

## The *Thelymitra pauciflora* R.Br. complex (Orchidaceae) in South Australia with the description of seven new taxa

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### Abstract

The South Australian members of the complex of self-pollinated, mostly blue flowered, sun-orchids related to *Thelymitra pauciflora* R.Br. are discussed. There are at least twenty South Australian species in the complex, many of which were only recently published. In addition, seven species are here described as new, namely *T. crenulata* R.J.Bates, *T. hygrophila* R.J.Bates, *Thelymitra latifolia* R.J.Bates, *T. odora* R.J.Bates, *T. orientalis* R.J.Bates, *T. pallidifructus* R.J.Bates and *T. rubricaulis* R.J.Bates.

**Keywords:** Orchidaceae, *Thelymitra*, sun-orchids, taxonomy, new species, South Australia.

### Introduction

*Thelymitra* J.R.Forst. & G.Forst. is a large and complex orchid genus of almost a hundred species, several described natural hybrids and a number of undescribed taxa. It is widespread in all temperate areas of Australia except true deserts. There are also a few tropical taxa in eastern Australia, about twenty species in New Zealand and at least one species each in Indonesia, New Guinea, New Caledonia and the Philippines.

About half the species of *Thelymitra* belong to a super-complex of taxa based around *T. longifolia* J.R.Forst. & G.Forst. of New Zealand (Jeanes 2004). These species are distinguished by mostly blue to mauve flowers, which are neither spotted nor strongly striped and have their column adorned with a simple tubular hood (post-anther lobe) with a pair of lateral lobes at the base. These lobes terminate in a mop- or toothbrush-like tuft of white or variously coloured cilia.

For simplicity, the Australian species of the *T. longifolia* super-complex are separated, following Jeanes (2004) into the *T. nuda* R.Br. complex of large flowered, usually fragrant, outcrossing species with coherent pollinia and the *T. pauciflora* R.Br. complex with small flowered, self-pollinated, usually un-perfumed species with non-coherent, mealy pollinia. Only the latter complex is treated in detail in this paper. The two complexes are most likely artificial (Jeanes 2004, citing unpublished results by M.A. Clements).

Jeanes (2004: 20) defined species belonging to the *T. pauciflora* complex as having

small flowers (perianth segments usually to 10 mm long, sometimes as long as 12 mm and rarely reaching or exceeding 15 mm) that are usually unscented, generally autogamous and often also cleistogamous.

The self-pollinated or autogamous nature of flowers in this complex has been discussed by Bates (1999), Jeanes (2004) and Jones et al (2010).

Self-pollination in all species of the complex is achieved through the friable, mealy or powdery pollinia falling onto the stigma directly below, usually while the flowers are still in bud. In cool weather, flowers may remain tightly closed throughout the flowering season and are therefore cleistogamous.

Autogamy is facultative, as flowers may open fully on hot days and native bees, on chance visits, transfer pollen. Hybrids have been recorded for many of the species treated here, usually with other more outcrossing species such as *T. ixioides* Sw. or *T. nuda* R.Br. as the second parent (Jones et al. 2010; pers. obs.), but none have been recorded between species within the *T. pauciflora* complex.

Robert Brown (1810) was the first botanist to study the *T. pauciflora* complex in any detail, naming *T. pauciflora*, *T. nuda* and *T. angustifolia* R.Br.

Bentham (1873) subsumed most members of the complex worldwide under the name *T. longifolia*, but most subsequent botanists believed that there were several to many species involved (Fitzgerald 1875–95; Nicholls 1969; Clements 1989; Bates & Weber 1990; Jeanes & Backhouse 2001; Jones & Clements 1998a, 1998b).

Some of these workers merely illustrated forms which they believed to represent different species, e.g. Bates (1999) dealing with South Australian taxa. Others actually named taxa, e.g. Jones & Clements (1998a, b) described *T. fragrans* D.L.Jones & M.A.Clem., *T. malvina* M.A.Clem., D.L.Jones & Molloy, *T. granitora* D.L.Jones & M.A.Clem., *T. gregaria* D.L.Jones & M.A.Clem., *T. imbricata* D.L.Jones & M.A.Clem.; Jeanes (2000) described *T. atronitida* Jeanes and *T. planicola* Jeanes. Apart from *T. malvina* these species are not found in South Australia; none were recognised as occurring here by the above authors. It was not until Jeanes' (2004) major revision of the Australian members

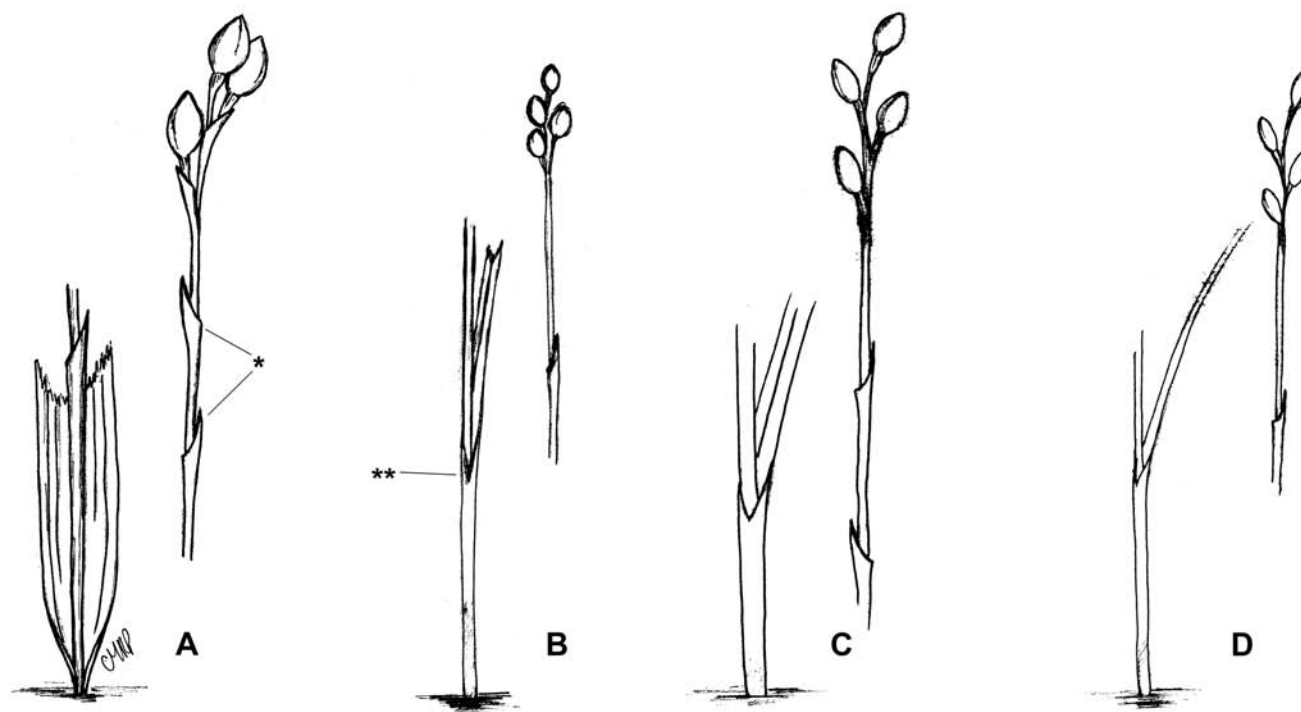


Fig. 1. Habit of species of the *Thelymitra pauciflora* complex with unopened flowers. A *T. latifolia*, showing the wide leaf of the plant, not sheathing the stem; B *T. crenulata*, with leaf sheathing the stem; C *T. hygrophila*; D *T. odora*. \* bracts on the scape; \*\* fistula.

of the *T. pauciflora* complex that South Australian material was given any serious consideration.

Jeanes (2004) named fifteen new species from within the complex. Eight of those he recognised occur in South Australia, namely *T. albiflora* Jeanes, *T. batesii* Jeanes, *T. bracteata* J.Z. Weber ex Jeanes, *T. brevifolia* Jeanes, *T. cyanapicata* Jeanes, *T. exigua* Jeanes, *T. inflata* Jeanes and *T. peniculata* Jeanes. He also resurrected a species, which other workers had not (or only tentatively) recognised, namely *T. arenaria* Lindl.

Since 2004 another species, *T. lucida* Jeanes, previously known only from Victoria, has been added to the South Australian list (Bates 2006) resulting in 15 species in the complex for South Australia.

J.A. Jeanes suggested there may be more South Australian species for the following reasons.

Firstly, in addition to examining herbarium material Jeanes also made excursions to sun-orchid rich parts of each state looking at plants *in situ*. Unfortunately his brief visit to South Australia in 2002 coincided with a severe drought, and he did not include the South-east region in his travels despite it being rich in members of the complex (J.A. Jeanes, pers. comm., 2005). He therefore missed many of the taxa that are mostly restricted to South Australia.

Secondly, Jeanes (2004) suggested that one species, *T. peniculata* Jeanes, was highly variable throughout its range occupying habitats ranging from coastal swamps to woodland to rock outcrops inland. He predicted that it was likely to include more taxa.

Furthermore Jeanes (2004: 28) stated in his discussion under *T. pauciflora* that the species “remains

poorly-known today due to the presence of many taxa that bear several features in common with the type, but may also differ from it in subtle ways.” He then listed major features of *T. pauciflora* *sensu stricto* such as “usually with two sterile bracts”. However most of the South Australian material determined by Jeanes as *T. pauciflora* consistently has a single sterile bract.

Seven new species of the *T. pauciflora* complex in South Australia are described and named in this paper. Further work is required to resolve the limits of several other putative taxa.

There are also references to several related but undescribed species by manuscript name (i.e. ‘*T. adorata*’ Jeanes ms and ‘*T. alpicola*’ Jeanes ms), but these do not occur in South Australia (Bell et al. 2005; Jeanes & Backhouse 2006; Jones 2006, 2008).

### Defining the species

All of the species named in this paper are well marked, reasonably constant entities, often forming pure populations. They reappear in similar habitat over a wide area and wherever they are sympatric with other members of the complex do not, or rarely, show any introgression. Most are allopatric, but wherever they are sympatric, hybrids are generally lacking.

Hybrids do, however, occur between members of the complex and species outside the complex, particularly with outcrossing taxa, usually as sporadic individuals of vegetatively reproducing clumps or colonies. Some of these hybrids have been named, e.g. *T. ×truncata* R.S. Rogers, a name that is generally applied to crosses between members of the *T. pauciflora* complex and plants of the blue spotted outcrossing *T. ixioides* Sm. or

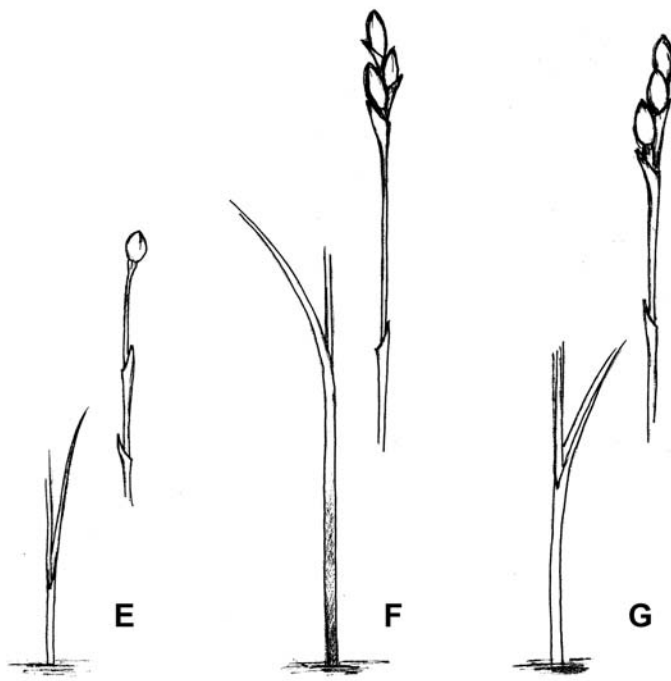


Fig. 1 (contd). Habit of species of the *Thelymitra pauciflora* complex. E *T. orientalis*; F *T. pallidifructus*; G *T. rubricaulis*.

its autogamous equivalent, *T. juncifolia* Lindl. (Jones 2006). These crosses are easily recognised as they have flower morphology similar to members of the *T. pauciflora* complex but with the darker spots of *T. ixioides* or *T. juncifolia*.

However, not much is known about crosses between different species within the *T. pauciflora* complex, as these are difficult to recognise. Jeanes (2004) points to difficulties caused to correct identification by a propensity for hybridisation.

#### Separating the new species: notes on morphology

Since about 1990 the author has made detailed studies of the complex in South Australia. About seven undescribed taxa were identified by 1992 and as many as ten by 2004. Following Jeanes' 2004 paper, in which most of these were named and described, the author, with the assistance of members from the Native Orchid Society of South Australia (NOSSA) began a detailed study of the genus in South Australia, matching taxa to specific habitats and different flowering times, fragrances, etc. Characters studied include vegetative features hardly considered before, such as distance from soil level to the leaf fistula (Fig. 1\*\*); number, size and shape of sterile bracts; presence or absence of fragrance and particularly flower-bud colour (or colour of sepal exterior surface) as these were realised to be important in separating taxa.

Features used to discern taxa therefore include some not previously given much importance, as well as those, primarily of the column, defined and illustrated in Weber & Bates (1986: 2134, Fig. 998) and somewhat modified by Jeanes (2004).

The following characters have been used to distinguish species:

- *Habit*: plant robust or slender, plant height, clumping or not clumping, stem rigid or lax.
- *Leaf characters*: the degree to which the leaf base sheaths the inflorescence; leaf length, rigid or lax, ribbed or not, flat or canaliculate, with or without a glaucous bloom and with a green or red base.
- *Scape*: red or green, straight or flexuose, glaucous or not.
- *Sterile bracts*: size, shape, number and position on the scape (Fig. 1\*).
- *Floral bracts*: colour, size, texture, shape and degree of sheathing. Many of these features are more important than floral features because they are more easily observed when flowers remain closed, which is the case most of the time.
- *Flower*: colour and the length of the ovary compared to flower size are two features given more importance than previously. Bud colour ranges from pale grey, green, through pink and brown to almost black. The shape and length of the floral segments, together with their colour (blue to mauve or white) are important and the number and intensity of darker striations on the segments may be useful — although this feature has not been used in the key. Within the floral column, post-anther lobe features proved to be very important, including shape, colour and texture of the orifice (Fig. 2\*\*) as well as size, colour, shape, position, texture and angle of the column arms and their trichomes. Jones (2004) distinguished between mop- or toothbrush-like tufts of hairs at the end of the column arms (Fig. 2\*, 3\*).

#### Habitat

Many species, but not all, proved to be highly habitat specific with some restricted to peat bogs (e.g. *T. rubricaulis*), others to vernal waterholes and ponds (e.g. *T. lucida* and *T. hygrophila*), to rock outcrops (e.g. *T. frenchii* Jeanes) or even confined to laterite (e.g. *Thelymitra* sp. *Laterite* (R. Bates 63950) Bates 2007). Many of these habitat specific taxa remain to be described.

#### Phenology

Flowering of many species of *T. pauciflora* complex is highly dependent on good spring rainfall (e.g. *T. holmesii* Nicholls). Fire plays an important role for other unrelated species of *Thelymitra* (e.g. *T. rubra* Fitzg.). The wet spring of 2005 (Bureau of Meteorology 2005) provided one of the best flowering seasons seen since 1992, except on inland fringes, and was most productive. The drought year of 2006 proved disastrous for sun-orchids and 2007 and 2008 were little better. In these dry years, flowers either did not form, or were soon aborted (pers. obs.).

Fortunately sun-orchids of the *T. pauciflora* complex produce copious seed and often quite large populations will establish in suitable disturbed habitat, such as

regularly slashed firebreaks, especially after wet years. Occurrence of species in firebreaks is most likely not related to fire, but just to the disturbed habitat. There is no indication in any of the species below that fire does play a part in their recruitment.

### Collecting specimens of the *Thelymitra pauciflora* complex

The *T. pauciflora* complex in South Australia is poorly represented in herbaria. The flowers are self-pollinated and rarely open and therefore do not attract the attention of collectors. Even wide-open flowers, once picked, quickly close and must be pressed immediately.

In the past collectors tended to see these taxa as a single variable species or they ignored them. In recent times, as collectors have become more discerning of morphological features, this has changed.

Jeanes (2004) emphasised the importance of collecting flowers and leaf portions for pickling in alcohol so that the shape and size of the flowers is preserved.

It is best to collect several flowers at different stages of development as there is always some variation and any single flower may be atypical and give a biased interpretation. Because colour and shape may be lost in dried or pickled flowers photographs are important to show colour and shape of live flowers.

When collecting from a population of plants with unopened flowers it is very easy to accidentally include material of other similar species. A proportion of collections may well, therefore, contain material of other, similar, sympatric species. It is therefore most important to collect voucher specimens for any research undertaken in this area.

It is not feasible to collect plants from the wild for *ex situ* studies as sun-orchids rarely thrive in cultivation.

Despite these difficulties between 10 and 15 taxa not recognised by Jeanes (2004) have been collected in South Australia since 2003, some apparently for the first time. Others were previously represented in the State Herbarium of South Australia by poor, fragmented material, often mixed on sheets with other species.

For those species not growing near firebreaks and requiring fire or other disturbance to initiate flowering, collections have been few and limited in number of specimens.

Consequently only the best known, often widely distributed and constant species are named and described in this paper. Other putative new taxa will continue to be investigated.

### Terminology

The terminology used is that of Jeanes (2004) with some minor adjustments.

The point on the tubular leaf base through which the inflorescence emerges is called the *leaf fistula* (Fig. 1\*\*) and its height above the leaf base is an important feature in separating species (cf. 'leaf sheathing' in the key). Likewise *bud colour* or colour of sepal exterior,

is often referred to in the key and descriptions as this is remarkably constant for most species.

*Sterile bracts* are the bracts on the scape other than those subtending flowers (Fig. 1\*) and the number of these tends to be constant for each species. Jeanes (2004) often stated "sterile bracts 1–2", but in the author's experience for a species with a single sterile bract this number is constant, except in abnormally large specimens or in specimens suspected of exhibiting hybrid influence.

The perianth segments of *Thelymitra* species have a varying number of *darker coloured linear striations* and the number and distinctiveness of these can be significant in determining species.

### Materials and methods

The strategies used were similar to those of Jeanes (2004), but with more emphasis on well pressed material and digital images since the latter allows texture and colour to be retained and gives a more holistic view. Spirit collections were made of all new taxa from as many populations as needed.

It was hardly possible to discern new species for the first time using poor material either dried or in spirit. This was only achieved by a great deal of field work, looking at large, thriving populations, especially where these were sympatric with other species for comparison. The basic technique for studying a suspected new taxon was to search as many locations with suitable habitat as possible over as wide range at the expected flowering time. This is difficult in the over-cleared and modified landscapes of South Australia.

As constant populations with the same features and flowering times began to show in the same habitats over a wide area, collections were made, GPS data was recorded and photographs taken.

Many of the species were first found at a single location, but when similar habitat was searched in different regions, these taxa were often observed to be frequent over a surprisingly wide distribution.

Some taxa that are restricted to a highly specific habitat, such as peat bogs, have so far only been seen in the South-east (SE) of the state. Although suitable habitat may once have been present in other regions, such as the Southern Lofty region (SL) or on Kangaroo Island (KI), such habitats have now been largely destroyed or massively altered.

All available herbarium material at AD and MEL was seen. Most of this had been annotated by Jeanes. No material at MEL could be assigned to any of the new taxa with certainty. The absence of old specimens in herbaria might also be explained by the fact that flowers of species of the *T. pauciflora* complex often remain closed and were therefore not collected, as collectors assumed that they were still in bud.

**Key to the species of the *Thelymitra pauciflora* complex in Australia**

*Characters defining the T. pauciflora complex:* Orchids with small (less than 2 cm across), blue, mauve or white flowers, without spots, tardily opening, with the post-anther lobe adorned with lateral lobes bearing hairlike tufts of variously coloured trichomes.

This key is modified from that of Jeanes (2004). Note that south-eastern (SE) Australia includes here South Australia and Tasmania.

1. Post-anther lobe with a glaucous or glistening bloom
  2. Post-anther lobe narrow at base and widening toward top; trichomes on the lateral lobes sparse, often connate at the base, 0.05–0.1 mm wide, bright yellow, strongly embracing the post-anther lobe
    3. Plants usually 12–30 cm tall; flowers usually 3–6, perianth segments > 10 mm long, ovate-lanceolate; post-anther lobe with much sparkling bloom, the two apical halves < 1 mm apart at their widest; trichomes of the lateral lobes adpressed outside the post-anther lobe, not inserted into the orifice and often exceeding it in height; predominantly SW Australia ..... *T. mucida* Fitzg.
    - 3: Plants always < 12 cm tall; flower usually solitary, sometimes two; perianth segments < 10 mm long, shortly ovate; post-anther lobe with a sparse silvery bloom, the two apical halves > 1 mm apart at their widest; trichomes of the lateral lobes at least partly inserted into the orifice of the post-anther lobe and not exceeding it in height; S.A., Vic. .... 5. *T. orientalis*
  - 2: Post-anther lobe widest near the middle and narrowing only slightly above and below; trichomes on the lateral lobes dense, not connate at the base < 0.05 mm wide, pale or creamy yellow, not embracing the post-anther lobe
    4. Post-anther lobe very inflated, brown grading into yellow at the apex, covered in a thick, waxy bloom, deeply bilobed, the lobes 1.5–2.5 mm long, c. 1 mm wide; trichomes on the lateral lobes 1.2–1.6 mm long, usually cream or yellow; plants from dry to moist woodland habitats; flowering season late Sep. to early Nov.; predominantly S.A. (Southern Lofty region); Vic. .... *T. inflata* Jeanes
    - 4: Post-anther lobe somewhat inflated, mostly black with a yellow apex, with a thin, sparkling bloom, bilobed, the lobes 1.2–1.6 mm long, c. 0.6 mm wide; trichomes on the lateral lobes 1–1.2 mm long, usually white, sometimes cream; plants from swampy habitats, often standing in water at anthesis; flowering season mid-Oct. to mid-Dec.; S.A., Vic. .... *T. lucida* Jeanes
- 1: Post-anther lobe without any bloom
  5. Trichomes on the lateral lobes usually cream or yellow, proximal trichomes often red, at least basally
    6. Post-anther lobe very inflated, mostly brown grading into yellow at the apex, deeply bilobed, the lobes ± parallel, 1.5–2.5 mm long; S.A., Vic., Tas. .... *T. inflata* Jeanes
    - 6: Post-anther lobe semi-inflated, mostly black with a distinct yellow apex, bilobed, the lobes usually diverging, 0.8–1.5 mm long
      7. Perianth segments usually 8–11 mm long; trichomes on the lateral lobes 1.2–1.8 mm long, rather sparse and of an untidy appearance; flowering season mostly Nov. and Dec.; SE Australia .... *T. holmesii* Nicholls
      - 7: Perianth segments usually 12–15 mm long; trichomes on the lateral lobes 1–1.5 mm long, very dense and of a neat appearance; flowering season mostly late Sep. and Oct.; SW Australia .... *T. xanthotricha* Jeanes
  - 5: Trichomes on the lateral lobes usually white, rarely pink to mauve, proximal trichomes not red
    8. Post-anther lobe more or less erect, not curved forward; plant usually < 14 cm tall; flowers 1–3; lower sterile bract entire or deeply bifid; rock outcrops in W.A. .... *T. frenchii* Jeanes
    - 8: Post-anther lobe curved forward for up to 90°; plant usually > 14 cm tall; flowers often > 3; lower sterile bract entire
      9. Post-anther lobe semi-cylindric, widely open on the ventral side; sterile bracts 3–4, lower ones often leaf-like; E Australia ..... *T. planicola* Jeanes
      - 9: Post-anther lobe not semi-cylindric, sterile bracts usually 1–3, none of them leaf-like
        10. Leaf lanceolate, usually less than half height of inflorescence (often much less than half), blade more or less flat, thin-textured, often with red margins, veins and suffusions, even wholly red; post-anther lobe often deeply and irregularly slit at the apex, usually red, orange-red or red-brown; SE Australia ..... *T. brevifolia* Jeanes
        - 10: Leaf linear to linear-lanceolate, usually greater than half the height of the inflorescence, often fleshy and canaliculate; post-anther lobe often notched, but not irregularly slit, usually brown to black with a yellow apex
          11. Post-anther lobe strongly compressed dorsally in the distal half; apical orifice small; trichomes purple or white
            12. Post-anther lobe mostly glossy black; trichomes white; sterile bracts usually two, flowers pale blue; Vic., S N.S.W., ?S.A. .... *T. atronitida* Jeanes
            - 12: Post-anther lobe reddish-brown; trichomes usually purple or mauve, rarely white; sterile bracts usually 3; flowers slate-blue to purple; E and SE Australia, New Zealand ..... *T. malvina* M.A.Clem., D.L.Jones & Molloy
      - 11: Post-anther lobe not strongly compressed; trichomes white or cream
        13. Lateral lobes not glabrous at the base, with trichomes extending more or less along their entire length in a toothbrush-like arrangement

- 14.** Perianth segments often > 12 mm long; mature plants tall and stout; flowers > 8, (at least on many plants)
- 15.** Post-anther lobe deeply notched, black with a yellow apex; flowers white or very pale blue; sterile bract usually solitary; near-coastal Vic. only . . . . . *T. pallidiflora* Jeanes
- 15:** Post-anther lobe emarginate, red-brown with a yellow apex; flowers usually blue or mauve; sterile bracts usually two
- 16.** Lower pedicels often partially decurrent on rachis; sepals mostly green on exterior surface; base of upper sterile bract often only half encircling the scape; sterile bracts to 15 cm long; fertile bracts to 3.5 cm long; SE Australia, mostly in S.A. . . . . *T. bracteata* J.Z. Weber ex Jeanes
- 16:** Pedicels never decurrent on rachis; sepals mostly purplish on exterior surface; upper sterile bract usually scape encircling, to 5 cm long; sterile bracts to 8 cm long; fertile bracts to 2 cm long; SE Australia . . . . . *T. arenaria* Lindl.
- 14:** Perianth segments rarely > 12 mm long; mature plants rather small and slender; flowers rarely more than 8 even on mature plants
- 17.** Post-anther lobe narrowest at the base and broadest toward the apex, deeply notched; SW Australia . . . . . *T. vulgaris* Jeanes
- 17:** Post-anther lobe usually broadest near the middle, narrowing only slightly above and below, emarginate to shallowly notched; south-eastern Australia
- 18.** Plants short and stout, to 12 cm tall, often forming clumps by vegetative reproduction; leaf nearly as long as, or longer than inflorescence; lowest fertile bract often with proximal margins connate
- 19.** Leaf very thick, fleshy, brittle, and at least as long as inflorescence; S Vic. . . . . *T. basaltica* Jeanes
- 19:** Leaf moderately fleshy, flexible, and shorter than inflorescence; SE Australia . . . . . *T. exigua* Jeanes
- 18:** Plants slender, not clump-forming; usually > 12 cm tall; leaf much shorter than inflorescence; fertile bracts with margins entirely free
- 20.** Flowers 1–10, usually white; post-anther lobe reddish brown with a yellow apex; trichomes on lateral lobes in elongate tufts; S.A. . . . . *T. albiflora* Jeanes
- 20:** Flowers 1–5, usually blue; post-anther lobe entirely dark blue to magenta; trichomes on lateral lobes in sub-globose tufts; S.A. (Southern Lofty region) . . . . . *T. cyanapicata* Jeanes
- 13:** Lateral lobes glabrous in at least the basal quarter to half, with trichomes in a more or less, terminal mop-like arrangement
- 21.** Leaf blade flat, scape emerging at soil level; flowers lilac; post-anther lobe not inflated; S.A., ?Vic. . . . . 3. *T. latifolia*
- 21:** Leaf blade at least partly channelled, often fleshy; scape emerging well above soil level; flowers blue; post-anther lobe inflated
- 22.** Perianth segments reflexing strongly back toward the ovary at temperatures above 25°; post-anther lobe black to greenish-black throughout; coastal Vic. . . . . *T. reflexa* Jeanes
- 22:** Perianth segments not or hardly reflexing; post-anther lobe never wholly black or greenish-black
- 23.** Leaf 3/4 of the height of the inflorescence or longer
- 24.** Plant with an overall pale greenish appearance; leaf fleshy; sterile bracts usually two; post-anther lobe shallowly notched at the apex; flowering season late Oct. to early Dec.; near-coastal Tas. . . . . *T. viridis* Jeanes
- 24:** Plant without an overall pale greenish appearance; leaf thin-textured; sterile bracts usually 3; post-anther lobe usually deeply bilobed at apex; flowering season June to Oct.; Qld, N N.S.W. . . . . *T. angustifolia* Jeanes
- 23:** Leaf less than 3/4 of the height of the inflorescence
- 25.** Flowers with some degree of outcrossing, perianth segments > 12 mm long; trichomes of lateral lobes often with cream to pale yellow apices; grassy woodland plants usually growing in vernal pools; S.A. (Southern Lofty region) . . . . . 2. *T. hygrophila*
- 25:** Flowers hardly outcrossing, perianth segments < 12 mm long; trichomes of lateral lobes always white; woodland or heath-land plants rarely growing in vernal pools
- 26.** Flowers fragrant, exterior surface of the buds and sepals slate grey; post-anther lobe black; S.A. . . . . 4. *T. odora*
- 26:** Flowers not fragrant, exterior surface of the buds and sepals not slate-grey; post-anther lobe not black
- 27.** Scape, bracts and sometimes ovary red to deep purple-red; trichomes on lateral lobes in elongate tufts
- 28.** Post-anther lobe hardly crenulate in its apical portion, the apex with a cleft > 1 mm deep, the orifice > 0.5 mm across; trichomes of the lateral lobes not obscuring the orifice of the post-anther lobe; S.A. (South-east, only N of Mt Gambier) . . . . . 7. *T. rubricaulis*
- 28:** Post-anther lobe distinctly crenulate in its apical portion, the apex with a cleft < 1 mm deep, the orifice < 0.5 mm across; trichomes of the lateral lobes usually at least partly obscuring the orifice of the post-anther lobe; S.A. (South-east) . . . . . 1. *T. crenulata*

- 27: Scape, bracts and ovary not red to deep purple-red; trichomes on lateral lobes in sub-globose tufts
- 29: Sterile bract always single; ovary very pale, yellow-green; exterior surface of sepals lilac with pale edges; S.A. . . . . . 6. *T. pallidifructus*
- 29: Sterile bracts usually 2; ovary not very pale, yellow-green, exterior surface of sepals not lilac with pale edges
- 30: Flowers usually 1–3, most often pale blue; lateral lobes 0.5–1 mm long, bent sharply upwards at c. 90° near the middle; post-anther lobe entire or emarginate; E and SE Australia . . . . . *T. pauciflora* R.Br.
- 30: Flowers usually 4–10, most often mauve or deep purplish blue; lateral lobes 1.2–1.5 mm long, curved gently upwards; post-anther lobe usually deeply bilobed at the apex
- 31: Plants of dry hills; leaf usually < 10 mm wide; mature flower buds inflated, about 10 mm in diameter, subacute at apex; exterior of sepals pink with darker striations; post-anther lobe orifice widely gaping, the two apical halves often compressed; trichomes of lateral lobes often sparse or lacking; S.A. (S Flinders Ra. and Mount Lofty Ra.) . . . . . *T. batesii* Jeanes
- 31: Plants mostly of damp habitats, particularly swamp margins in South Australian forms; leaf usually > 10 mm wide; mature flower buds not inflated, < 8 mm in diameter, acute at apex; exterior of sepals ranging from brown to grey and pale-edged; post-anther lobe orifice hardly gaping, the two apical halves not compressed; trichomes of the lateral lobes dense; SE Australia . . . . . *T. peniculata* Jeanes

**Taxonomy**

New species of South Australian *Thelymitra*

1. *Thelymitra crenulata* R.J.Bates, sp. nov.

A *Thelymitra pauciflora* R.Br. *una bractea sterili, floribus saturatiore cyanellis alabastris fuscioribus, columna parva cyanea cum lobo post-anthera crenulato incisurato minuto saepe partim obtectae trichomatibus complanatis, florenti postea, et crescendo plerumque in turbario differt.*

**Typus:** South Australia, South-East region: Kangaroo Flat (Native) Forest Reserve, south of Glencoe, common on break KF 18 adjacent KF 15 on firebreaks in peaty sand-heathland near waterholes, 12 Nov. 2003, R.Bates 61622; holo: AD; iso: MEL.

*Thelymitra* sp. *Black buds* (R.Bates 64389) Bates, J. Adelaide Bot. Gard. Suppl. 1: 202 (2005).

*Thelymitra* sp. *Dark buds* (R.Bates 64416) Bates, Orchids S. Austral., ver. 1, CD-ROM (2006).

*Thelymitra crenulata* (R.Bates 64389) Bates, Orchids S. Austral., ver. 4, CD-ROM (2009), nom. inval.

*Illustration:* Bates (2006–2010), as *Thelymitra* sp. *Dark buds* (R.Bates 64416) and *Thelymitra crenulata* (R.Bates 64389).

Glabrous terrestrial *orchid* to 30 cm tall. *Tubers* ovoid 20–25 mm long, 8–15 mm wide. *Leaf* linear, 6–20 cm long, 1–3 mm wide, erect, fleshy, canaliculate, ribbed abaxially, green with a purplish base or wholly purplish, sheathing the scape for 2–6 cm, apex acute. *Scape* 15–30 cm long, 0.8–2 mm diam, straight, red to purplish and green. *Sterile bract* single, ovate, set below the middle of the scape, 2–3 cm long, closely sheathing, red to purplish and green, apex acute. *Fertile bracts* ovate, 6–15 mm long, 3–4 mm wide, sheathing the pedicels, purplish-red, with some pale bloom, acute. *Pedicels* 3–6 mm long, slender. *Ovary* green, narrow obovoid, 4–8 mm long, 3–4 mm wide. *Flowers* 1–7: 10–12 mm diam, deep blue with 8–10, strong, linear,

darker lines, opening widely only on warm to hot humid days and usually only briefly; *buds* dark purple to brown with lilac sepal margins. *Perianth segments* 6–7 mm long, 4–5 mm wide, concave, acute or apiculate; *dorsal sepal* ovate often hooding the column, apiculate; *lateral sepals* ovate, apiculate; *petals* ovate obtuse to subacute, *labellum* ovate subacute, smaller than the sepals. *Column* erect from the end of ovary, 3.5–4 mm long, 2–2.5 mm wide, oblong, blue; *post-anther lobe* hooding the anther, 1.5–2 mm long, tubular, not inflated, curved sharply forward before the middle, narrower and ribbed toward the apex, dark or reddish-brown, apex small, yellow, margins irregular, crenulate, not thickened, with a tiny opening; *auxiliary lobes* tiny, quadrate or absent; *lateral lobes* convergent, 0.8–1 mm long, digitiform, porrect, curved sharply upwards, each with an elongated, mop-like arrangement of white trichomes adpressed to the apex of the post-anther lobe, individual trichomes to 0.8 mm long with thickened ends. *Anther* inserted about midway along the column, 2–2.1 mm long, c. 1 mm wide, connective produced into an apical beak; *pollinarium* 1.5–1.7 mm long, *viscidium* more or less circular, *pollinia* friable, mealy, white, soon collapsing onto the stigma. *Stigma* situated at base of column, ovate-quadrate, 1.6–1.7 mm long, margins irregular. *Capsules* obovoid, 8–10 mm long, 4–5 mm wide, erect, ribbed. **Fig. 1B, 3A–C.**

*Distribution and habitat.* Apparently endemic to South Australia in a small area of the lower south-east around Mount Gambier (SE), but possibly also in adjacent parts of south-western Victoria. The species is restricted to disturbed areas such as slashed firebreaks and tracks on damp sandy heath near waterholes.

*Conservation status.* Rare and localised, threatened by changed hydrology and management practices such as

ploughing firebreaks or allowing old tracks to grow over, probably **endangered** according to NPWC (2003).

*Flowering period.* Late October to mid November; like most members of the complex the flowering season is often telescoped into a single week and depends on weather conditions.

*Pollination biology.* This species is facultatively auto-gamous and often also cleistogamous. The flowers are not fragrant and open only briefly nevertheless putative hybrids with *T. ixioides* and *T. malvina* have been observed, the former hybrid with a few spots on the sepals, the latter with mauve trichomes.

*Distinguishing features and notes.* The species can be recognised by a combination of features, such as the linear leaf, mid to high leaf fistula, single sterile bract low on scape, dark colour of the plants especially the flower buds, small deep blue flowers with darker linear veins, the narrow post-anther lobe with its bright bands of colour and the tiny irregular notch in its apex and the rather dense white tuft of trichomes. The species was not collected until 2003, but was found to be locally common in years with a wet spring.

*Etymology.* The epithet *crenulata*, Latin, refers to the crenulate or crinkled surface of the post-anther lobe.

#### *Selected specimens examined at AD*

SOUTH AUSTRALIA. **SE:** Black Lagoon, Kangaroo Flat N.F.R., N of Mount Gambier, 12 Nov. 2003, *R.Bates 61627*; Honans N.F.R., S of Glencoe, scattered on firebreaks over peaty sand near lagoons, Nov. 2003, *R.Bates 61637*; Kilsby Lane, off Lake Leake Road, where common on mown road reserve in damp sedge-heath-land, 30 Oct. 2004. *R.Bates 64389*; Below The Bluff, N of Mt Gambier, in peat bog recently burned, 30 Oct. 2004, *R.Bates 64413*; Honans N.F.R., 31 Oct. 2007, *R.Bates 75465*; The Marshes, N of Glencoe, 30 Oct. 2008, *R.Bates 80151* (dupl. MEL).

#### 2. *Thelymitra hygrophila* R.J.Bates, *sp. nov.*

A *Thelymitra holmesii* Nicholls habitu caespitoso, floribus plus pedicellis longioribus, lobo post-anthera valde sed non concinne incisurato, lobis lateralibus columnae trichomatibus caespitosis albis (in sicco saepe luteis) differt.

**Typus:** South Australia, Murray region: Springton Road, just before High Eden turn-off, south side of road, in vernal pool under river red gums, 20 Oct. 2004, *R.Bates 64102*; holo: AD.

*Thelymitra sp. Springton* Bates, Orchids S. Austral., ver. 1, CD-ROM (2006).

*Thelymitra sp. Springton* (*R.Bates 63666*) Bates, Orchids S. Austral., ver. 2, CD-ROM (2007).

*Thelymitra sp. Springton* (*R.Bates 64102*) Bates, Orchids S. Austral., ver. 4, CD-ROM (2009).

*Illustration:* Bates (2006–2010), as *Thelymitra sp. Springton*, *Thelymitra sp. Springton* (*R.Bates 63666*) and *Thelymitra sp. Springton* (*R.Bates 64102*).

Glabrous, clumping terrestrial orchid to 40 cm tall. Tubers not seen. Leaf linear 10–30 cm long, 2.2–6 mm wide, erect fleshy, canaliculate, ribbed abaxially,

'v' shaped in cross section, dark green, sheathing for 2–6 cm above the base, apex acute. Scape 20–40 cm long, 2–4 mm diam., straight, green. Sterile bracts usually 2, linear to linear-lanceolate, 3–6 cm long, green, apex acute. Fertile bracts ovate, acute, 4–10 mm long, 2–5 mm wide, loosely sheathing the pedicels, green, sometimes slightly glaucous. Pedicels 4–5 mm long, slender, within the floral bract. Ovary narrow, cylindrical, 6–12 mm long, 4–6 mm wide. Flowers 1–5: 15–20 mm diam., pale blue to cornflower blue, opening easily on warm humid days, hardly fragrant; buds narrow, slate grey with pale blue margins to sepals. Perianth segments ovate-lanceolate to ovate, 7–11 mm long, 3–8 mm wide, concave, with c. 10 lines; dorsal sepal ovate, subacute; lateral sepals ovate-lanceolate, slightly asymmetric, acute; petals ovate, obtuse to subacute; labellum similar to other petals. Column erect from the end of ovary, 5–7 mm long, 2–3 mm wide, pale blue; post-anther lobe hooding the anther, 3–4 mm long, 2–3 mm wide, rather inflated, slightly tubular, open on the ventral side, strongly curved and flattened dorsally, dark brown to black, the apex thickened and deeply notched, yellow; auxiliary lobes absent; lateral lobes converging, c. 1 mm long, digitiform, porrect at base, curved forwards, each with a dense apical tuft of white trichomes held in front and below the post-anther lobe, the individual trichomes c. 1 mm long, with swollen tips which tend to dry yellowish. Anther inserted about midway along the column, ovoid, 2.5–3 mm long, connective produced into an apical beak to 0.7 mm long; pollinarium c. 1.2 mm long; viscidium circular, c. 0.5 mm long; pollinia friable, mealy, white. Stigma situated at base of column, quadrate, 1.5–2.5 mm long, margins irregular. Capsules elongate-obovoid, 10–15 mm long, 5–7 mm wide suberect, strongly ribbed. **Fig. 1C, 3D–F.**

*Distribution and habitat.* So far only found in the higher parts of the Mount Lofty Ranges in richer soils of river red gum grassy flats where vernal pools are scattered, either in the smaller pools or around edges of larger ones in rushes and sedges; MU, SL. Probably much more widespread prior to European settlement and likely to have occurred in similar habitat all the way north to the southern Flinders Ranges before the almost total destruction of this habitat through clearing, ploughing or grazing. More recently decreased rainfall means the ponds in which it grows rarely contain water.

*Conservation status.* Critically **endangered** with future threat through continuing land clearance and drying of its remaining habitat due to climate change (NPWC 2003).

*Flowering period.* October, usually finished within 3 weeks.

*Pollination biology:* Neither strongly outcrossing nor autogamous, as not all capsules set seed.

*Distinguishing features and notes.* Plants without open flowers look like *T. holmesii* because of the slate grey



buds, but the dense clumps of plants, less crowded flowers of a softer blue and the dense white terminal trichomes on the lateral arms of the column serve to set it apart. Unlike *T. holmesii* smaller plants may have a single sterile bract. In many ways the species could be confused with *T. exigua* which is also a clumping species, but has broader leaves, smaller flowers with buds not slate-grey, the trichomes spread along the entire length of the lateral lobes of the column.

The author can remember large populations of this species near Kuitpo in the SL region before the area was planted to pines.

**Etymology.** From Greek *hygros*, water, and *phelos*, love, indicating that the species is restricted to the vicinity of waterholes.

**Specimens examined at AD:**

SOUTH AUSTRALIA. **MU:** High Eden Road, reserve in river red gum woodland, 25 Oct. 2005, *R.Bates* 66290. **SL:** Cromer C.P., in ephemeral pond in river red gum flat, 26 Oct. 2005, *R.Bates* 66309; Knott Hill N.F.R., in pond in sedges near red gums, 25 Oct. 2008, *R.Bates* 80099.

**3. *Thelymitra latifolia* R.J.Bates, sp. nov.**

*A Thelymitra peniculata* Jeanes *habito robustiore, folio latiore planoque non scapo vaginans, alabtris rotundis, floribus pallide malvinis et plus leviter lineolatis, columnae lobo post-anthera non vel vix incisurato et apice crenulato differt.*

**Typus:** South Australia, Southern Lofty region: Millbrook Reservoir, Pine Peninsula, in regenerating sandy patch, 12 Oct. 2004, *R.Bates* 64051; holo: AD; iso: MEL.

*Thelymitra peniculata* Jeanes, *Muelleria* 19: 50 (2004), partly.

*Thelymitra* sp. *Latifolia* (*R.Bates* 64108) Bates, *Orchids S. Austral.*, ver. 1, CD-ROM (2006)

*Thelymitra* sp. *Latifolia* (*R.Bates* 64051) Bates, *Orchids S. Austral.*, ver. 3, CD-ROM (2008).

*Thelymitra pauciflora* auct. non R.Br.: Weber & Bates in Jessop & Toelken, *Fl. S. Austral.* 4: 2142 (1986).

*Thelymitra peniculata* auct. non Jeanes: Jeanes, *Muelleria* 19: 50 (2004), partly, only as to *R.Bates* 15644 as cited in paper, but including other specimens in AD.

**Illustrations:** Bates (2008–2010), as *Thelymitra* sp. *Latifolia* (*R.Bates* 64051).

Glabrous terrestrial orchid to 30 cm tall. *Tuber* ovoid 1–2 cm long, 5–10 mm wide. *Leaf* lanceolate, 5–10 cm long, 5–15 mm wide, blade flat, obliquely erect, leathery, dark green with reddish tints mostly at base and on margins, lamina with several longitudinal ridges, not sheathing the scape or sheathing only at extreme base, apex acute. *Scape* 10–30 cm long, 2–4 mm wide, glaucous, green with pink or purplish tints. *Sterile bracts* usually two, linear lanceolate 2–5 cm long, closely sheathing except at the acuminate free apex, green with purplish tints sometimes glaucous. *Fertile bracts* ovate acuminate, 7–15 mm long, 5–8 mm wide somewhat inflated, highly textured, purplish with some pale bloom. *Pedicels* 5–10 mm long, slender. *Ovary* obovoid, 5–8 mm long, 4–5 mm diam., green. *Flowers* 2–8: 14–20



Fig. 2. *T. latifolia*. A, B column (front and side view), C flower, D leaf. \* column arms with toothbrush-like tufts of hairs; \*\* orifice of column.

mm across, pale to mid-blue sometimes mauve or pink, opening briefly and only on warm humid days, mostly in the morning; buds rounded, lilac to brown with pale greenish or bluish margins to sepals. *Perianth segments* 6–10 mm long, 4–5 mm wide, concave, shortly apiculate or blunt, with 6–12 longitudinal striations; *dorsal sepal* ovate, sub-acute; *lateral sepals* ovate, often asymmetric, subacute; *petals* obovate, obtuse; *labellum* obovate, obtuse, smaller than other segments. *Column* erect from the end of ovary, 5–6 mm long, 3–4 mm wide, pale pink; *post-anther lobe* hooding the anther, 3–4 mm long, 2–3

mm wide, tubular, curved gradually, yellow and brown or predominantly yellow including the apex, which is not or slightly notched rather than gaping, lightly ribbed longitudinally with somewhat crenulate margins; may appear to gape on pressed material due to squashing; *auxiliary lobes* often present as two short thick spurs on lower apical margins; *lateral lobes* converging 1.2–1.5 mm long, porrect at base, curving gently upwards and forwards with a sub-terminal, elongated, mop-like, untidy tuft of white trichomes, which are held well in front of the post-anther lobe, the individual trichomes 1–1.5 mm long, slender with a thickened apex, often drying a dirty colour. *Anther* inserted above centre of column, ovoid 1.6–1.8 mm long, the connective extended into an apical beak; *pollinarium* 1.5–2 mm long; *viscidium* ± circular c. 0.5 mm diam.; *pollinia* white, mealy friable rarely seen intact in open flowers. *Stigma* at base of column, ovate-quadrate, c. 2.2 mm diam., margins irregular. *Capsules* obovoid, 10–11 mm, long 4–8 mm wide, erect and ribbed. **Fig. 1A, 2.**

*Distribution and habitat.* In South Australia found from the southern Flinders Ranges southward through the Mount Lofty Ranges to the South-east (FR, NL, MU, SL, SE) and probably also in western Victoria. Found in woodlands in various soil types from leached pale sands to yellow gravelly clays and may occur near swamps.

*Conservation status.* Widespread, locally common and well conserved in conservation parks.

*Flowering period.* Late September in the north of its range to early November in the south.

*Distinguishing features.* Easily recognised by the following characters: the broad flat green leaf blade (but not as red as in *T. brevifolia*); the glaucous scape emerging from the leaf base at or near ground-level; the two short sterile bracts and the purplish, minutely tuberculate floral bract, which has a pale bloom; the short lilac buds; rounded flowers in various shades of mauve to blue; the numerous striations on the segments; the post-anther lobe more strongly yellow than most species, which is lightly ribbed apically, apex not markedly inflated, margins crenulate to sub-crenulate. The lateral lobes are directed well in front of the post-anther lobe and the white trichomes form an elongate mop. The flowers are not fragrant.

*Etymology.* The name *latifolia*, Latin, means flat leaf, as this species has a broad flat leaf on mature flowering plants, although in poor seasons and on smaller plants the leaf may be much reduced in width.

#### *Selected specimens examined at AD*

SOUTH AUSTRALIA. **FR:** Alligator Gorge N.P., 27 Sep. 1988, *R.Bates 15644*. **MU:** 'Fernlee Dell', High Eden via Springton, in deep sand under bracken, 17 Oct. 2004, *R.Bates 64045*. **SL:** Boyles Swamp Mylor, 5 Dec. 1980, *R.Bates 879*; Ti Tree Creek Road via Prospect Hill, in pink gum woodland, 8 Nov. 2003, *R.Bates 61781*; Pine Peninsula, Millbrook Reservoir, 3 Nov. 2003, *R.Bates 61475*; Scott Creek C.P., 16 Oct. 2004, *R.Bates*

*64009*; Scott Creek C.P., Bushrat Ck, 16 Oct. 2004, *R.Bates 64008*; Millbrook Reservoir, Gate 38, open woodland under powerlines, 25 Oct. 2004, *R.Bates 64108*; Lobethal Bushland Reserve, top firebreak, 24 Oct. 2004, *R.Bates 64114*; Mt Bold, Thomas Gully, 2 Nov. 2005, *R.Bates 66408*; SE corner of Mt Bold Reserve, 2 Nov. 2005, *R.Bates 67221*; Peter Ck, Oct. 2007, *R.Bates 75088*; Lenswood Agric. Res. Centre, 20 km E of Adelaide, 15 Oct. 1977, *A.G.Spooner 5407*. **SE:** Pine Hill Soak, on crests of dry sand ridges, 11 Nov. 2003, *R.Bates 61588*; Bangham C.P., sand slopes in stringy bark woodland, Nov. 2003, *R.Bates 61655*; 10 km N of Kalangadoo, 31 Oct. 2004, *R.Bates 64414*; State Forest adjacent to W side of Lower Glenelg River N.P., 24. Oct. 1982, *J.Z.Weber 7831*.

#### 4. *Thelymitra odora* R.J.Bates, *sp. nov.*

*A Thelymitra pauciflora* R.Br. *fistula altiore*, una *bractea sterili*, *alabastris atroschistaceis marginibus pallidis*, *floribus atrocyaneis cum venis fuscioribus et collo nigero*, *lobo post-anthera laete luteo vel aurantiaco et trichomatibus brevibus densis et floribus fragrantibus differt.*

**Typus:** South Australia, Southern Lofty Region: Lobethal, scrub at the top of ridge, E of bushland reserve, 15 Oct. 2007, *R.Bates 75072*; holo: AD, iso: MEL.

*Thelymitra sp. Slate Buds* (*R.Bates 64092*), Bates, Orchids S. Austral., ver. 1, CD-ROM (2006).

*Thelymitra sp. Odorata* (*R.Bates 61708*), Bates, Orchids S. Austral., ver. 3, CD-ROM (2008).

*Illustrations:* Bates (2006–2010), as *Thelymitra sp. Slate Buds* (*R.Bates 64092*) and *Thelymitra sp. Odorata* (*R.Bates 61708*).

Glabrous terrestrial *orchid* to 30 cm tall. *Tuber* elongate ovoid to spindle shaped 2–3 cm long, 6–8 mm wide. *Leaf* linear 8–12 cm long, 1.5–2.5 mm wide, erect, canaliculate, not fleshy, slightly ribbed abaxially, dark green with a purplish base, sheathing at the base for 4–8 cm above ground level, apex acute. *Scape* 15–30 cm long, 1–2 mm diam., slender, straight, pale mauve. *Sterile bracts* two, rarely single, linear, 2–5 cm long, sheathing except at the slightly swollen orifice, pink, acute. *Fertile bracts* ovate-acuminate, 5–10 mm long, 2–4 mm wide, sheathing the pedicels, purplish, sub-glaucous, acute. *Pedicels* slender 5–7 mm long. *Ovary* narrow-obovoid, 5–10 mm long, 2–3 mm wide, sub-glaucous. *Flowers* 1–4: 12–14 mm diam., usually deep blue, opening only on warm humid days; *buds* slate coloured, with some powdery bloom, the sepal margins broad, pale grey and blue or white. *Perianth segments ovate* 6–8 mm long, 3–5 mm wide, concave, often shortly apiculate, lines 10–12 moderately distinct; *dorsal sepal* ovate, obtuse to subacute; *lateral sepals* ovate lanceolate, often asymmetric, acute; *petals* ovate, obtuse to apiculate; *labellum* obovate, acute, usually slightly smaller than other segments. *Column* erect from end of ovary, 5–6 mm long, 2–3 mm wide, white or pale blue; *post-anther lobe* hooding the anther, 3–5 mm long, 1–2 mm wide, tubular, dark coloured and ribbed on top, apex yellow or orange, not expanded, shallowly but neatly notched, margins crenulate and slightly incurved; *auxiliary lobes* present as two incurved triangular spurs less than 1

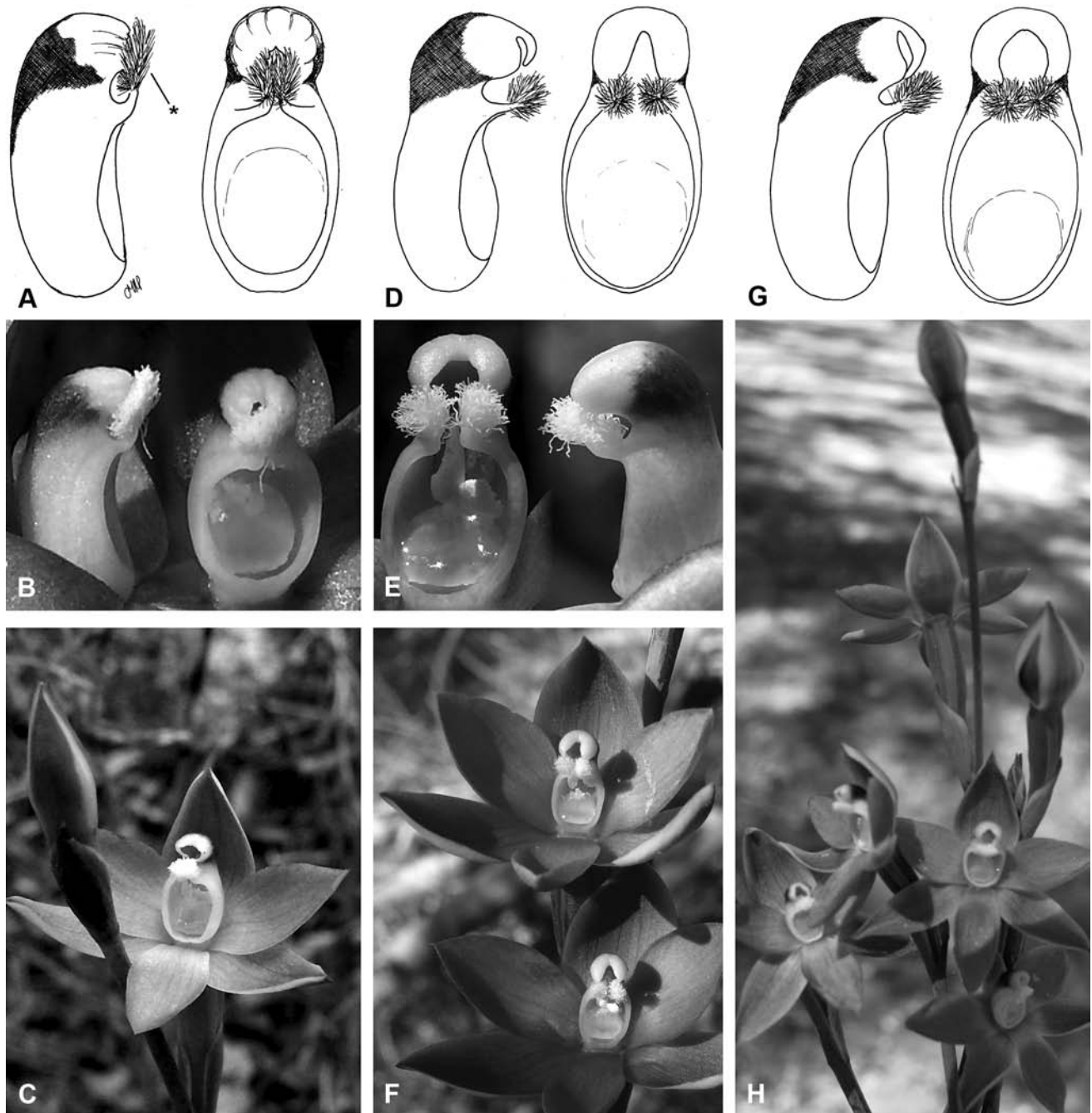


Fig. 3. A–C *T. crenulata*: A, B column (front and side view), C flower. D–F *T. hygrophila*: D, E column (front and side view), F flower. G–H *T. odora*: G column (front and side view), H flower. \* column arms with mop-like tufts of hairs.

mm long on the lower apex of the post-anther tube and sometimes touching near the anther apex; *lateral lobes* converging 1.3–1.4 mm long, digitiform, porrect at the glabrous base, curved upwards at right angles, each with a dense mop-like tuft of white trichomes held in front of the post-anther lobe; each trichome 1–1.2 mm long. *Anther* inserted above centre of column ovoid, 1.5–2 mm long, the connective produced into an apical beak 0.2–0.4 mm long; *pollinarium* 1–1.5 mm long; *viscidium* circular c. 0.2 mm diam.; *pollinia* mealy, friable, white. *Stigma* at base of column, quadrate, c. 2.5 long, 2 mm

wide, margins irregular. *Capsules* obovoid, 10–15 mm long, 4–6 mm wide, erect, ribbed. **Fig. 1D, 3G–H.**

*Distribution and habitat.* So far only known from a small area of the southern Mount Lofty Ranges (Adelaide Hills) from Mount Lofty north to Mount Pleasant and Mt Gawler in pebbly winter seepage areas, particularly on slashed firebreaks where populations of up to a hundred plants may be set up; SL, MU. The species was probably much more widespread before European settlement.

*Conservation status.* The species is highly localised, never common, with isolated populations in relict damp

woodland sites. A conservation status of **vulnerable** is suggested according to NPWC (2003), indicating the species is vulnerable to extinction. The total population of *T. odora* was estimated at about 2000 plants in 2010.

*Flowering period.* The flowering season restricted to about two weeks in late October and early November.

*Pollination biology.* This species is facultatively autogamous and cleistogamous in a cool spring when flowers do not open.

*Distinguishing features.* A species only readily recognised in early flowering when the slaty grey buds with pale edges are obvious and in contrast to *Thelymitra pauciflora* which flowers earlier in the same area. The unexpanded post-anther lobe with its deep yellow, sometimes orange apex, with its neat 'v' shaped notch also helps to identify the species. This is one of a number of similar species having a powdery white bloom on the floral bract and ovary.

*Notes.* There may be two subspecies involved, as plants from swampy habitat have larger flowers and a distinct violet fragrance whereas woodland populations have small blooms and a more general floral perfume.

*Etymology.* From the Latin *odora*, perfumed. This is one of the few species of the *T. pauciflora* complex to have a fragrance.

#### *Selected specimens examined at AD*

SOUTH AUSTRALIA. **SL:** Onkaparinga Woollen Mills Reservoir, 16 Nov. 2003, *R.Bates 61708* (site later under water); Lobethal Woodland Reserve, 16 Nov. 2003, *R.Bates 61709*; Warren Reservoir, upper reaches, 16 Nov. 2003, *R.Bates 61711*; Warren Reservoir, near Williamstown 27. Oct. 2003, *R.Bates 61884*; Adelaide Gully Road, Gate 28, top springs in grass and damp woodland, 1 Nov. 2004, *R.Bates 64220*; Lobethal Bushland Reserve, east section, top firebreak, Nov. 2005, *R.Bates 66401*; 2 km N of Lobethal, near hilltop, 10. Nov. 2005, *R.Bates 66614 & Susan*; Lobethal F.R., north of town on the top firebreak, 30 Oct. 2005, *R.Bates 66966*; Millbrook Scrub, off Adelaide Gully Road, 4 Nov. 2005, *R.Bates 67008*.

#### 5. *Thelymitra orientalis* R.J.Bates, *sp. nov.*

*A Thelymitra mucida* Fitzg. *plantibus parvulis, floribus paucioribus parvis cum segmentis brevibus obtusis, lobo post-anthera parum argenteo-glaucis, ambobus lobi lateribus perangustibus, trichomatibus erectissimis inter ambos duos insertis adpressisque differt.*

**Typus:** South Australia, South-east region: The Marshes Forest Reserve, N end of central N-S-track, Nov. 2003, *R.Bates 62078*; holo: AD, iso: MEL.

*Thelymitra* sp. '*orientalis*' Bates, Orchids S. Austral., ver. 4, CD-ROM (2009), in text.

*Thelymitra mucida* subsp. *orientalis* Bates, Orchids S. Austral., ver. 4, CD-ROM (2009), nom inval., in figure caption.

*Thelymitra mucida* auctt. non Fitzg.: Weber & Bates in Jessop & Toelken, Fl. S. Austral. 4: 2141 (1986), partly; Jeanes, Muelleria 19: 67 (2004), partly; Bates, Orchids S. Austral. ver. 1, CD-ROM (2006).

*Illustration:* Bates (2009, 2010), as *T. mucida* subsp. *orientalis*.

Glabrous terrestrial orchid to 10 cm tall. *Tuber* ovoid, white, to 1.5 cm long, c. 1 cm diam. *Leaf* filiform, terete to c. 5 cm long, c. 2 mm wide, rigidly erect, green with a red base, obscurely channelled, clasping the base of the scape for 1–2 cm. *Scape* to 10 cm long, c. 1 mm wide, wiry, red tinted, with usually a single flower but occasionally two. *Sterile bracts* 2, lanceolate-ovate, to 10 mm long, strongly clasping the scape, apex obtuse. *Fertile bract* pale purple, ovate, loose, c. 4 mm long, c. 2 mm wide, with minor pale bloom, obtuse to sub-acute. *Pedicel* very slender only 1 mm long; *ovary* dark purple, ovoid, 3–5 mm long, 2–3 mm wide. *Flower* to 10 mm diam., deep blue with magenta tints and 6–8 darker striations; *bud* plump, slate-grey; *perianth segments* shortly ovate, 5–7 mm long, 4–5 mm wide, rounded, apex obtuse or shortly mucronulate; *sepals* cupped, slate grey outside with blue edging, the dorsal sepal hooding the column, *petals* flatter and more rounded, labellum narrower. *Column* very erect, oblong, rich purple, 3–4 mm long, c. 2 mm wide; *post-anther lobe* hooding, 1–2 mm long, c. 1 mm wide, black with very little or no shining silver bloom, apex yellow, divided into two narrow lobes with crenulate, incurved margins; *lateral lobes* c. 2 mm long, c. 1 mm wide, porrect at first then erect, very flat, indigo, the trichomes sparse, slender, 1–2 mm long, yellow with golden apical third, lower trichomes magenta based, the tufts strongly recurved and adpressed inside and outside the two halves of the apical lobe, not exceeding it in height. *Anther* situated behind column centre, ovoid c. 1 mm long, the connective not beaked; *pollinarium* white, to 1 mm long, *viscidium* circular to 0.1 mm diam.; *pollinia* mealy, friable, white. *Stigma* at base of column, quadrate, to 1 mm across, margins smooth. *Capsules* obovoid, 8–10 mm long, 5–6 mm wide, dark green, erect, hardly ribbed. **Fig. 1E, 4A–C.**

*Distribution and habitat.* Known with certainty only from the western end of Kangaroo Island, the lower South-east of South Australia and (south) western Victoria. *T. orientalis* grows in damp heathy flats and seepage areas in high rainfall districts usually in leached peaty white sands.

*Conservation status.* Apparently very localised, rare and endangered due to habitat clearance for pine plantations and farms; suggest conservation rating of **endangered**, according to criteria of NPWC (2003).

*Flowering period.* All collections have been made on hot days in late October or early November.

*Pollination biology.* The species is facultatively autogamous and may be cleistogamous in cool periods when flowers do not open.

*Distinguishing features.* Most plants from South Australia and western Victoria previously identified

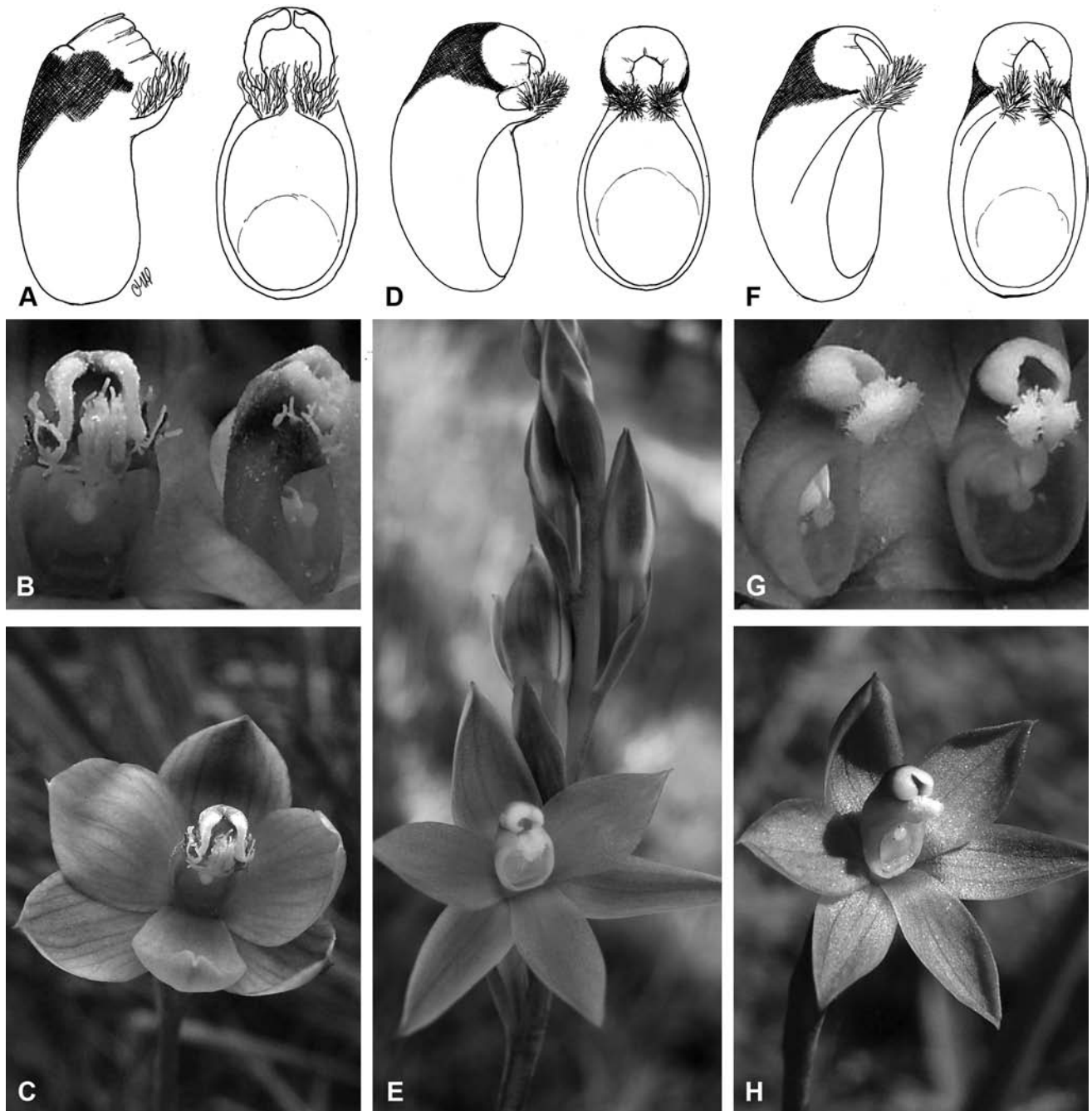


Fig. 4. A–C *T. orientalis*: A, B column (front and side view), C flower. D–E *T. pallidifructus*: D column (front and side view), E flower. F–H *T. rubricaulis*: F, G column (front and side view), H flower.

as *Thelymitra mucida* were placed by Jeanes (2004) in the allied, (recently named) species *Thelymitra inflata* Jeanes and *T. lucida* Jeanes. These species both differ from *T. mucida* in being quite robust, with larger, deeper blue flowers, more inflated post-anther lobe and different trichome arrangement. Some collections have since been re-determined as *T. merraniae*. Only a few South Australian and Western Victorian collections were left under *T. mucida* which is quite a common species in South-western Australia.

The remaining South Australian and western Victorian specimens are far smaller than Western

Australian plants, most are single flowered with a short filiform leaf, most have little or no bloom on the column and the trichomes are strongly adpressed to and between the two halves of the post-anther lobe. On the suggestion of Jeanes (pers. comm., 2006) these have been treated here as a separate species, *T. orientalis*, rather than a subspecies of *T. mucida*.

*Note.* It is yet to be ascertained whether *T. mucida* sensu stricto occurs in the eastern States. Although I have seen some images of flowers from South Australia that would appear to be of this taxon I have seen no good specimens.

It is likely that there are other taxa involved in the *Thelymitra mucida* complex since there is considerable variation in size and morphology of flowers.

*Etymology.* The name *orientalis*, Latin, of the East, has been chosen to show that this is an eastern Australian species similar to the Western Australian species *T. mucida*.

#### *Specimens examined at AD*

SOUTH AUSTRALIA. **KI:** Opposite Mt Taylor C.P., S coast of Kangaroo Island, in peat bog, 23 Oct. 2008, *R.Bates 80092*. **SE:** The Marshes N.F.R., centre track, Nov. 2005, *R.Bates 63452*.

VICTORIA. **SW:** Syphon Road swamp, Grampians, 12 Nov. 1985, *R.Bates 6520*.

#### 6. *Thelymitra pallidifructus* R.J.Bates, *sp. nov.*

A *Thelymitra pauciflora* R.Br. *una bractea sterili, floribus alabastrisque lilacinis, ovario pallidissime flavivirente (in sicco saepe pallide), lobi post-antherae apice anguste crenulato, trichomatibus minus confertis, florenti postea, et crescendo plerumque in turbario differt.*

**Typus:** South Australia, South East region: Whennan Native Forest Reserve, Mt Burr, Top track in sandy scrublands, 30 Oct. 2004, *R.Bates 64170*; holo: AD; iso: MEL.

*Thelymitra pauciflora* R.Br., Prodr. 314 (1810), partly.

*Thelymitra sp. Pale capsules* (*R.Bates 64170*) Bates, Orchids S. Austral., ver. 2, CD-ROM (2007).

*Illustration:* Bates (2008), as *Thelymitra sp. Pale capsules* (*R.Bates 64170*).

Glabrous terrestrial *orchid* to 30 cm tall. *Tubers* ovoid, 10–20 mm long, 5–8 mm wide; *Leaf* shortly linear 10–15 cm long, 1–2 mm wide, obliquely erect, fleshy, canaliculate at first, lamina becoming flat distally on larger specimens, ribbed abaxially, green with a red tinted base, sheathing the scape for 3–5 cm, fistula narrow, apex gradually acuminate. *Scape* 15–30 cm long, 1–2 mm diam., slender, usually slightly flexuose, green or pinkish. *Sterile bract* single, linear lanceolate, 2–3 cm long, pale pink or green, closely sheathing, apex acute. *Fertile bracts* short, ovate to quadrate, 8–10 mm long, 4–6 mm wide, pinkish, glaucous. *Pedicels* 1–3 mm long, grading into the ovary. *Ovary* narrow-obovoid, 5–10 mm long, 3–5 mm wide, a pale yellow-green on live material, remaining pale when dried fresh. *Flowers* 2–10: 10–15 mm across, usually lilac but sometimes pale blue, opening only on warm humid days and then only briefly; *buds* slender, lilac and green with pale lilac sepal edges. *Perianth* segments 6–10 mm long, 3–6 mm wide, concave, not apiculate; *dorsal sepal* ovate, obtuse to sub-acute, with c. 5 indistinct lines, often hooding the column; *lateral sepals* ovate-lanceolate, with indistinct lines, obtuse to sub-acute; *petals* somewhat broader, ovate, obtuse or sub-acute; *labellum* smaller, ovate-oblong, apex obtuse. *Column* erect from the end of the ovary, 4–5 mm long, 2–3 mm wide, quadrate, white or palest lilac; *post-anther lobe* hooding the anther, c. 2 mm long, tubular, curved forward, pale yellow with

a brown to purple brown collar at the base but, apex hardly to irregularly notched, not thickened, lobes not inflated, margins sub-crenulate to dentate, *auxiliary lobes* indistinct; *lateral lobes* converging, 0.8–11 mm long, digitiform, curved sharply upwards near the base, each with an untidy mop-like arrangement of white trichomes, individual trichomes to 1 mm long, held in front of the post-anther lobes not embracing them. *Anther* inserted midway along the column, ovoid, 2–2.5 mm long, connective produced into an apical beak 0.5 mm long; *pollinarium* 1.3–1.5 mm long; *viscidium* more or less circular c. 0.1 mm across; *pollinia* friable, mealy white. *Stigma* situated at base of column, concave, quadrate, c. 1.7 mm wide., margins smooth. *Capsules* narrowly obovoid, 10–15 mm long, 5–7 mm wide, ribbed, pale greenish-yellow until dried. **Fig. 1F, 4D–E.**

*Distribution and habitat.* Widespread and locally common from the southern Mount Lofty Ranges, western Kangaroo Island and the lower South-east, mostly in damp or swampy heathland often in sandy soils, often in slashed fire breaks and lightly grazed areas usually with other *Thelymitra* spp. (MU, SL, KI, SE).

*Conservation status.* Widespread, common and well conserved in conservation parks.

*Flowering period.* Late October to mid November, the flowering season very short as in other self-pollinated, later flowered sun-orchids.

*Pollination biology.* The short lived flowers are mostly inbreeding, autogamous even cleistogamous, but hybrids are recorded with more outcrossing species such as *T. ixioides* and *T. nuda*.

*Distinguishing features and notes.* *Thelymitra pallidifructus* is most easily recognised by the combination of high leaf fistula, short stature, single sterile bract, pale yellow-green ovaries and fresh capsules, lilac buds and flowers, and crenulate post-anther lobe apex. Like many members of the sub-complex the species sets up large colonies in suitable disturbed habitat such as slashed fire breaks cut through damp heath. Long thought to be distinct, but only recently have detailed studies showed it to be constant and habitat specific.

*Etymology.* From the Latin *pallens*, pale, and *fructus*, a fruit, in reference to the pale ovary and developing capsule. The epithet is treated as a noun in apposition.

#### *Selected specimens examined at AD*

SOUTH AUSTRALIA. **MU:** Kaiser Stuhl N.F.R. in boggy woodland, late Oct. 2005, *R.Bates 67395*. **SL:** Mylor town common, Nov. 2004, *R.Bates 64439*; Mt Bold Reserve on firebreaks in slashed heath, 5 Nov. 2005, *R.Bates 67086*; Mt Compass, 30 Oct. 1921, *J.B.Cleland 248*. **KI:** Intersection of Playford Hwy and Cassini Rd, 26 Oct. 1990, *B.M.Overton 1409*; 5.5 km SE of Cape Forbin, 24 Oct. 1990, *A.C.Robinson npki-79*; Willson River, 5 Oct. 1913, *R.S.Rogers 5059*; De Mole River in swampy places, Oct. 1909, Mr Smith the lighthouse keeper, sub *R.S.Rogers 5068*. **SE:** Old Comaum Road, 5.5 km N of Coonawarra junction, Nov. 2003, *R.Bates*

61542; Kangaroo Flat N.F.R., 11 Nov. 2003, *R.Bates* 61639 (dupl. MEL); Nangwarry, 29 Oct. 2004, *R.Bates* 62480; Lake Leake Road, in mown sand-heath, 30 Oct. 2004, *R.Bates* 64417; Tantanoola Forest, Nov 2003, *R.Bates s.n.*; Mt Burr F.R., 11 Nov. 1959, *P.G.Wilson* 1105.

7. *Thelymitra rubricaulis* R.J.Bates, *sp. nov.*

A *Thelymitra pauciflora* R.Br. *scapo bracteaque maronino ad purpureo, folio saepe colorato simili, una bractea parva sterili, scapo bracteaque valde pallida glaucidine, floribus multiplicibus cum apice minuto lobi post-antherae et anguste 'v'-formi incisurato, et crescenti in turbario differt.*

**Typus:** South Australia, South-East region: Whennan Scrub Forest Reserve, near Mt Burr, on Track WH1, slashed peat bog on edge of sandy track, 29 Oct. 2004, *R.Bates* 64155; holotype: AD.

*Thelymitra sp. Rubricaulis* (*R.Bates* 64273) Bates, *Orchids S. Austral.*, ver. 1, CD-ROM (2006).

*Illustration:* Bates (2006–2010) as *Thelymitra sp. Rubricaulis* (*R.Bates* 64273).

Glabrous terrestrial orchid to 35 cm tall. *Tubers* narrowly ovoid, 1–2 cm long, 4–8 mm wide. *Leaf* linear, blade short, 8–15 cm long, 2–3 (–5) mm wide, canaliculate to flat, erect, dark green to maroon with red to purplish, tubular base sheathing the scape for 4–10 cm, apex shortly acute. *Scape* 15–35 cm long, 1–2 cm wide, slender, straight, bright red to purple, usually with a pale bloom which is easily rubbed off. *Sterile bract* single, linear-lanceolate, 2–4 cm long, mostly sheathing, deep maroon with pale bloom, apex short and acute. *Fertile bracts* small, ovate-acute, 4–10 mm long, 2–3 mm wide, sheathing only the base of the pedicel, maroon with pale powdery bloom. *Pedicels* 6–15 mm long, slender, purplish. *Ovary* narrow-ovoid, 7–15 mm long, 2–4 mm wide, deep pink to maroon, often with pale bloom at the base and extending onto the pedicel. *Flowers* 1–8: 9–12 mm across, deep blue to mauve, opening only on warm humid days and then only briefly; *buds* narrow, maroon with pale sepal edges, some indistinct bloom. *Perianth segments* 6–8 mm long, 2–3 mm wide, concave, not apiculate with 6–8 darker parallel lines; *dorsal sepal* ovate, obtuse to subacute; *lateral sepals* lanceolate, symmetrical, acute; *petals* ovate to obovate, obtuse to sub-acute; *labellum* obovate, obtuse slightly smaller than sepals. *Column* erect from end of ovary, 4–5 mm long, 2–3 mm wide, purplish; *post-anther lobe* hooding the anther, 2–3 mm long, 1.5–2 mm wide, tubular, compressed dorsally, curving past the middle, hardly compressed, almost black at the base, apex deep yellow, neatly notched, the lobes not inflated, margins smooth, not thickened or crenulate, flowers soon collapsing when pollinated; *auxiliary lobes* absent; *lateral lobes* more or less parallel, c. 1.2 mm long, porrect at the glabrous base, obliquely erect, each with an elongated tuft of dense, white, tidy trichomes embracing the post-anther lobe, individual trichomes c. 1 mm long, not swollen at tip. *Anther* inserted about the centre of the column, ovoid, 2 mm long, the connective produced into a short beak; *viscidium* more or less

circular, c. 0.5 mm wide; *pollinia* friable, mealy, white. *Stigma* at base of column, ovate-quadrate, 1.5–2.5 mm long, c. 2 mm wide, margins irregular. *Capsules* elongate-ovoid, 10–20 mm long, 4–8 mm wide, dark coloured, erect, ribbed. **Fig. 1G, 3F–H.**

*Distribution and habitat.* Restricted in South Australia to the lower South-East in an area from Penola to Mount Burr to Glencoe to Nangwarry. Found only on slashed firebreaks and track-sides in peaty sand usually adjacent bogs and seepage slopes in heath and low woodland with bracken often dominant (SE). Probably also in similar habitat in south-western Victoria and may once have occurred in peat bogs of the SL and KI regions.

*Conservation status.* Localised and rare but does occur in colonies of up to fifty plants; suggested rating of **vulnerable** according to the criteria of NPWC (2003), as both, the predicted drying of the climate and some present management plans make the species vulnerable to extinction.

*Flowering.* Taking into account the swampy, cold habitat, the species flowers remarkably early, usually finishing flowering before the end of October.

*Distinguishing features and notes.* Easily distinguished from the rest of the complex by the bright pink to purple-maroon colour of the stems, the narrow leaf with high fistula, the slender yet remarkably rigid inflorescence with its single sterile bract, the pale bloom on any part of the plant, the long capsules, the deep blue flowers, small column and small neatly incised notch in the post-anther lobe. It is surprising that the species was not collected in South Australia until 2004 given the vivid colouring of plants. However the early flowering (for the habitat) and rarely opening blooms would prevent most collectors from gathering material. The author has not yet seen plants in full bloom, but the flowers do not appear to produce any fragrance. Hybrids are not known.

*Etymology.* From Latin *ruber*, red, and *caulis*, a stem, reflecting the deeply coloured inflorescence. The epithet is treated as a noun in apposition.

*Specimens examined at AD*

SOUTH AUSTRALIA. **SE:** 3.6 km N of The Marshes (N.F.R.), 11 Oct. 2003, *R.Bates* 61608; Whennans F.R. on top track, mown edges, 29 Oct. 2004, *R.Bates* 64176; Adjacent Whennan S.F., 30 Oct., s.anno, *R.Bates* 64273; Mt MacIntyre N.F.R., 30 Oct. 2004, *R.Bates* 64419; Lake Leake Road north of Glencoe, Oct. 2004, *R.Bates* 64461; Nangwarry Forest (all in seed), Oct. 2005, *R.Bates* 66301; The Marshes (E), 30 Oct. 2008, *R.Bates* 80154 (dupl. MEL).

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<sup>1</sup> EDITORIAL NOTE: The publication history of the *Orchids of South Australia* CD-ROM is complex, as the dates when the chapters were up-dated are not known. For simplicity, a new version is listed here for each year. The CD-ROM was at times available from NOSSA and also from the author. Chapters were also available at the Society's web-site in the past. Copies are lodged with the State Herbarium of South Australia, Adelaide.