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Patersonia rosea (Iridaceae, Patersonioideae) a new species from the New South Wales central and lower north coast regions

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Abstract

Patersonia rosea Branwhite *sp. nov.* is described and illustrated, and notes provided on distribution, conservation status and habitat. Morphological differences that distinguish it from similar species of *Patersonia* are discussed, and molecular data indicating relationships are also presented.

Introduction

Patersonia R.Br. is a distinctive monophyletic genus within Iridaceae and the sole member of subfamily Patersonioideae Goldblatt (Goldblatt *et al.* 2008). Approximately 25 *Patersonia* species are recognised worldwide, the majority (18 spp.), endemic to Australia (Cooke 1986; Keighery 1990). Other species occur in Borneo, Sumatra, New Guinea, the Philippines and New Caledonia (Goldblatt *et al* 2011; Goldblatt 2012).

The number of *Patersonia* species in Australia has remained relatively stable since the publication of the Flora of Australia treatment (Cooke 1986) with only one additional species described since (Keighery 1990).

In this paper we describe a new taxon from the New South Wales central coast that was recognised as distinct in the field by one of us (BB) in the 1980s. The informal phrase name *Patersonia* sp. 'Pink' was adopted on account of its pink coloured tepals. It appears to share some features of *Patersonia sericea* R.Br. and others of *P. glabrata* R.Br., and its superficial resemblance to these taxa may explain why it has been overlooked by other workers. It sometimes co-occurs with one or both of these species, and to rule out the possibility of hybrid origin, population variability was examined in the field and molecular investigations undertaken. Although few populations are currently known and available material is limited, we here recognise the new taxon at species rank based on morphology and molecular data, to facilitate wider recognition and appropriate conservation.

Methods

Morphology

The description presented is based on limited material and may require amendment as further collections becomes available. Floral characters were assessed on fresh and spirit material. All other characters were assessed on pressed specimens. Flowering stem and leaf width were measured at the midpoint. Filament length was measured from the point where the filament tube becomes free from the perianth to where the filaments attach to the anther base.

Taxon sampling and DNA extraction

We sampled from 41 *Patersonia* ingroup accessions comprising silica-dried and herbarium-sheet material that included broadly sampled east coast species *P. glabrata*, *P. fragilis* (Labill.) Asch. & Graebn., the two varieties of *P. sericea*, several accessions of *P.* sp. 'Pink', along with a representative of *P. macrantha* Benth. and *P. occidentalis* R.Br. from NT and WA respectively (Cooke 1986). Based on Baker *et al.* (2022), outgroup samples were selected representing a sister clade within the family Iridaceae; the three plastid markers were extracted from two complete chloroplast genomes downloaded from GenBank namely *Iris domestica* (L.) Goldblatt & Mabb. (GenBank: HSN11621) and *I.* × *germanica* L. (GenBank: NC_062594). DNA isolation was performed as for Jobson *et al.* (2017). The final dataset contained 43 accessions of which 41 were previously unpublished (Table 1). Location details of east coast ingroup accessions were used to create a distribution map (Fig. 4).

Amplification and sequencing

Amplifications were performed as for Jobson *et al.* (2017), using three non-coding plastid (cpDNA) and the nuclear (nDNA) ribosomal gene marker. The cpDNA markers included the *rps*16 intron, the *trn*D–*trn*T intron spacer (*trnD–T*), and the *matK*–5′*trnK* spacer (*matK*) that were amplified using parameters described in Shaw *et al.* (2005). The nuclear ribosomal ITS region was amplified for several samples using the forward primer ITS5A (Stanford *et al.* 2000) and the universal internal reverse primer ITS2, and reverse primer ITS4 (White *et al.* 1990). Polymerase chain reaction (PCR) conditions for ITS were performed as described in White *et al.* (1990). Despite repeated attempts to amplify the region, most samples failed due to either extreme woodiness of tissue providing low nuclear DNA concentration or inhibitory secondary compounds. Several attempts at cloning and amplifying other nuclear markers, such as ETS and *phyC*, all failed to produce plant nuclear DNA. Further experimentation is required to successfully amplify nuclear markers in *Patersonia*.

Phylogenetic analyses

Phylogenetic analyses were performed on (1) the three individual datasets, and (2) the concatenated matrix comprising all three markers. The most suitable nucleotide substitution model for each of the three markers was assessed using the Akaike information criterion (AIC) implemented in jModelTest (ver.2.1.7, see https://en.bio-soft.net/tree/MODELTEST.html, accessed 10 April 2023; Guindon & Gascuel 2003; Posada 2008). The best fit was GTR+ I+G and with a burn-in involving the first 25% of the samples, we estimated Bayesian posterior probability with five independent runs of 20 million generations, using four chains with sampling of trees every 1000 generations. All parameters were set as Dirichlet, with all other priors unlinked with a flat multinomial distribution. Stationarity was assessed by examining plots of the –lnL across generations in Tracer (ver. 1.6, Rambaut *et al.*, see https://beast.community/tracer, accessed 10 April 2023). The effective sample size (ESS) was set to >1000, and the remaining trees were used to construct a 50% majority rule consensus tree, visualised using FigTree (ver. 1.4.0; http://tree.bio.ed.ac.uk/software/figtree/).

Relevant dried and alcohol-preserved material representing all related species, held at the National Herbarium of New South Wales (NSW), Australian National Herbarium (CANB), and Queensland Herbarium (BRI) were examined.

Results

Sequences and alignment

The *rps16* matrix was 904 bp long, of which 186 characters (20%) were parsimony informative, *trnD-T* matrix was 967 bp long, of which 194 characters (20%) were parsimony informative, and the *matK* matrix was 854 bp long of which 200 characters (18%) were parsimony informative. All three datasets included members of all ingroup taxa; *rps16* (n = 39), *trnD-T* (n = 33), *matK* (n = 25) (Table 1). The concatenated three gene matrix contained 41 ingroup and two outgroup taxa and was 2725 bp long with 484 parsimony informative characters (18%).

Phylogenetic relationships

The separately analysed *rps16*, *trnD-T* and *matK* trees were largely topologically congruent, and all three datasets were concatenated and analysed together as a single matrix (Fig. 5). The 50% consensus tree showed strongly supported major clades (posterior probability (PP) = 1). The phylogeny shows that *P. glabrata* and *P.* sp. 'Pink' are each fully supported and monophyletic, and together they are sister to a clade containing *P. fragilis* and *P. sericea*. Within the *P. sericea* clade are two unsupported subclades. The single accession of *P. occidentalis* was supported as sister to *P. fragilis*, while the single representative of *P. macrantha* is nested within a paraphyletic *P. sericea* (Fig. 5).

Taxonomy

Patersonia rosea Branwhite, ***sp. nov.***

Type: New South Wales: [precise locality withheld], Charmhaven, 5 Dec 2022, *R.W. Jobson 4233* (holo: NSW 1125307 (sheet), NSW 963067 (spirit); iso: CANB, BRI).

Loosely tufted rhizomatous perennial to c. 50 cm high. Flowering stems (0.5–) 21–60 cm long, 1.5–3.0 mm wide, oval, oblong-rectangular, planoconvex or trigonous in cross-section, with a tendency to spirally twist, rigid, unbranched, leafless, the slightly raised veins usually equal to or broader than the width of the space between the veins, with a dense matted indumentum completely obscuring ground tissue but tending to dislodge in patches, usually glabrescent except proximally and ± distally; hairs mostly branched proximally, brown proximally, white above. Leaves equitant, 4–8 at base of each flowering stem in a 2-ranked fan, dull green, linear to linear-ensiform, with a tendency to spirally twist, suberect, 23–66 cm long, subequal to or slightly longer or slightly shorter (rarely much longer) than the flowering stem, 1.4–2.8 (–4.0) mm wide, pliable, narrowly acute; proximal sheathing part with matted appressed fawn-coloured hairs on the faces and longer more spreading white hairs on the hyaline true margins; blade faces with close parallel veins, the very narrow recessed intervein spaces minutely papillose, indumentum of appressed hairs not persisting ± except proximally; blade margins with appressed to ascending white hairs with fused dark brown to almost black bases, the indumentum persisting or peeling off in sections. Inflorescence a binate (rarely trinate) rhipidium, each rhipidial unit with 3–9 flowers. Outermost spathe pair 35–50 mm long; firmer-textured part greyish-brown to mid-brown, with numerous close parallel veins, indumentum of densely matted short appressed hairs persisting at least in part, rarely glabrescent in very short-stalked inflorescences; membranous margins to c. 3.5 mm wide, glabrous. Outer bracts resembling the outermost spathes but with longer more spreading hairs on the keel, ± glabrescent; inner bracts progressively becoming more predominant white than brown and with a winged keel distally, glabrous or glabrescent. Flowers radially symmetric, fugacious; floral tube white, with a hairy proximal section 5–20 mm long and glabrous distal section 15–25 mm long; tepals strongly unequal; outer three tepals spreading horizontally, pink (± violet before flowers open and/or when flowers have finished), broadly elliptic-obovate, 16–25(–30) mm long, 12–20(–25) mm wide, obtuse; inner three tepals erect, pink, obovate to obcuneate, c. 2 mm long, narrowed at base into a short claw. Stamens symmetrically disposed; filaments 3.5–5.0 mm long, virtually fully connate into a cylindrical column, white, ± tinged pink, distal free part to c. 0.5 mm long; anthers subsessile, ± oblong, 3.2–4.5 mm long, yellow, cordate basally, 2-celled, latrorse, with connective c. as broad as cells. Ovary ± cylindrical, hairy; style exerted 4–6 mm beyond apex of filament column, yellow, becoming sharply deflexed with age; stigmatic lobes fleshy, white, broadly to transversely elliptic or ovate, 1.2–1.5 mm long, densely papillose-shortly hairy. Capsules narrowly ovoid to ellipsoid or narrowly obovoid, elliptic to planoconvex or unequally trigonous in cross-section, 13–21 mm long, 4–6 mm diam., mid brown at maturity; valve external surface mostly glabrescent but remaining hairy on midvein (at least distally) and along one of both margins. Seeds c. cylindrical-fusiform to narrowly ovoid, sometimes distorted, 3.2–4.8 mm long, pale brown, finely and closely striate, rounded and abruptly curved at attachment end; aril extending from the non-attachment end of the seed along one side of the seed to almost the opposite end, linear, closely appressed to the seed, cream-stramineous when dry. Figures 1, 2.

Diagnostic characters: Distinguished from other *Patersonia* spp. by the combination of the following characters: flowering stems usually slightly longer or slightly shorter (rarely much shorter) than the leaves and with a dense matted indumentum that tends to come off in patches except proximally and ± distally; leaves strictly basal, with flat blades mostly to 2.8 (–4.0) mm wide, hairy at least initially though often glabrescent; outermost spathe pair 35–50 mm long, the firmer-textured greyish-brown to mid-brown part with a partially persistent indumentum of densely matted short appressed hairs; floral tube hairy proximally; tepals pink; staminal filaments virtually fully connate into a cylindrical column; ovary hairy; seeds cylindrical-fusiform to narrowly ovoid, 3.2–4.8 mm long, pale brown, finely and closely striate, lacking a pit at one end, with a pale linear aril extending along one side of the seed for almost its entire length.

Table 1. Accessions used in the three-gene matrix. Secondary collectors are not included. Locality abbreviations: ACT, Australian Capital Territory; NSW, New South Wales; NT, Northern Territory; Qld, Queensland; Tas., Tasmania; WA, Western Australia. GenBank numbers for each gene region are shown. Previously published sequenced not shown; NS indicates a sequence that either failed or was not included in the study. PLR = precise location removed for conservation reasons.

Code	Herbarium #	Taxon	Collector	Coll. date	Location	co-ords S	co-ords E	rps16	trnDT	matK
P01	CANB 955810	*P. glabrata*	Albrecht 16513	27/03/2022	NSW, Mt Budawang Rd, 2.29 km due N of Mt Budawang summit	-35.459444	149.994722	OQ851008	OQ851047	OQ850985
P02	CANB 955815	*P. glabrata*	Albrecht 16518	17/04/2022	NSW, Intersection of Wallagoot Lake Rd & Saphire Coast Rd	-36.766944	149.921944	OQ851009	OQ851048	OQ850986
P03	CANB 955829	*P. glabrata*	Albrecht 16534	26/04/2022	NSW, c 260m NW of the junction of Mines and Bucklands Rds	-37.445278	149.839167	OQ851010	OQ851049	OQ850987
P04	CBG 9504016	*P. glabrata*	Gilmour 7098	5/09/1990	NSW, Upper Bellinger River, near Bishops Creek	-30.408333	152.616667	OQ851011	OQ851050	NS
P05	CANB 865101	*P. glabrata*	Pedersen 1269	3/09/2013	Cult Booderee Bot Gardens ex Yattta Yatta, Little Forest Rusden Head Track	-35.280556	150.3175	OQ851012	OQ851051	NS
P06	CANB 876116	*P. glabrata*	Purdie 9555	2/09/2014	NSW, Highway 33 N of Sydney, just S of Cooks Road turnoff, Glenworth Valley	-33.403056	151.2125	OQ851013	OQ851052	OQ850988
P07	CANB 744474	*P. glabrata*	Fethers 135	15/11/2006	NSW South Coast, Twelve Mile Road, towards Boyd Lookout	-35.165278	150.439444	OQ851014	OQ851053	NS
P08	CANB 955812	*P. fragilis*	Albrecht 16515	27/03/2022	NSW, Mt Budawang summit	-35.479722	149.995278	OQ851015	OQ851054	OQ850989
P09	CANB 918642	*P. fragilis*	Branwhite sn	11/12/2019	NSW, Charmhaven, Mona Road, c. 540 m W of the Arizona Rd intersection	-33.23	151.484167	OQ851016	OQ851055	OQ850990
P10	CBG 8914064	*P. fragilis*	Jones sn	7/12/1989	NSW, Bullock Creek, c. 1 km along Point Lookout road.	-30.466667	152.3	OQ851017	OQ851056	OQ850991
P11	CANB 510773	*P. fragilis*	Mant 54	3/11/1998	Victoria, Grampians, swamp area along Hamilton Water Supply pipeline	-37.453611	142.19	OQ851018	OQ851057	OQ850992
P12	CANB 885932	*P. fragilis*	Purdie 10449	20/10/2015	TAS, Arthur Highway, Port Arthur	-43.1425	147.846111	OQ851019	OQ851058	OQ850993
P13	CANB 952306	*P. sericea* s.lat	Braby 224	27/12/2020	NSW, Tallaganda National Park, 7.6 km E of Huskinstown	-35.410833	149.536667	OQ851020	OQ851059	OQ850994
P14	CANB 955816	*P. sericea* s.lat	Albrecht 16519	17/04/2022	NSW, Intersection of Wallagoot Lake Rd & Saphire Coast Rd	-36.766944	149.921944	OQ851021	OQ851060	OQ850995
P15	CANB 918641	*P. sericea* s.lat	Branwhite sn	11/12/2019	NSW, Charmhaven, W of the intersection of the Pacific Hwy & Windermere Ave	-33.223611	151.498056	OQ851022	OQ851061	OQ850996
P16	CANB 527799	*P. sericea* s.lat	McDougall 694	12/11/1999	NSW, Bittangabee Bay, Ben Boyd National Park	-37.223889	150.018056	OQ851023	OQ851062	NS
P17	CANB 617293	*P. sericea* s.lat	Donaldson 2416	19/09/2000	NSW, Pilliga Nature Reserve, 1.4 km E of Borah Creek Road	-30.863333	149.533611	OQ851024	OQ851063	OQ850997
P18	CANB 449596	*P. sericea* s.lat	Moore 9342	22/10/1992	NSW, Apex Park on Gwydir Highway 1.8 km E of Warialda	-29.6	150.683333	OQ851025	OQ851064	NS
P19	CBG 7703024	*P. sericea* s.lat	Crisp 2969	12/06/1977	QLD, Leichhardt District, Blackdown Tableland, WNW of S. Mimosa Ck falls	-23.783333	149.016667	NS	OQ851065	OQ850998
P20	NSW963073	*P. sp. 'pink'*	Branwhite A	11/12/2019	NSW, Charmhaven, site A	PLR	PLR	OQ851026	OQ851066	OQ850999
P21	CANB 914168	*P. sp. 'pink'*	Branwhite B	11/12/2019	NSW, Charmhaven, site B	PLR	PLR	OQ851027	NS	OQ851000
P22	CANB 914169	*P. sp. 'pink'*	Branwhite C	11/12/2019	NSW, Charmhaven, site C	PLR	PLR	OQ851028	OQ851067	OQ851001
P23	CANB 914170	*P. sp. 'pink'*	Branwhite D	11/12/2019	NSW, Charmhaven, site D	PLR	PLR	OQ851029	OQ851068	OQ851002
P24	CANB 918640	*P. sp. 'pink'*	Branwhite sn	11/12/2019	NSW, Charmhaven, site F	PLR	PLR	OQ851030	OQ851069	OQ851003

Code	Herbarium #	Taxon	Collector	Coll. date	Location	co-ords S	co-ords E	rps16	trnDT	matK
P25	CANB 955854	*P. sericea* s.lat	Albrecht 16559	2/01/2021	NSW Property of Joe McAuliffe, SE of the intersection of Nerriga Rd	-35.158333	150.156389	OQ851031	OQ851070	OQ851004
P26	CANB 660108	*P. sericea* s.lat	Purdie sn	31/10/2004	NSW, Nadgigoma National Park, Eurodux Fire Trail	-35.313889	149.822222	OQ851032	OQ851071	OQ851005
P27	CANB 795386	*P. sericea* s.lat	Percival 19	7/10/2010	NSW, Southern Highlands; Penrose State Forest.	-34.632778	150.211667	OQ851033	NS	OQ851006
P28	CANB 712675	*P. sericea* s.lat	Johnstone 2235	18/11/2007	NSW, Old Bathurst Road between Mt Riverview and Emu Plains	-33.742222	150.641111	OQ851034	NS	OQ851007
P29	CBG 8602971	*P. sericea* s.lat	Parris 8936	22/02/1986	NSW, 9 km SW of Pambula, NW of Nethercote, NW of `Ocean View'	-36.966667	149.783333	OQ851035	NS	NS
P34	AQ641675	*P. glabrata*	Bean 10935	5/10/1996	Qld, Darling Downs Hellhole Gorge, NE of Yangan	-28.123408	152.376087	OQ851036	NS	NS
P36	AQ836291	*P. sericea* s.lat	Forster 39987	28/06/2013	Qld, WB Bullyard Conservation Park	-24.965833	152.048611	OQ851037	NS	NS
P37	AQ606631	*P. glabrata*	Forster 24690	6/09/1999	Le Palmgrove NP NW of TAROOM	-25.050556	149.278889	OQ851038	NS	NS
P39	AQ748679	*P. fragilis*	Stephens 2509077	25/09/2007	Qld, Mo Lamberts Swamp Nth Stradbroke	-27.6425	153.443056	OQ851039	OQ851072	NS
P40	AQ839630	*P. fragilis*	Forster 43453	16/12/2015	Qld, WB Wide Bay training area, Tin Can Bay track	-25.924444	152.966111	OQ851040	OQ851073	NS
P41	AQ671554	*P. glabrata*	Forster 23757	4/11/1998	Qld, Le Palmgrove NP NW of Taroom	-25.050556	149.278889	OQ851041	NS	NS
P42	AQ850358	*P. sericea* s.lat	Booth 5425	24/09/2009	Qld, PC Eurimbula NP	-24.153333	151.78	OQ851042	OQ851074	NS
P43	AQ458833	*P. macrantha*	Forster 6070	23/11/1989	NT, Finnis River Crossing	-12.983333	130.75	OQ851043	NS	NS
P44	AQ465625	*P. occidentalis*	Smith 1063	18/08/1988	WA, Hindmarsh Rifle range	-31.316667	117.133333	OQ851044	OQ851075	NS
P45	AQ915827	*P. glabrata*	Halford QM1014	18/02/2014	Qld, Shoalwater Bay Training Area, Clinton Sector, Mount Westall.	-22.363333	150.58	OQ851045	OQ851076	NS
P46	AQ831259	*P. sericea* s.lat	Halford QM486	17/04/2011	Qld, Shoalwater Bay Training Area, Mount Parnassus sector,	-22.782222	150.579167	OQ851046	OQ851077	NS

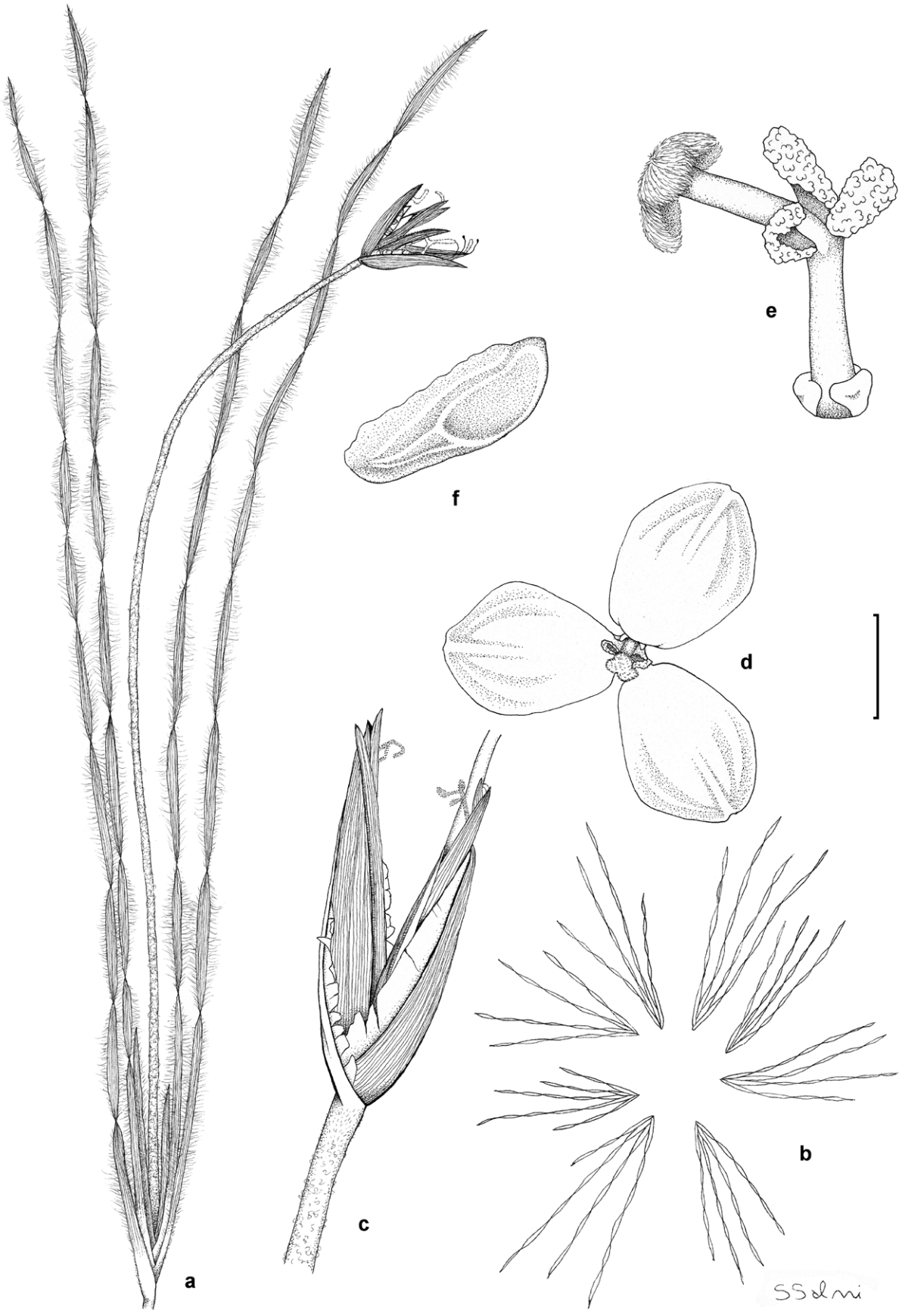

Fig. 1. *Patersonia rosea*: **a.** habit; **b.** arrangement of leaf-bearing shoots in mature plant (plan view); **c.** inflorescence showing outermost spathe pair; **d.** flower showing prominent outer 3 tepals; **e.** inner tepal whorl (at base), filament column, anthers, style and stigmatic lobes; **f.** seed. Scale bar: a = 30 mm; b = 3 mm; c = 13 mm; d = 10 mm; e = 2.5 mm; f = 2.3 mm. Illustration by S. Salmi (*B. Branwhite* s.n., 18 Dec 2022).

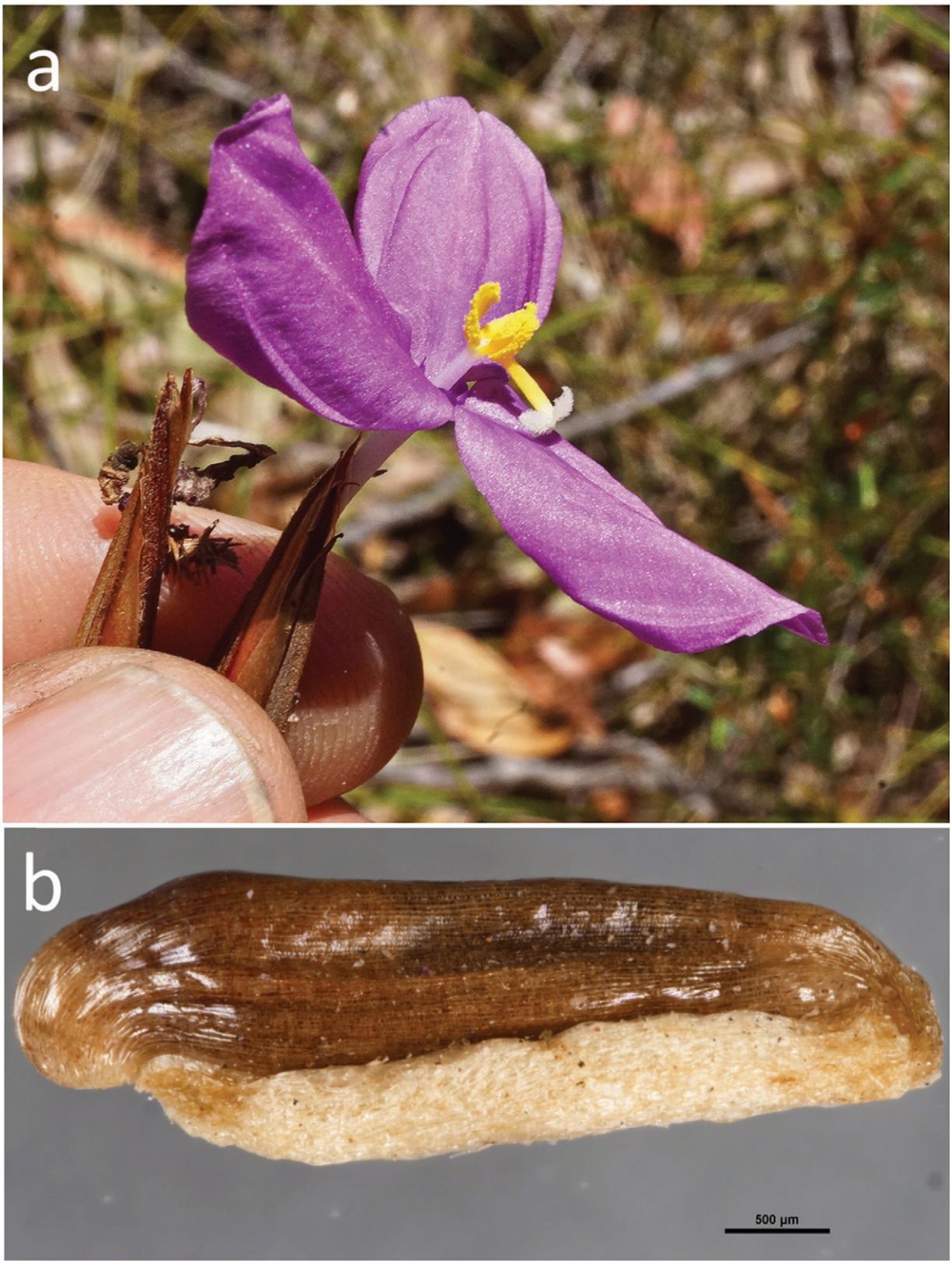

Fig. 2. *Patersonia rosea*: **a.** flower; **b.** seed. Images a = R. Jobson (*R.W. Jobson 4233*); b = J. FitzGerald (*B. Branwhite* s.n., 18 Dec 2022)

Specimens examined: NEW SOUTH WALES [precise localities withheld]: North Coast: Laurieton, Nov 1915, *J.L. Boorman s.n.* (NSW); Central Coast: Charmhaven, 26 Dec 2022, *D.E. Albrecht 16567 & B. Branwhite* (CANB); Wyee, 26 Dec 2022, *D.E. Albrecht 16568* (CANB); Wyee, 26 Dec 2022, *D.E. Albrecht 16569* (CANB, NSW); Charmhaven, 18 Dec 2022, *B. Branwhite s.n.* (CANB).

Distribution: All populations known to be extant occur in the Charmhaven – Wyee area on the New South Wales central coast (Fig 4). A single specimen from Laurieton, c. 200 km further north, collected by J.L. Boorman over a century ago appears to be *Patersonia rosea*. Further field work in the New South Wales north coast region is required to determine whether the species persists at Laurieton and whether it occurs between there and the Charmhaven – Wyee area.

Conservation status: None of the four extant populations currently known in the Charmhaven – Wyee area occur within a conservation reserve, although the species may be present within the nearby Lake Macquarie and Munmorah State Conservation Areas, and Colongra Swamp Nature Reserve. All known populations are small and the total number of plants of the species observed in the field to date is in the low hundreds. Given the extent of potential habitat, the species may be more abundant in the Charmhaven – Wyee area; however, survey is difficult due to private land tenure. The 1915 collection from Laurieton indicates the species may have a more extensive distribution than known populations would suggest, and wider searches are encouraged.

Some populations are currently under imminent threat from development. There is an urgent need to undertake further searches in suitable habitat to gain a more comprehensive understanding of distribution, abundance and threats. The current level of knowledge of the species precludes a confident assessment of conservation status and therefore it is best treated as data deficient. In addition to land clearing, the root rot fungus, *Phytophthora cinnamomi* is another potential threat as *Patersonia rosea* occurs in a habitat that is susceptible to this pathogen. Field observations of the susceptibility of *Patersonia* species to *P. cinnamomi* are currently conflicting (McDougall 2006), and experiments exploring the susceptibility of this species are required.

Habitat: Populations in the Charmhaven – Wyee area occur in dense sedgeland with an open stratum of emergent sclerophyllous shrubs (Fig. 3). These sedge-dominated patches occur within a matrix of open forest/woodland dominated by *Eucalyptus haemastoma* and/or *Angophora inopina* with a heathy understorey. Soils are grey sandy loam, over a poorly drained yellowish subsoil. Species commonly associated with *Patersonia rosea* include *Actinotus minor*, *Angophora inopina*, *Baeckea diosmifolia*, *Banksia oblongifolia*, *Blandfordia grandiflora*, *Comesperma ericinum*, *Cyathochaeta diandra*, *Epacris pulchella*, *Goodenia stelligera*, *Lambertia formosa*, *Lepyrodia scariosa*, *Pimelea linifolia*, *Ptilothrix deusta* and *Xanthorrhoea fulva*. *Patersonia sericea* commonly occurs with *P. rosea*, and *P. fragilis* and *P. glabrata* sometimes also occur in vicinity. At one location *Patersonia rosea* occurs in a power line easement where the vegetation is periodically slashed. These habitats are extensive on the coastal plains of the central coast between Lake Macquarie and Wyong (c. 7800 ha; see Bell and Driscoll 2016, Bell 2019), although they are largely in private ownership with few dedicated conservation reserves. Significant or threatened plant taxa occurring in such habitats include *Acacia bynoeana, Angophora inopina, Cryptostylis hunteriana, Genoplesium branwhiteorum, Genoplesium insignis, Grevillea parviflora* var. *parviflora, Hibbertia stichodonta,* and *Tetratheca juncea* (Bell 2001, 2004; Jones 2001; Toelken 2013; Renner *et al.* 2022; Branwhite pers. obs.).

Phenology: Flowering plants have been noted in December and January, though observations are limited.

Etymology: The specific epithet refers to the colour of the tepals when flowers are open, which is pink in all plants observed to date.

Affinities: Based on the molecular phylogeny of species occurring in eastern Australia, *Patersonia rosea* is sister to *P. glabrata*. (Fig. 5). Seed morphology appears to correlate with molecular data as both species have a linear aril on one side of the seed for virtually the whole length of the seed (Fig. 2b). *Patersonia rosea* resembles *P. glabrata* but is readily distinguished by the leaves being all basal (cf. cauline in *P. glabrata*) and the flowering stems being pubescent above the leaves (cf. glabrous in *P. glabrata*). Additional characters, including tepal colour (open flowers pink in *P. rosea*, cf. violet in *P. glabrata*) and seed aril morphology (lacking a more prominent cap-like part at one end of seed in *P. rosea*, cf. with a more prominent cap-like part at one end of seed in *P. glabrata*) may also separate these two species but the reliability of these features requires further checking.

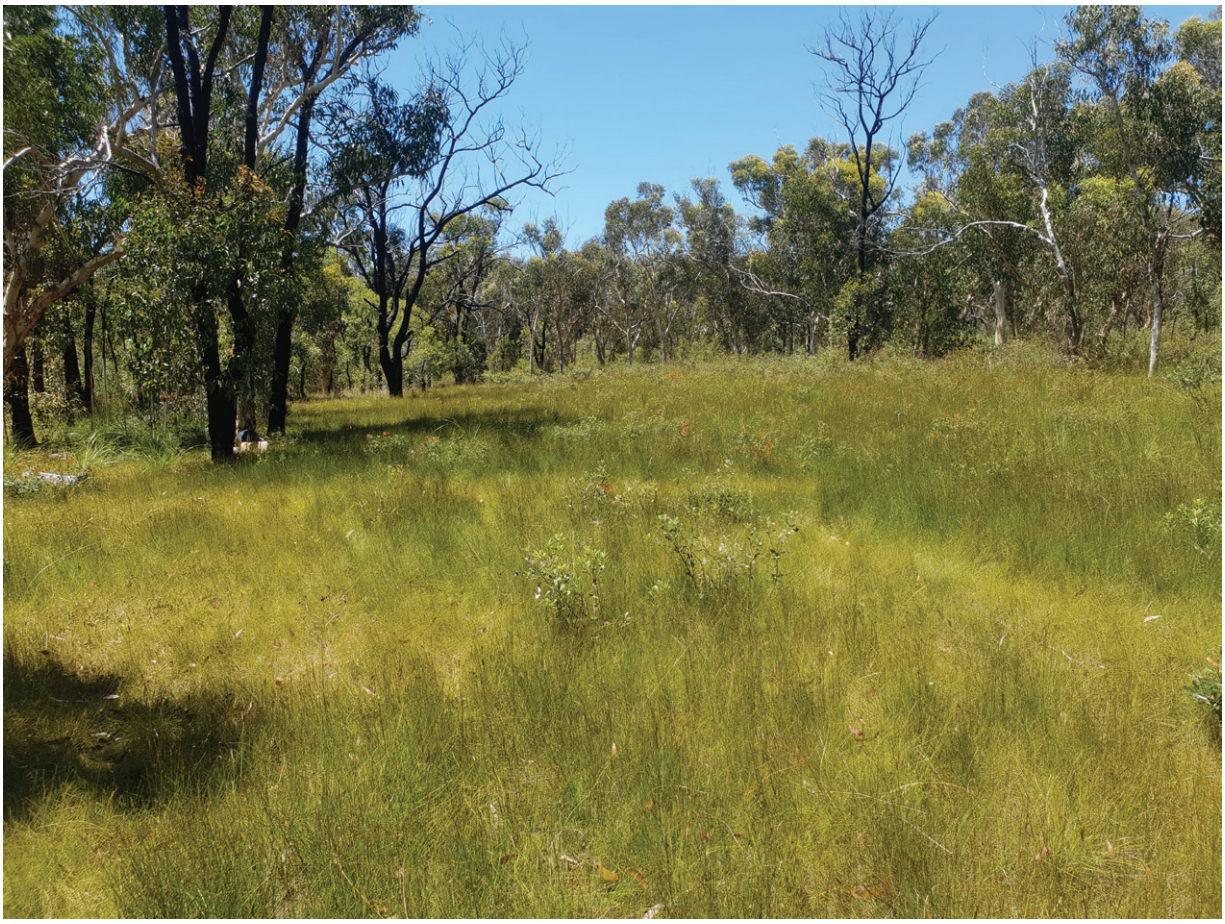

Fig. 3. Typical habitat of *Patersonia rosea*. Image = D. Albrecht (*D.E. Albrecht 16567 & B. Branwhite*)

Patersonia rosea has also been confused with *P. sericea* as both species have hairy leaves, flowering stems and spathes, at least in part when young. However, *P. sericea* differs from *P. rosea* in having dark brown to blackish spathes (cf. greyish-brown to mid-brown in *P. rosea*) and seeds that are distinctly longitudinally ridged, lack an aril and have a prominent pit at one end (cf. finely and closely longitudinally striate, arillate and lacking a pit at one end in *P. rosea*). Tepal colour (open flowers violet to purple in *P. sericea*, cf. pink in *P. rosea*) may also separate these two species but the reliability of this feature requires confirmation.

Notes: Plants occasionally produce very short flowering stems intermixed with the typical longer ones. There is a tendency for the outermost spathes of short-staked inflorescences to be less hairy. All plants of *P. rosea* seen in the field with open flowers have pink rather that violet or purple tepals. Further checking is required to gauge the consistency of this feature.

The known populations of *Patersonia rosea* occur in habitat containing *P. sericea*, *P. fragilis* and/or *P. glabrata*. These co-occurrences presented the possibility that *P. rosea* may be of hybrid origin with parentage involving two of the latter taxa. To determine whether this was the case, our sequencing effort attempted to compare the maternally inherited plastid marker phylogeny to a paternally inherited nuclear phylogeny with discordance of phylogenetic affiliation between the phylogenies potentially indicating recent hybridization (Jobson & Davies-Colley 2020). Although our nuclear marker sequencing effort was not successful, the maternal tree shows strong genetic divergence between *P. rosea* and its sister species *P. glabrata* (separated by 43 synapomorphies; Fig. 5). In addition, we found that all five accessions of *P. rosea* share indels of 4, 6, 7, 14 and 17 bps long; each of these is not present in any other sampled sequence (data not shown). The possibility that genetic divergence of this magnitude arose between ancestral maternal parent and its hybrid progeny is very unlikely. In addition, the 1915 Laurieton collection c. 220 km NE of the Charmhaven–Wyee sites provides evidence against a localised hybridization event and instead suggests a broader pre-development distribution across the central to lower north coast region (Fig. 4).

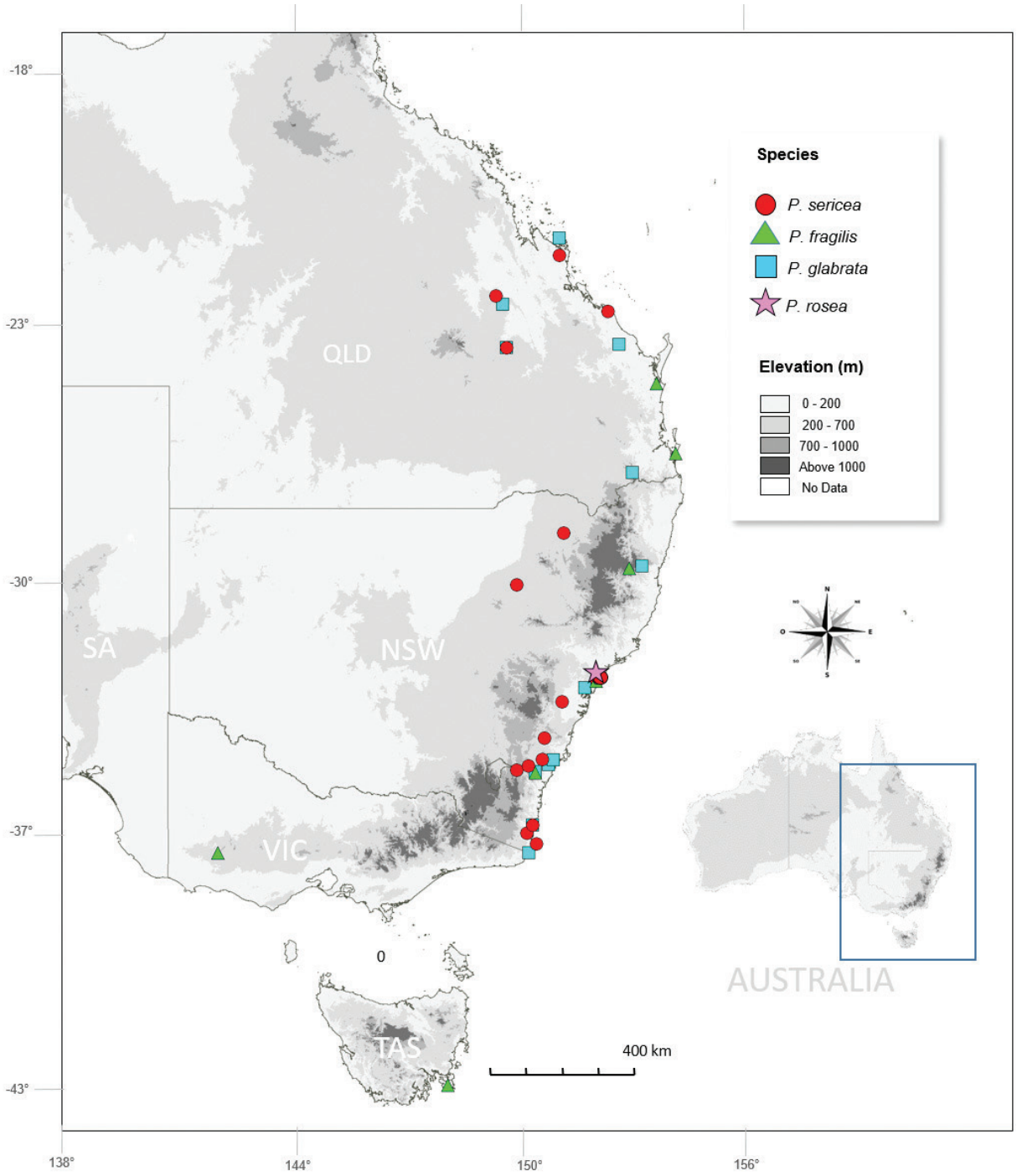

Fig. 4. Australia showing sites of *Patersonia* accessions used in the molecular phylogeny; *P. rosea* (pink star), *P. fragilis* (green triangle), *P. glabrata* (blue square), and *P. sericea* s.l. (red circle). *Patersonia macrantha* (NT) and *P. occidentalis* (SW WA) not shown.

Fig. 5. The 50% majority-rule consensus tree of the Bayesian inference analysis from the combined three cpDNA dataset across the genus *Patersonia* and two outgroup taxa. Recognised species are shown with bars. Outgroup is a collapsed branch (not shown). Branch lengths represent substitution rate; scale bar: 0.03. Posterior probability of strong support is shown above branches (1–0.95), weak support shown where relevant. Unsupported branches not indicated.

Key to the species of *Patersonia* in New South Wales

(Seed measurements exclude aril, if present)

1a. Leaves, flowering stems and spathes glabrous; seeds compressed-ovoid, black, smooth, 2–2.5 mm long with a prominent white aril confined to one end..... ***Patersonia fragilis***

1b. Leaves, flowering stems or spathes at least party hairy when young, sometimes glabrescent with age; seeds cylindrical, cylindrical-fusiform to narrowly ovoid, brown, sometimes with a waxy bloom, finely and closely longitudinally striate to ridged, mostly 2.5–6 mm long, aril lacking or if present then linear and on one side of the seed for virtually the whole length of the seed, with or without a larger cap-like part at one end..... **2**

2a. Leaves cauline; flowering stems (above leaves) glabrous; seeds arillate..... ***Patersonia glabrata***

2b. Leaves all basal; flowering stems (above leaves) pubescent, at least partly; seeds with or without an aril..... **3**

3a Spathes greyish-brown to mid-brown; seeds arillate, lacking a pit at one end ..... ***Patersonia rosea***

3b. Spathes dark brown to blackish; seeds lacking an aril, with a prominent pit at one end ..... ***Patersonia sericea* s.lat.***

* Further study of the infraspecific variation within *Patersonia sericea* is required, which is beyond the scope of this study.

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References

Baker WJ, Bailey P, Barber V, Barker A, Bellot S, Bishop D, Botigué LR, Brewer G, Carruthers T, Clarkson JJ, Cook J, Cowan RS, Dodsworth S, Epitawalage N, Françoso E, Gallego B, Johnson MG, Kim JT, Leempoel K, Maurin O, Mcginnie C, Pokorny L, Roy S, Stone M, Toledo E, Wickett NJ, Zuntini AR, Eiserhardt WL, Kersey PJ, Leitch IJ, Forest F (2022) A comprehensive phylogenomic platform for exploring the Angiosperm Tree of Life. *Systematic Biology* 71: 301–317. https://doi.org/10.1093/sysbio/syab035

Bell SAJ (2001) Notes on population size and habitat of the vulnerable *Cryptostylis hunteriana* Nicholls (Orchidaceae) from the Central Coast of New South Wales. *Cunninghamia* 7: 195–204.

Bell SAJ (2004) Distribution and habitat of the vulnerable tree species, *Angophora inopina* (Myrtaceae), on the Central Coast of New South Wales. *Cunninghamia* 8: 477–484.

Bell SAJ, Driscoll C (2016) *Vegetation Mapping Report* [Volume 1] *and Vegetation Community Profiles* [Volume 2], *Lake Macquarie Local Government Area*. Unpublished Report and Mapping to Lake Macquarie City Council. March 2016. Eastcoast Flora Survey. Available at: https://www.lakemac.com.au/Development/Planning-controls/Local-Planning-Controls#section-5

Bell SAJ (2019) *A Revised Interim Vegetation Classification of the Central Coast Local Government Area*. Unpublished Report and Mapping to Central Coast Council. July 2019. Eastcoast Flora Survey. Mapping available at: https://maps.centralcoast.nsw.gov.au/public/

Cooke DA (1986) Iridaceae. In: George, AS ed. *Flora of Australia*. Volume 46. Pp. 1–66. Canberra: Australian Government Publishing Service.

Goldblatt P, Manning JC, Munzinger J, Lowry, PP (2011) A new native family and new endemic species for the flora of New Caledonia: *Patersonia neocaledonica* sp. nov. (Iridaceae, Patersonioideae), from the Mount Humboldt massif. *Adansonia*, sér. 3, 33: 201–208. https://doi.org/10.5252/a2011n2a4

Goldblatt P (2012) Systematics of *Patersonia* (Iridaceae, Patersonioideae) in the Malesian Archipelago. *Annals of the Missouri Botanical Garden* 98: 514–523. https://doi.org/10.3417/2010070

Goldblatt P, Rodriguez A, Davies TJ, Manning JC, Powell MP, van der Bank M, Savolainen V (2008) Iridaceae 'Out of Australasia'? Phylogeny, biogeography, and divergence time based on plastid DNA sequences. *Systematic Botany* 33: 495–508. https://doi.org/10.1600/036364408785679806

Guindon S, Gascuel O (2003) A simple, fast, and accurate method to estimate large phylogenies by maximum likelihood. *Systematic Biology* 52: 696–704. https://doi.org/10.1080/10635150390235520

Jobson RW, Davies-Colley T (2020) Redescription of the suspended aquatic *Utricularia aurea* Lour. (sect. *Utricularia*) and a new species *U. adamsii* for northern Australia. *Telopea* 23: 21–33. https://doi.org/10.7751/telopea14301

Jobson RW, Baleeiro PC, Reut MS (2017) Molecular phylogeny of subgenus *Polypompholyx* (Utricularia; Lentibulariaceae) based on three plastid markers: diversification and proposal for a new section. *Australian Systematic Botany* 30: 259–278. https://doi.org/10.1071/SB17003

Jones DL (2001) Six new species and a new combination in *Genoplesium* R.Br. (Orchidaceae) from eastern Australia. *The Orchadian* 13: 293–307.

Keighery GJ (1990) *Patersonia spirafolia* (Iridaceae), a new species from south-western Australia. *Nuytsia* 7: 137–139. https://doi.org/10.58828/nuy00159

McDougall KL (2006) The responses of native Australian plant species to *Phytophthora cinnamomi*. Appendix 4. Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 2: 1–52. https://www.dcceew.gov.au/sites/default/files/documents/appendix4.doc

Posada D (2008) jModelTest: phylogenetic model averaging. *Molecular Biology and Evolution* 25: 1253–1256. https://doi.org/10.1093/molbev/msn083

Renner MAM, Towle BJ, Weston PH (2022) Two new species of *Genoplesium* R.Br. *sensu lato* (Orchidaceae: Prasophyllinae) from the Central Coast of New South Wales. *Telopea* 25: 285–299. https://dx.doi.org/10.7751/telopea15648

Shaw J, Shafer HL, Leonard OR, Kovach MJ, Schorr M, Morris AB (2005) The tortoise and the hare II: relative utility of 21 noncoding chloroplast DNA sequences for phylogenetic analysis. *American Journal of Botany* 92: 142–166. https://doi.org/10.3732/ajb.92.1.142

Stanford AM, Harden R, Parks CR (2000) Phylogeny and biogeography of *Juglans* (Juglandaceae) based on *matK* and ITS sequence data. *American Journal of Botany* 87: 872–882. https://doi.org/10.2307/2656895

Toelken HR (2013) Notes on *Hibbertia* subg. *Hemistemma* (Dilleniaceae) 9. The eastern Australian *H. vestita* group, including *H. pedunculata* and *H. serpyllifolia*. *Journal of the Adelaide Botanic Gardens* 26: 31–69.

White TJ, Bruns T, Lee S, Taylor JW (1990) Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In *PCR protocols: a guide to methods and applications*. (Eds MA Innis, DH Gelfand, JJ Sninsky, TJ White) pp. 315–322. (Academic Press, Inc.: New York, NY, USA)

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