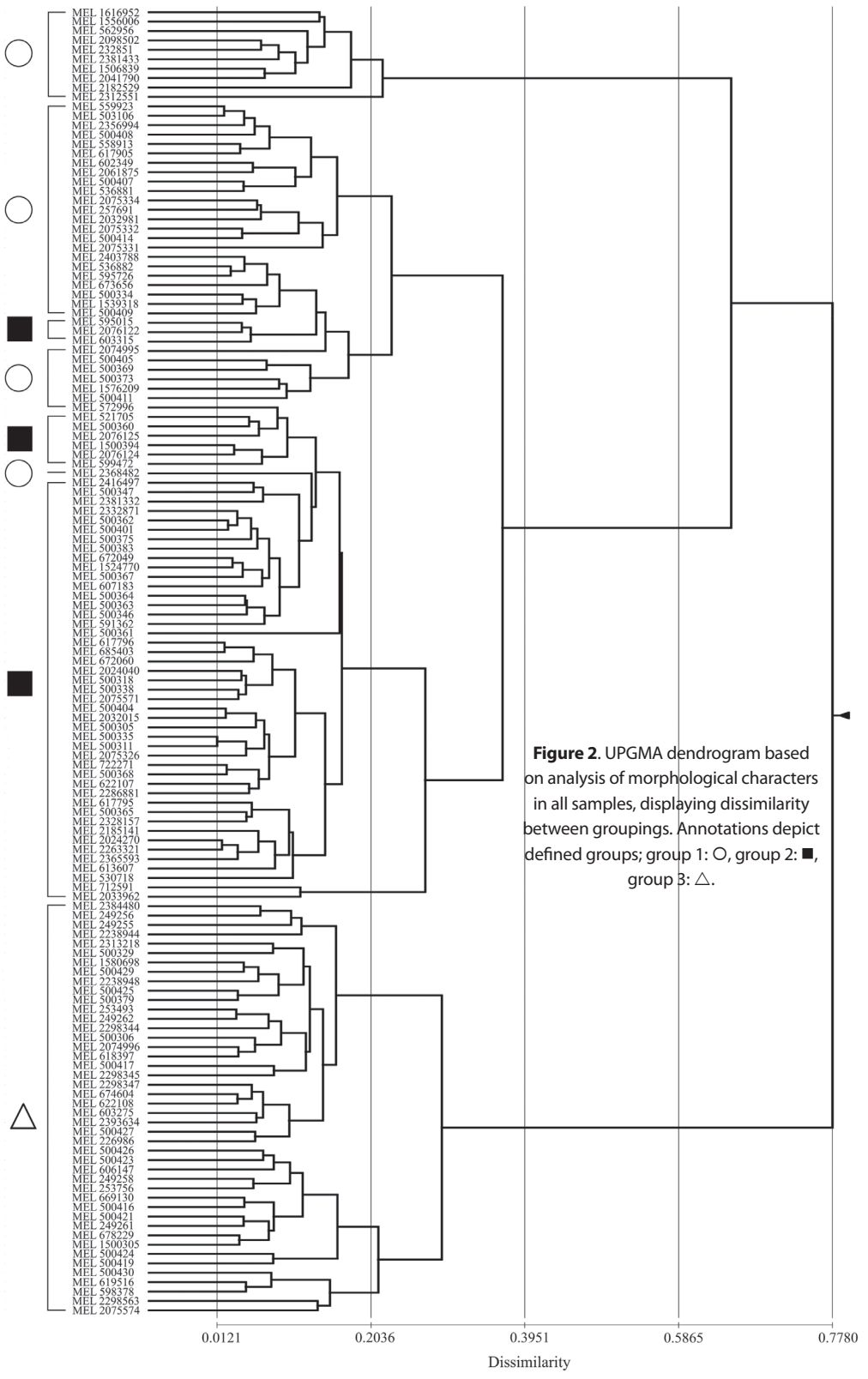


Figure 2. UPGMA dendrogram based on analysis of morphological characters in all samples, displaying dissimilarity between groupings. Annotations depict defined groups; group 1: ○, group 2: ■, group 3: △.

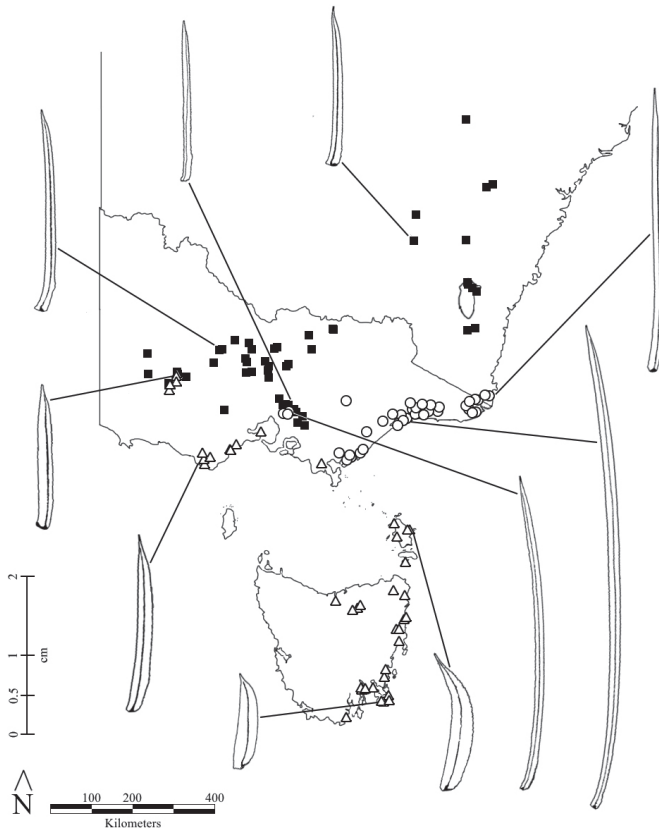


Figure 3. Distribution map displaying specimens included in analyses, symbols depict defined groups; group 1: ○, group 2: ■, group 3: △, scale horizontal. Accompanied by representative phyllode diagrams typical of each group, displaying outlines and primary nerves, scale vertical.

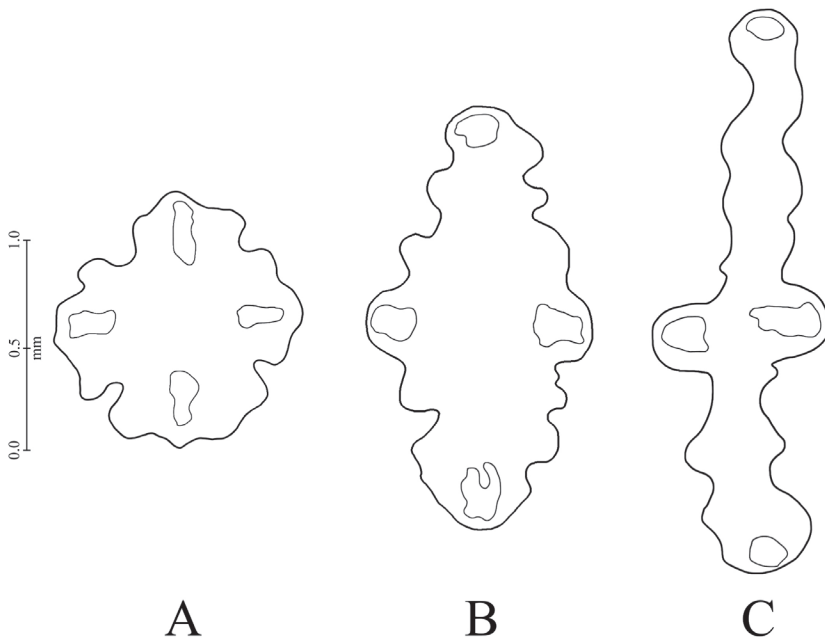


Figure 4. Phyllode cross-sections depicting differences observed in character 9. Primary nervature is indicated within phyllode outlines.

A (MEL712591) typifies subterete to terete shape present in group 1 (○) and group 2 (■).

B (MEL249258) is representative of intermediate, rhombic cross-sections present in group 2 and group 3 (△).

C (MEL606147) typifies flattened cross-sections of group 3.

Nillumbik Shire), MEL2076122 (NSW, Bathurst) and MEL603315 (central Victoria) (group 2) placing amongst the branch containing mostly group 1 samples, and MEL572996 (Victoria, Gippsland) and MEL2368482 (Victoria, Gippsland) (group 1) placing in the group 2 branch.

Distributions of specimens included in this study are presented in Figure 3 according to defined groups. Group 1 specimens were distributed in near-coastal areas from Nadgee Nature Reserve in New South Wales through Gippsland lowlands to east of Wilsons Promontory, with outlying specimens from the Macalister River north of Traralgon, and the Nillumbik Shire (about 40 km north-east of Melbourne). Group 2 specimens were widely distributed through New South Wales and the Australian Capital Territory (other than the south-east coastal area), central and north-eastern Victoria, Melbourne and the Grampians in the west where they overlapped with group 3. All Tasmanian specimens belonged to group 3, which also included specimens from the Grampians, Otways and immediately north-west of Wilsons Promontory in Victoria.

Kruskal-Wallis values (Table 1; Figure 5) indicated that phyllode cross-sectional shape (KW: 89.571) and phyllode width (KW: 89.402) were most significant in distinguishing between groups. Additionally, phyllode shape (KW: 81.185), length of longest phyllode (KW: 79.704) and (mean) phyllode length (KW: 79.202) were significant measures. Group 1 and 2 specimens tended to possess phyllodes that were subterete to terete in cross-section and linear, with those of group 1 narrow-linear. Group 3 included specimens with flattened phyllodes, ranging from linear to narrow-ovate or narrow-oblong. Phyllode width values were lower in groups 1 (0.75–1.5 mm) and 2 (1–1.5(–1.75) mm), compared with those of group 3 ((1.25–)1.5–3 (–4.5) mm). Mean and maximum phyllode lengths were highest in group 1 (mean range: 25–70 mm, max range: 34–95 mm), overlapping slightly with the maximum ranges of the mean in group 2 (mean range: 10–26 mm, max range: 19–42 mm) and group 3 (mean range: 12–27 mm, max range: (14–)19–50 mm). Less significant distinguishing characters included phyllode angle from the stem (KW: 44.804), which was more acute in group 1 (mean: 48.9°) than groups 2 (mean: 67.2°) and 3 (mean: 60.3°), and distance from the pulvinus to the gland on

the phyllode (KW: 43.574), which was greatest in group 1 (mean: 4.41 mm) when compared to group 2 (mean: 2.89 mm) and group 3 (mean: 2.37 mm). Characteristics of the inflorescence: peduncle length, capitulum diameter, number of flowers per capitulum and colour, and the distance between nodes, were variable without providing significant support for groupings. Box-and-whisker plots are included (Figure 5) for those characters useful in differentiating between groups.

Discussion

Phenetic analyses indicated three groups within *Acacia genistifolia* worthy of taxonomic recognition. These groups followed trends observed in historical nomenclature, beginning with the description of the Tasmanian *A. prostrata*, which noted distinctly flattened phyllodes resembling specimens recognised here as comprising group 3 (Loddiges *et al.* 1822). This form differed from the typical form of the species that was designated as *A. genistifolia* by Link (Court 1972), and which corresponds to our group 2. This distinction was noted by Bentham (1842), who referred to specimens corresponding to our group 3 form as *A. diffusa*, and our group 2 form as *A. cuspidata* A.Cunn. ex Benth. Bentham (1853) later recognised a form with long, slender phyllodes, '2–2 ½ inches [5–6.3 cm] in length', corresponding to our group 1, as *A. cuspidata* var. *longifolia* Benth., whilst Maslin (2001a) also noted this form, observing phyllodes up to 8 cm long. Similarly, Maslin (2001a) mentioned a Tasmanian form with broad phyllodes, which are included within our group 3. Hence, the distinctions made in this study were not novel, but the study has provided clarity regarding the characteristics that may be used to distinguish them.

Ordination results (Figure 1) depicted groups 1, 2 and 3 as distinct and showed no overlap. The dendrogram (Figure 2) supported separation of group 3 from groups 1 and 2 but showed overlaps between groups 1 and 2 that were not observed in the ordination. However, these results still suggested trends consistent with the ordination in distinguishing between the two groups. These groupings were based primarily on phyllode features. Phyllode shape was useful in distinguishing between groups, with those in group 1 typically linear or narrow-linear, group 2 linear, and group 3 ranging from linear to narrow-ovate or narrow-oblong. Phyllode

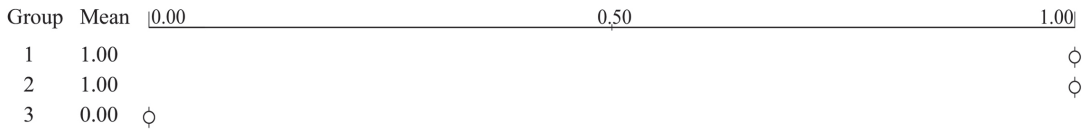
cross-section shape and width were the most significant features that differentiated group 3 (flattened; 1.5–3 mm wide) from groups 1 and 2 (rhombic in cross-section to terete; 0.75–1.5 mm wide) (Figure 4). Mean and maximum phyllode lengths were the most useful characters for discriminating between groups 1 and 2, with those of group 1 specimens typically longer. Phyllode lengths only overlapped in the minimum range

of the mean of group 1. Phyllode angle from the stem provided some value in separating groups 1 and 2; more acute in group 1 than group 2. However, this character (KW: 44:804) is less reliable than mean (KW: 79.202) and maximum (KW: 79.704) phyllode lengths. Inflorescence characters, though variable, provided little support for these groupings (Table 1).

Geographic distributions patterns of *Acacia genistifolia*

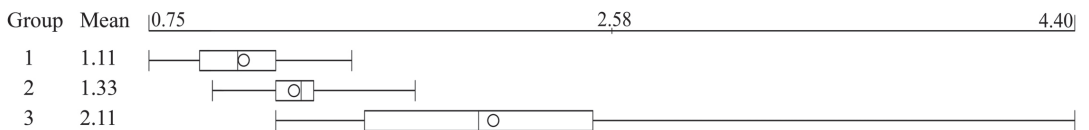
Shape in cross section

KW = 89.571



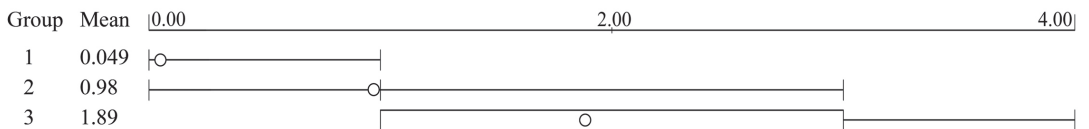
Phyllode width (mm)

KW = 89.402



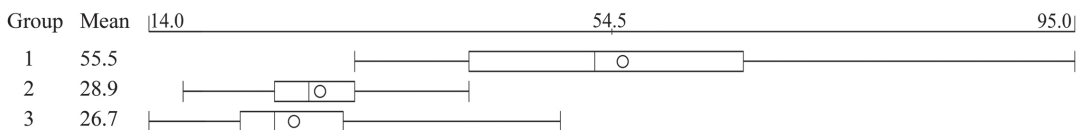
Phyllode shape

KW = 81.184



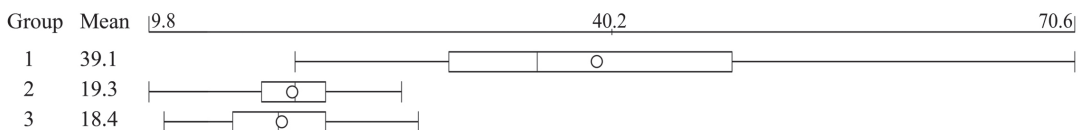
Length of longest phyllode (mm)

KW = 79.704



Phyllode length (mm)

KW = 79.202



Phyllode angle from stem (degrees)

KW = 44.804

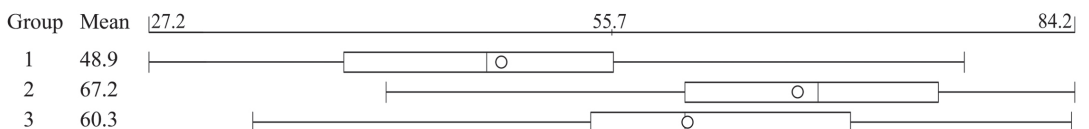


Figure 5. Box-and-whisker plots for characters used in differentiating groups, displaying: 25th–75th percentiles, minimum, maximum and mean values. Kruskal-Wallis (KW) values provide an indication of significance.

groups defined in this study generally aligned with the trends presented in the ordination (Figure 1) and dendrogram (Figure 2). Group 1 is predominantly distributed in near-coastal regions in southeastern New South Wales and eastern Victoria. However, three specimens in this group originated from the Nillumbik Shire and another was labelled 'Macalister' and presumed to be a natural occurrence in the upper rather than lower catchment of the Macalister River. Despite its location further inland and likely at higher elevation than other records, the Macalister River specimen is congruent with other group 1 specimens. The records of group 1 specimens in the Nillumbik Shire are discussed in more detail below. Group 2 exhibited a more dry-adapted, inland distribution that included South Australia and extended from central New South Wales through the Australian Capital Territory and central Victoria to the Grampians, where it overlaps with group 3. Specimens of groups 1 and 2 were allopatric except in the Nillumbik Shire. Group 3 was the only form present in Tasmania, with disjunct mainland Australian populations in the Wilsons Promontory region, Otways and Grampians. This group did not occur in areas occupied by group 1.

It might be expected that the specimens from group 1 and 2 which overlapped in geographic distributions (Figure 3) would be those which overlapped in the dendrogram. This was the case for only one of the group 2 samples placed amongst group 1, with the others being from Bathurst and central Victoria. The same was noted for the group 1 samples placed with group 2 in the dendrogram, both from Gippsland. Hence, geographic range overlap in this region was not correlated with overlap in the dendrogram. Additionally, the separation of a branch including ten group 1 specimens presented a partition within that group (Figure 2), although, this outcome was centred on phyllode length, with all specimens distributed in Gippsland. Ultimately, the recurrence of similar patterns in ordination and dendrogram results, coupled with their distributions, supported division of the *Acacia genistifolia* complex.

Whilst the data presented in the ordination (Figure 2) and dendrogram (Figure 3) support recognition of three taxa corresponding to groups 1, 2 and 3, the appropriate rank for their recognition is debatable. A combination of phyllode morphological differences and

generally strong geographic and ecological separation of the groups, with a lack of discriminating reproductive characters, supports their recognition as subspecies within *A. genistifolia* (e.g. Stuessy *et al.* 2014). In some instances, the groups become more morphologically similar to each other when in closer proximity, possibly owing to increased gene flow or because environmental conditions are more similar and have a large influence on their morphology. This is particularly noticeable with the higher similarity in phyllode morphology in group 3 plants relative to group 2 plants in Victoria. Comparatively, the similarity of phyllodes in Tasmanian group 3 plants relative to typical group 2 plants is noticeably less (Figure 3). Occasional weakening in morphological distinction due to environmental conditions or genetic continuity also urges in favour of group recognition as subspecies. Hence, the overarching similarity between the groups is reflected by classifying observed variation at subspecies rank, yet allows for their individual recognition. Recognition of subspecies based primarily on phyllode morphology is also given precedent within other *Acacia* species such as *A. boormanii* (Tucker *et al.* 2018), *A. longifolia* (Maslin 2001b) and *A. victoriae* (Ariati *et al.* 2007). Consequently, the following classification is proposed; group 1 = *A. genistifolia* subsp. *attenuata* A.T.Webb, group 2 = *A. genistifolia* subsp. *genistifolia*, group 3 = *A. genistifolia* subsp. *platyphylla* A.T.Webb. This is the first time designations have been applied at subspecies rank in this group. To avoid nomenclatural confusion and association on the basis of type illustrations (e.g. *A. diffusa*, *A. longifolia*, *A. prostrata*), new names have been applied to group 1 (subsp. *attenuata*) and group 3 (subsp. *platyphylla*). Group 2 includes specimens resembling the type of the species and is recognised as subsp. *genistifolia*.

Phyllodes typically longer than those expected for subsp. *genistifolia* were noted from a few specimens included in this study originating from near Pantom Hill, Nillumbik Shire, about 40 km north-east of Melbourne. These plants displayed intermediate morphologies between subsp. *attenuata* and subsp. *genistifolia*. Whilst most specimens from this location placed within group 2 (i.e. subsp. *genistifolia*) some placed within group 1 (i.e. subsp. *attenuata*) in Figure 2, leading to some confusion regarding the identification of specimens

there. Targeted field observations could not confirm the presence of 'typical' subsp. *attenuata* in the area. However, environmental plasticity was observed amongst specimens belonging to subsp. *genistifolia*, with longer, thinner phyllodes present in shaded areas on lower slopes of ranges, or on etiolated new growth. This could explain why collections from this area displayed phyllodes longer than expected. In addition, plants here may be influenced by relatively nearby populations of subsp. *attenuata* or by historic continuity with that subspecies but are now long separated from it. Ultimately, the distributions of subspecies presented in this study support subsp. *attenuata* and subsp. *genistifolia* as allopatric. For these reasons, it is believed that intermediate specimens from this region are best regarded as subsp. *genistifolia*.

Future studies could utilise molecular data to confirm phenotypic patterns presented in this study. A previous study by Brown *et al.* (2010) included two samples of *Acacia genistifolia*; one from group 2 and one from group 3. Their phylogeny derived from ITS and ETS data showed *A. genistifolia* to be polyphyletic. However, in that study much of the sequence data used to generate the phylogeny was missing for *A. genistifolia* samples. Accordingly, the Brown *et al.* (2010) result should be verified with further study.

The following descriptions outline the reinterpretation of *Acacia genistifolia* based on results of phenetic analyses in this study. Scored characters outside of those analysed are included, particularly phyllode length-to-width ratios and pod characters. Outlying measurements are bracketed.

Taxonomy

***Acacia genistifolia* Link, Enum. Hort. Berol. Alt. 2: 442 (1822)**

Phylloce genistifolia (Link) Link, *Handbuch* 2: 133 (1831), as *genistaefolia*.

Acacia diffusa Ker Gawl. *Bot. Reg.* 8: 634 (1822). Type: plate in *Bot. Reg.* 'Said to be a native of the newly discovered territory on the inland side of the Blue Mountains in New South Wales.'

Acacia cuspidata A.Cunn. ex Benth., *London J. Bot.* 1: 337 (1842); *Acacia diffusa* var. *cuspidata* (A.Cunn. ex Benth.)

Benth., *Fl. Austral.* 2: 333 (1864). Type: New South

Wales. Marleys Plains, April 1824, *A. Cunningham* 46 (syn: K791425, K791427 photos seen); Vineyard, *Hügel* (1837) (syn: K791431 photo seen); Argyle County, *Fraser* (syn: K791429 photo seen).

Type: GERMANY. Berlin, cultivated in botanic gardens, *Schumann s.n.* (lecto, here designated: MEL39790!).

Open shrub to 3 m. *Branchlets* strongly ribbed, stipules inconspicuous, caducous. *Phyllodes* sessile, pungent and rigid, terete to flattened, straight to slightly recurved, 4-veined with a single vein per angle, 0.75–4.5 mm in diameter, (10–)15–70(–95) mm long, diverging from the stem at (33–)40–80(–84)°, gland single, 1–5(–11) mm from pulvinus. *Inflorescences* simple, 2–4 per axil, peduncles slender, 5–19(–24) mm long, basal bract caducous. Heads globular, 10–18-flowered, white to bright yellow. *Flowers* 4-merous. *Pods* submoniliform, linear, sometimes curved (rarely beginning to coil), glabrous or sparsely to moderately covered by short appressed hairs, (34–)40–80(–100) mm long, 2–7 (–8) mm wide. *Seeds* 3.5–5 mm long × 2.5–3.5 mm wide, funicle white to cream, enlarged into an aril at seed base, doubling back and tapering to point of attachment.

Habitat and Distribution: A few records exist in South Australia, from north of Adelaide near Mintaro and Angaston. A single individual was known for many years but has now apparently died (M. O'Leary, pers. comm.), suggesting that this species may now be extinct in the state. Scattered through New South Wales and the Australian Capital Territory, from Dubbo south to Nadgee Nature Reserve, mostly inland of the Great Dividing Range and extending west to Griffith. Widespread in Victoria, excluding the highlands, north-west and south-west of the state. Prevalent in Tasmania, particularly the east and including the islands of the Furneaux Group. Typically grows in dry sclerophyll forests and heathland, below 1000 m.

Typification: The type specimen (MEL39790) is here designated as a lectotype, due to the lack of a cited holotype in the protologue and the apparent lack of a specimen at the Botanic Museum Berlin-Dahlem (B), likely resulting from the massive loss of types at B as a consequence of bombing in the Second World War (e.g. Hiepko 1987). No specimens at other herbaria where Link typically lodged his specimens (e.g. BR, C, FI, H, LIV, P, PH, W; Stafleu & Cowan 1981) were found on the Global Plants website (<https://plants.jstor.org/>). The label on MEL39790 identifies it as part of the type that

was at B, thus, its designation originally as an isotype by Court (1972).

Acacia genistifolia* Link subsp. *genistifolia

Phyllodes rhombic in transverse section or terete, linear, 1–1.5 mm in diameter, 14–26(–40) mm long, <20 times longer than wide, diverging from the stem at 42–80 (–84)°. *Pods* with sparse covering of short appressed hairs, 50–80(–100) mm long, 2–7 mm wide.

Selected specimens examined (20): SOUTH AUSTRALIA. Goyder: side track [0.6 km] of the Gap Road off the Mintaro – Hilltown road, c. 10.5 km from Mintaro, 30.xii.1990, *D.E. Symon 15038* (AD99104585 *n.v.*). Clare and Gilbert Valleys: 6 km due N of Mintaro, Black Hill Native Flora Park, 22.xi.1990, *M. Jusaitis and K. Holliday 14* (AD99049202 *n.v.*). **NEW SOUTH WALES.** Central Tablelands: 8.3 miles east of Bathurst, 14.iv.1972, *R. Coveny 4148* (MEL, NSW). Riverina: 45.4 km from turnoff to Griffith nearest Rankins Springs in Temora, towards Harden, 8.xi.1979, *N. Hall H79/88* (MEL). Southeast: 18km east-northeast of Boorowa, 12.vi.2004, *A.J. Leishman 117* (BRI, CANB, MEL, NSW); c. 1 km from Numeralla towards Cooma, 10.viii.1997, *A.M. Lyne 2377* (CANB, MEL, NSW). **AUSTRALIAN CAPITAL TERRITORY.** Canberra: Fairbairn Avenue, opposite the stockyard, viii.1963, *Walker ANU1060* (MEL); lower slopes of Black Mountain, 3.ix.1952, *R. Melville 827* (K, MEL). **VICTORIA.** Central West: Wannon, Youngs State Forest, 10.ix.2004, *D. Osler 37* (MEL). Goulburn Valley: Dookie Agricultural College, 4 km south of Mt Major, 26.viii.1992, *I. Crawford 1815 & J. Strudwick* (CANB, MEL); 20 km west-northwest of Seymour, 8.viii.1975, *A.C. Beauglehole 50112* (MEL). Grampians: Roses Gap, 12.viii.1957, *A.J. Hicks s.n.* (MEL500311); Wallaby Rocks, 25.iv.1981, *H.S. Meyer 63* (MEL). Nillumbik Shire: Greensborough, 13.ix.1969, *H. Veitch s.n.* (MEL500405); Hurstbridge, corner of Haleys Gully & Broad Gully Roads, 11.x.1981, *R.A. Kilgour 105* (MEL); Panton Hills, 14.ix.1952, *D. Morton s.n.* (MEL500334). North Central: Inglewood Flora Reserve, 2.0 km northwest of Inglewood, 14.viii.1996, *J.W. Grimes 3442* (MEL, NY); Heathcote-Graytown National Park, 20.viii.2017, *N.G. Karunajeewa 1567* (AK, CHR, DAO, MEL); Dalynong State Forest, 9 km west-northwest of

Archdale, 8.ix.1979, *A.C. Beauglehole 64708* (MEL). Wimmera: 4.xii.1891, *F.M. Reader s.n.* (MEL500383).

Distribution: In South Australia, previously known only from near Mintaro and Angaston and now possibly extinct there. In New South Wales, from Dubbo south to Cooma, including the Australian Capital Territory, extending westward to Griffith. In Victoria, in a more-or-less continuous band between near Rutherglen and the Grampians, and immediately north-east of Melbourne.

Notes: Distinguished from subsp. *attenuata* which has *phyllodes* that are generally longer (25–70(–90) mm), >20 times longer than wide, and less spreading; intermediates resembling subsp. *attenuata* exist in the Nillumbik Shire north-east of Melbourne. Distinguished from subsp. *platyphylla* which has typically broader *phyllodes* (>1.5 mm wide) that are flattened in cross-section. Distribution overlaps with subsp. *platyphylla* in the Grampians, where plants in subsp. *genistifolia* and subsp. *platyphylla* have not yet been collected from the same site, despite their close proximity to each other. Further surveying is required to confirm whether the two subspecies are always parapatric, or whether they do coexist in sympatry in some parts of the Grampians. This subspecies is not considered rare or threatened in New South Wales, the Australian Capital Territory or Victoria. However, in South Australia widespread land clearing appears to have resulted in its functional extinction in that state.

***Acacia genistifolia* Link subsp. *attenuata* A.T.Webb, subsp. nov.**

Acacia cuspidata var. *longifolia* Benth., *Linnaea* 26(5): 609 (1855). Type: Victoria, Merrimans Ck, *F. Mueller s.n.* (holo: K 791432 photo seen; iso: MEL5004131, 5004141)

Type: AUSTRALIA. Victoria. Gippsland, Raymond Island, 14 km south-east of Bairnsdale, 37° 55' S, 147° 45'

Key to *Acacia genistifolia* subspecies

1. *Phyllodes* ≤1.5 mm in diameter, rhombic in cross-section to terete and more-or-less isodiametric, mature pods glabrous or sparsely covered with short appressed hairs. Mainland Australia 2
- 1: *Phyllodes* >1.5 mm in diameter, more-or-less flattened in cross-section, mature pods with sparse to moderate covering of appressed hairs. Victoria in the Grampians, Otways and Wilsons Promontory region, Tasmania subsp. *platyphylla*
- 2: *Phyllodes* mostly 25–70(–90) mm long, >20 times longer than wide. Southeastern New South Wales, Gippsland subsp. *attenuata*
- 2: *Phyllodes* 14–26 mm (rarely to 40 mm) long, <20 times longer than wide. Widespread; South Australia, New South Wales and the Australian Capital Territory, central Victoria including the Grampians and immediately north-east of Melbourne subsp. *genistifolia*

E, 27.ix.1992, *I. Crawford 1890* (holo: MEL1616952, iso: CANB, PERTH)

Phyllodes subterete to terete, sometimes rhombic in transverse section, linear or narrow-linear, (0.75–) 1–1.5 mm in diameter, 25–70(–95) mm long, >20 times longer than wide, diverging from the stem at 38–65 (–77)°. *Pods* mostly glabrous, (35–)40–80(–99) mm long, 2–5(–8) mm wide.

Selected specimens examined (20): NEW SOUTH WALES.

Southeast: Nadgee State Forest, intersection of Range Road and Ireland Timms Road, 27.ix.1984, *D.E. Albrecht 1004* (BRI, MEL); Murrica [Merrica] River, Nadgee Faunal Reserve c. south of Eden, 15.viii.1963, *E.F. Constable 4350* (BRI, CANB, MEL, PERTH).

VICTORIA. Gippsland: Port Albert, *F.Muell s.n.* (MEL500407); Port Albert 100 m west of main pier, 2.ix.1995, *A. Paget 1325* (MEL); Bruthen Creek, 1892, *W.H.Lucas s.n.* (MEL2075331); heath near Wonboyn and Genoa Rivers, ix.1860, *F. Mueller s.n.* (MEL500411), Sale, lower Thompson River, viii.1893, *A. Purdie s.n.* (MEL2075332); Rotamah Island, 25.viii.1986, *I. Crawford 457* (BRI, MEL, PERTH); Colquhoun State Forest north of Nowa Nowa, 6.iv.1996, *J.W. Grimes 3449* (MEL, NY); Holey Plains State Park, 9.x.2014, *N.G. Karunajewwa, 1031* (DAO, MEL); Croajingalong National Park, 600m from the intersection of New Binns Road on the west side of Duncans Road, 5.xii.2016, *D.J. Ohlsen 653* (MEL); 10 km northwest of Nowa Nowa, 22.viii.1978, *P.K. Gullan 372 & N.G. Walsh* (MEL); Mt. Raymond, 14 km east of Orbost, 14.x.1945, *N.A. Wakefield 4060* (MEL); Mallacoota Inlet National Park, 7.viii.1970, *A.C. Beauglehole 33639* (MEL); Nooramunga Wildlife Reserve, St. Margaret Island, 8.xii.1978, *A.C. Beauglehole 62340* (MEL); Boggy Creek, 1937, *F. Robbins, A.C. Beauglehole 3762* (MEL); Croajingalong National Park, Betka River, 8.xii.2009, *J.A. Jeanes 2258* (CANB, K, MEL, NSW); Golden Beach, Lake Reeve, 2.xii.2015, *V. Stajsic 7728* (MEL); 17 km north of Orbost on the Bonang Highway, 17.viii.1983, *K.R. Thiele 516* (MEL); Macalister [River], *E.A. Chesterfield 1505* (MEL).

Distribution: From Nadgee Nature Reserve in southeastern New South Wales through near-coastal areas of Gippsland, Victoria to Wilsons Promontory area, with an outlying occurrence in the Macalister River catchment (northwest Gippsland).

Etymology: From the Latin *attenuatus*, meaning narrowed and elongated, in reference to the long, thin phyllodes typical of this subspecies.

Notes: Differentiated from subsp. *genistifolia* which has phyllodes that are generally shorter (14–26(–40) mm), <20 times longer than wide and more spreading. Distinguished from subsp. *platyphylla* which has typically broader phyllodes (>1.5 mm wide)

that are generally flattened in cross-section. Its range does not overlap with that of subsp. *platyphylla* or subsp. *genistifolia*. Following the fires of the 2019–2020 summer, much of the habitat of this subspecies has been burnt. Although, as with most wattles, it will most likely regenerate well from soil-stored seed.

***Acacia genistifolia* Link subsp. *platyphylla* A.T.Webb, subsp. nov.**

Acacia prostrata Lodd., G.Lodd. & W.Lodd., *Bot. Cab.* 7:631 (1822) Type: plate in *Bot. Cab.*, 'A native of Van Diemens Island; we raised our plants from seeds in 1818, and they flowered two years afterwards.'

Type: AUSTRALIA. Tasmania. c. 40 km east-northeast of Hobart, 6 km north along Kellevie Rd. from Arthur Highway near Copping, 2 km north-east along Franklins Rd., 42° 45' S, 147° 49' E, 27.vii.1983, *J.D. Briggs 962* (holo: MEL249261, iso: CANB, HO).

Phyllodes flattened to rhombic in transverse section, linear to narrow-ovate or narrow-oblong, sometimes subulate or sub-falcate, 1.5–4.5 mm in diameter, 10–27(–50) mm long, diverging from the stem at (33–)45–78°. *Pods* with sparse to moderate covering of short appressed hairs, (34–)40–80(–91) mm long, 2–7(8) mm wide.

Selected specimens examined (20): VICTORIA. Grampians: Plantation Road between Halls Gap and Roses Gap, 28.v.1963, *T.B. Muir 2856* (MEL); 4 km north of Zumsteins, 28.ii.1988, *S.T.W. Parfett 143* (AD, BRI, MEL). Otways: off Distillery Creek Road, inland from Aireys Inlet, 5.ix.2003, *G.W. Carr 0309-82/1* (MEL); Moonlight Head, 7.ix.1980, *M.G. Corrick 6545* (MEL); Corangamite [Otways] 8 km east-southeast of Carlisle River, 3.x.1985, *S.G. Harris 68* (CANB, HO, MEL, PERTH). Wilsons Promontory Region: Fish Creek Quarry, ix.2006, *B. Teesdale s.n.* (MEL2393634). **TASMANIA.** Furneaux Group: Clarke Island, 1894, *E. MacLaine s.n.* (MEL500416); Flinders Island, Middle Patriarch, southern slope, 6.x.1978, *J.S. Whinray 2488* (CANB, MEL). Central North: near Prossers Forest, 17.xii.1969, *M.G. Corrick 2021* (MEL). East Coast: Orford, above Prosser River, 29.xii.1969, *M.G. Corrick 2095* (MEL). North East: Scamander, Winifred Curtis Reserve, 17.xii.2009, *J. Wood 120* (HO, K, MEL); north of St. Helens, broad ridge south of Swimcat Creek, 24.vii.1981, *A. Moscal 829* (MEL). South East: Lindisfarne, 3.ix.1923, *R.A. Black 253*, (MEL); 1.5 km south of Observatory Hill, 19.ix.1984, *W.F. Pataczek 012* (MEL); Brown Mountain, bottom slopes, 1892, *Rev. J. Bufton 18* (MEL); Eaglehawk Neck, 17.xii.1952, *J.H. Willis s.n.* (MEL500421); Pittwater Bluff, 8.ix.1984, *A. Moscal 8410* (MEL); Fortescue Bay, Cape Haury Track, 18.xii.1980, *A. Brown 75* (AD, MEL); Remarkable

cave near Port Arthur, 20.ix.1981, A. Brown 319 (HO, MEL); Southport Island, xii.1858, F. Mueller s.n. (MEL500423).

Distribution: In Victoria, recorded from the Grampians, Otway Range and Wilsons Promontory region (Foster and Fish Creek). It is of predominantly Tasmanian distribution, particularly the southeast around Hobart and the Tasman Peninsula, along the eastern and northeastern coasts and including the islands of the Furneaux Group.

Etymology: From the Greek *platy-* (flat, broad) and *phyll-* (pertaining to leaves), in reference to the flattened phyllodes typical of this subspecies.

Notes: In general, Tasmanian plants have relatively shorter phyllodes than do those from Victoria. This may be due to a longer period of genetic isolation from the 'typical' subspecies in the Tasmanian population, while some degree of genetic 'leakage' between subsp. *genistifolia* and subsp. *platyphylla* may be ongoing in Victorian populations. This subspecies is differentiated from other subspecies which have generally narrower phyllodes (<1.5 mm wide) that are typically subterete to terete. It is the only subspecies that occurs in Tasmania. It is not uncommon and is well reserved in Tasmania but can be considered rare in Victoria.

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