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PICEA FARRERI, A NEW TEMPERATE CONIFER FROM UPPER BURMA

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ABSTRACT. A new species of temperate conifer *Picea farreri* Page & Rushforth (Pinaceae) is described from Upper Burma. The plant shows affinities with both *P. spinulosa* (Griffith) Henry and *P. brachytyla* (Franchet) Pritzel. Both herbarium and living material have been studied. Affinities and geography of the new species are discussed.

Divergent views have been expressed in the taxonomic treatment of Chinese conifers by different authors. Largely this is the result of the limitations of the material available in herbaria. Conifers are for the most part large, and in many cases very large, forest trees. Yet herbarium specimens are at best mere fragments, often the only material that could be reached, and not particularly typical of the whole tree. A second limitation is that much of the material which could be taxonomically compared (such as foliage and shoots, winter buds, cones, seed, bark and information on habit as well as ecology) is frequently lacking in herbaria, as is information on the variability of such features within a population. A third limitation is that herbarium preservation treatment has usually resulted in total dismemberment of leaves from shoots (especially in *Picea*; see Page, 1979), leaving little information about their original arrangement which is often characteristic of the plant in life.

These purely herbarium problems can become compounded by the biological ones. For not only are the Sino-Himalayan species of most conifer genera numerous and variable, they are spread over enormous geographical areas, which are topographically and climatically diverse. Most specimens available to the western taxonomist are those of scattered gatherings made along the routes of the main collectors, to whom conifers were generally of only marginal interest.

The consequences of these problems are that collectors have sometimes been impressed in the field by large differences between specimens, especially where these affect tree size, form, habit, and ecology, and have tended to establish segregate species incorporating such field evidence (e.g. the segregate species in *Picea* included in Sargent, 1916). By contrast, workers familiar with mainly herbarium material have tended to unite the same plants into a few highly polymorphic but more readily definable groupings, not always reflecting the real variation present in the field (e.g. Stapf, 1922). A satisfactory taxonomic treatment probably lies somewhere between these extremes. Wilson (1926, p. 48) commenting on the grouping by Stapf of all the Chinese spruces of the sect. *Omorika* Mayr. under *Picea brachytyla* Pritzel, stressed: 'As I know them in a wild condition these trees present many differences which are, I think, entitled to recognition. As our knowledge increases and the plants become properly known under cultivation it will be possible to critically revise the classification of the species of *Picea* native of China . . .'.

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Since Wilson's field collections, others (chiefly those of Forrest, Kingdon-Ward and Rock) have helped swell the amount of herbarium material available to taxonomy, and much of the Chinese conifer material introduced into the British Isles by these collectors as seed has succeeded somewhere, with the resultant trees now reaching reproductive maturity. In examining such living Chinese collections over the British Isles, as well as herbarium material, in an attempt to correlate living specimens with seed-number introductions (Page & Rushforth, in preparation), we have been impressed by differences exhibited by the cultivated specimens from different wild sources. In particular, the following specimen, which belongs within the Sino-Himalayan *Picea brachytyla–P. spinulosa* group, has impressed each of us as sufficiently distinct from the other members of this group to warrant taxonomic recognition as a separate species. This species is here described on the basis of the living tree, as well as examination of herbarium holdings at K, BM, and DD.

Picea farreri Page & Rushforth, **sp. nov.** (fig. 1, a–f).

Ic.: Rushforth, Quart. J. For. 73:13 (1979).

Arbor vertice lato aperto et ramulis ultimis perpendulis, habitu *P. spinulosa* similis sed foliis brevioribus magis complanatis subtus ut in *P. brachytyla* niveis differt.

Tree with broad open crown and highly pendulous ultimate branchlets closely resembling *P. spinulosa* in habit but with shorter more flattened leaves which are niveous-white below as in *P. brachytyla*.

Type. Upper Burma: Feng-Shui-Ling Valley, 1919, *Farrer* 1435 (holo. E, cones and seed only).

Other specimens. Upper Burma: Feng-Shui-Ling Pass Road, 3 miles from Pass, *Kermode* 17216 (DD & K). Cultivated tree from seed of *Farrer* 1435, Exbury, 12 xii 1945, *A. B. Jackson* s.n.(E); ibid., 20 ix 1977, *C. N. Page & K. D. Rushforth* s.n.(E); ibid., 3 v 1978, *K. D. Rushforth* s.n.(E).

A black-and-white photograph taken in the wild and deposited by Kermode as No. 1198 in the photographic section of the Forest Research Institute and Colleges, Dehra Dun, is of this species.

P. farreri can be characterised as follows.

Tree to 30 m or more. Crown broadly conical, of open habit. Branches spreading to slightly descending, slender. *All branchlets steeply descending; the ultimate markedly pendulous*. Bark grayish, scaly.

Shoots olive-brown to pale orange-brown, dull to scarcely shining, becoming paler tan or yellowish-brown and more shining by third year; sparsely pubescent in first year, becoming glabrescent in second year. Strong shoots with moderate ridges and grooves; weak shoots almost smooth in first year. Pulvinus of similar colour to shoot; slightly pubescent; less than 1 mm in height; curved forward. Hairs on both pulvinus and shoot similar; short, glandular, matching shoot in colour.

Foliage moderately sparse, with *leaves arranged almost all around shoots* (especially on all weaker shoots), becoming denser above and somewhat pectinate beneath only on stronger shoots. Leaves on all shoots distinctly forward pointing; on strong shoots the lateral ones mostly at

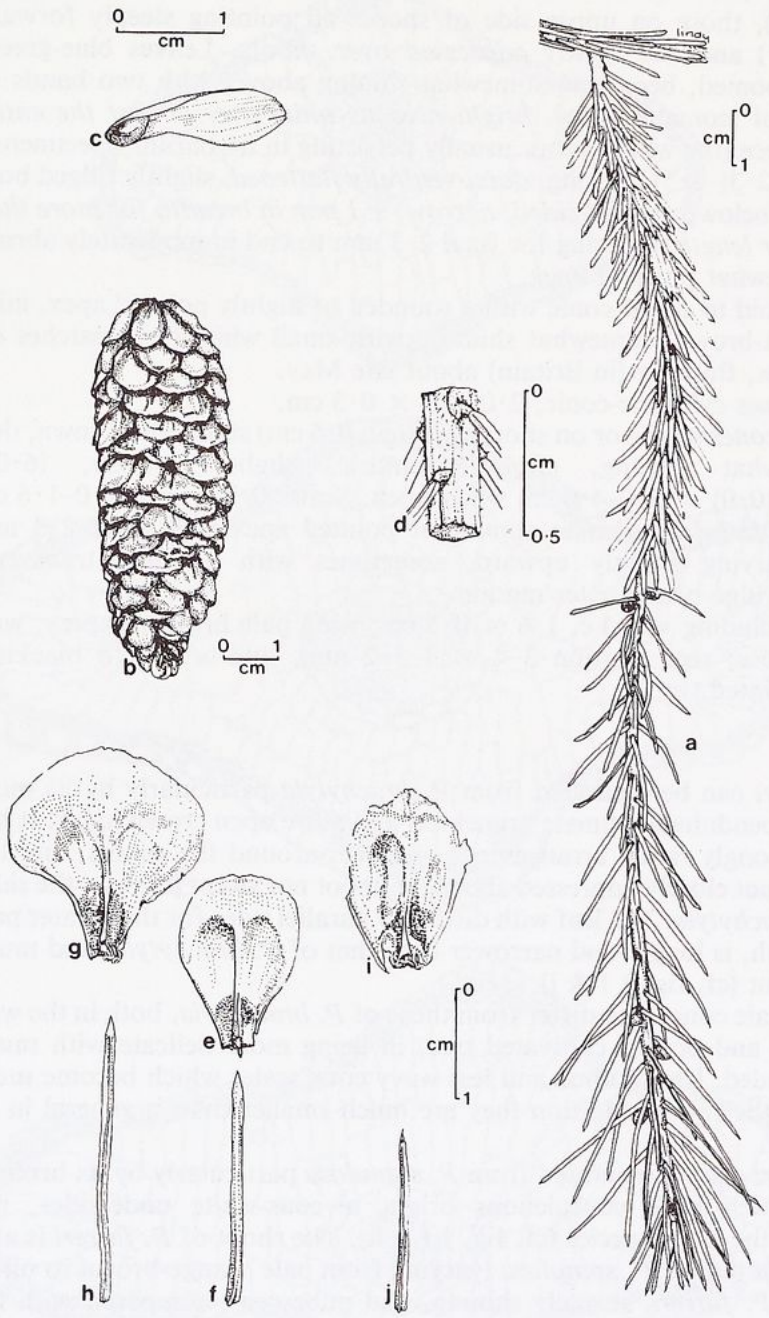

FIG. 1. a–d, *Picea farreri*: a, shoot showing arrangement of foliage (denser foliage above from drought year 1976, sparser foliage below from 1977); b, female cone; c, seed; d, detail of shoot. 1. e–j, comparison of cone scales and leaves of *P. spinulosa, P. farreri* and *P. brachytyla*: e & f, *P. farreri*; g & h, *P. spinulosa*; i & j, *P. brachytyla*. (a–f, cultiv. *Farrer* 1435; g–h, *Cave* s.n., Sikkim, 15 v 1915; i–j, *Wilson* 1282 & 2052, W Hupeh).

30°–60° to shoot (with individual leaves subtending buds spreading at nearly 80°), those on upper side of shoots all pointing steeply forward (about 20°) and *not tightly adpressed over shoots*. Leaves blue-green, slightly bloomed, becoming somewhat shining above, with two bands of 5–6 rows of stomata below, *bright niveous-white over almost the entire lower surface* (the white colour usually persisting in herbarium specimens), (1·5–)1·8–2·3(–2·5) cm long, *dorsi-ventrally flattened,* slightly ridged both above and below, *parallel-sided, narrow, ± 1 mm in breadth for more than 4/5 of their length,* tapering for final 2–3 mm to end in moderately abrupt acute somewhat pungent apex.

Buds ovoid to ovoid-conic with a rounded to slightly pointed apex, mid- to chestnut-brown, somewhat shining, with small white resin patches on lower scales, flushing (in Britain) about late May.

Male cones cylindric-conic, 2·0–2·5 × 0·3 cm.

Female cones sessile or on short (less than 0·5 cm) stalk, mid-brown, dull to somewhat shining, ellipsoid-cylindric, slightly woody, (6·0–) 7·0–9·5(–10·0) × 3·0–4·0 cm when open. Scales 0·8–1·2 × 1·0–1·6 cm with *irregularly rounded* to somewhat pointed apex, the outer 2–3 mm usually curving slightly upward, sometimes with a small transverse thickened ridge below outer margin.

Seed (including wing) c. 1·6 × 0·5 cm; wing pale brown, papery, with margin erose; seed portion 3–4 × 1·5–2 mm, mid-brown to blackish-brown, pointed.

P. farreri can be separated from *P. brachytyla* particularly by its more markedly pendulous ultimate branchlets and more open crown habit. It has a more strongly radial arrangement of leaves around the shoots, and the leaves are not closely adpressed above the shoot nor swept down at the sides as in *P. brachytyla*. The leaf with distinctly parallel sides for the greater part of its length, is longer and narrower than that of *P. brachytyla*, and much less pungent (cf. fig. 1 f & j).

The female cones also differ from those of *P. brachytyla,* both in the wild gatherings and on the cultivated tree, in being more delicate with much more rounded, less toothed and less wavy cone scales which become more woody at the tip; in addition they are much smaller than is general in *P. brachytyla*.

P. farreri can be separated from *P. spinulosa* particularly by its broader leaves, which have conspicuous bright niveous-white undersides, not present in the latter species (cf. fig. 1 f & h). The shoot of *P. farreri* is also darker than that of *P. spinulosa* (varying from pale orange-brown to olive-brown in *P. farreri*, scarcely shining, and pubescent; compared with the very pale, shining and usually glabrous shoot of *P. spinulosa*). *P. farreri* also has a sessile pulvinus to each leaf, rather than the long slender pulvinus of *P. spinulosa*. In addition the leaf section of *P. farreri* is less quadrangular than that of *P. spinulosa* and paired resin canals are present in most sections, contrasting with those of the latter species where these canals usually stop short and are consequently absent from most sections (fig. 2 A-C).

We have named the new species in honour of its original collector.

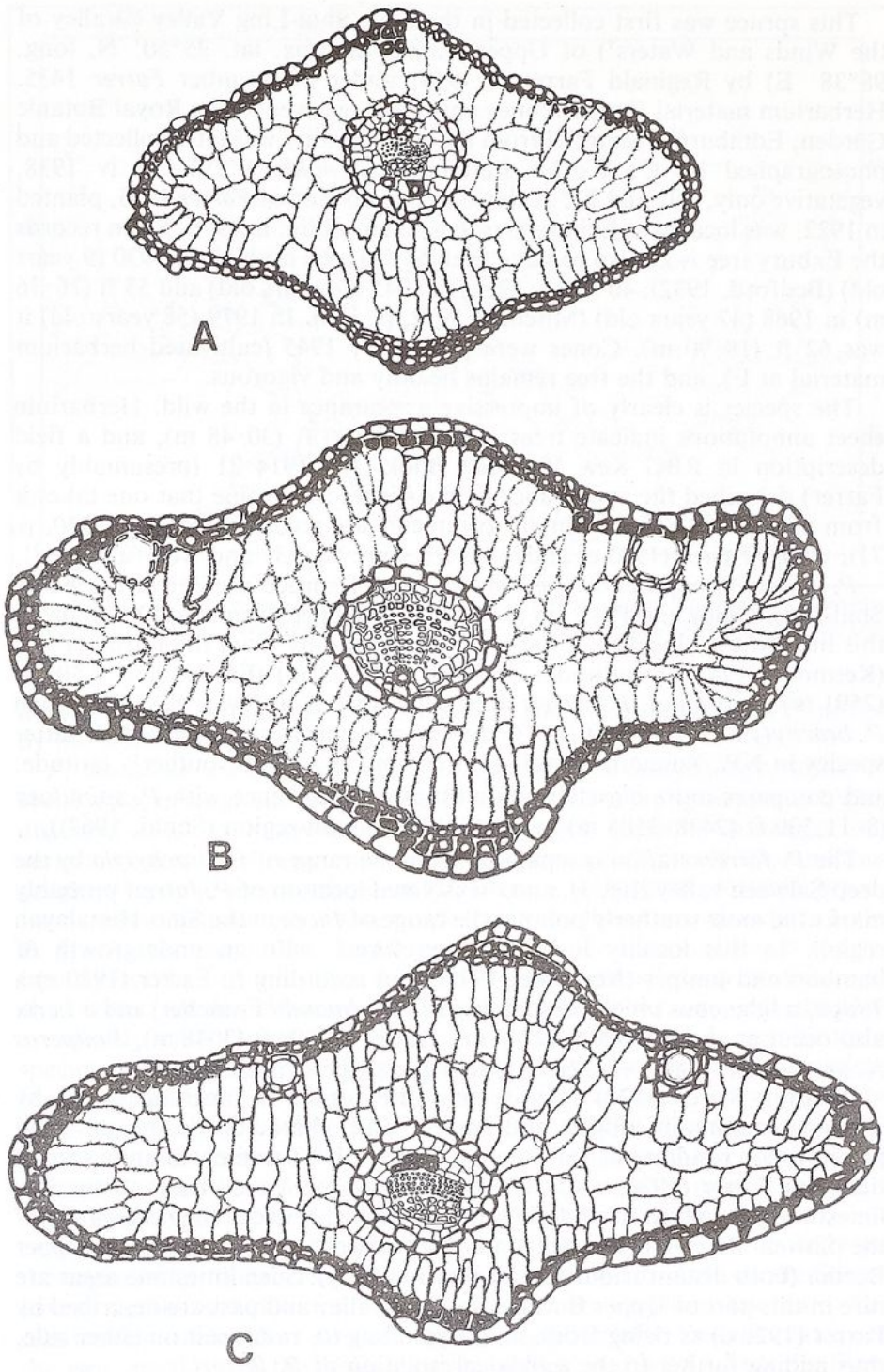

FIG. 2. T.S. of leaves: A, *Picea spinulosa*; B, *P. farreri*; C, *P. brachytyla* showing relative differences in size and shape (all × 110), abaxial (green surface) uppermost.

This spruce was first collected in the Feng-Shui-Ling Valley ('Valley of the Winds and Waters') of Upper Burma (approx. lat. 25°50′ N, long. 98°38′ E) by Reginald Farrer in 1919, under the number *Farrer* 1435. Herbarium material (female cones only) was received at the Royal Botanic Garden, Edinburgh. Material from the same locality was later collected and photographed by C. W. D. Kermode (*Kermode* 17216, 23 iv 1938, vegetative only, DD and K). A single tree from seed of *Farrer* 1435, planted in 1922, was located at Exbury Gardens, Hampshire, in 1976. From records the Exbury tree is known to have been $5\frac{1}{2}$ ft (1·68 m) high in 1930 (9 years old) (Bedford, 1932), 40 ft (12·19 m) in 1945 (24 years old) and 55 ft (16·76 m) in 1968 (47 years old) (Mitchell, 1972, p. 182). In 1979 (58 years old) it was 62 ft (18·90 m). Cones were present by 1945 (cultivated herbarium material at E), and the tree remains healthy and vigorous.

The species is clearly of impressive appearance in the wild. Herbarium sheet annotations indicate trees reach over 100 ft (30·48 m), and a field description in RBG Kew 'Inwards Book' for 1914–21 (presumably by Farrer) described the appearance of the spruce as 'so fine that one takes it from afar to be a pine'. Similar comments are recorded by Cox (1930, p. 71), whilst Farrer (1920 e) adds that trees are 'stately and well furnished'.

P. farreri is apparently the only species of spruce present in the Feng-Shui-Ling Valley and Pass, on the Border of Upper Burma and Yunnan. In this little-known locality, it has been recorded only from the Burmese side (Kermode, 1945), at altitudes of 8,000 ft (2438 m) (Farrer) and 8,500 ft (2591 m) (Kermode). *P. farreri* is clearly a species of lower elevations than *P. brachytyla* (9–12,000 ft (2743–3658 m) at the nearest stations of the latter species in NW Yunnan) as well as occurring at a more southerly latitude, and compares more closely in its altitudinal occurrence with *P. spinulosa* (8–11,500 ft (2438–3505 m) in the Sikkim-Bhutan region (Sanhi, 1962)).

The *P. farreri* station is separated from the range of *P. brachytyla* by the deep Salween valley (fig. 3), and the isolated location of *P. farreri* probably marks the most southerly point in the range of *Picea* in the Sino-Himalayan region. In this locality it forms open forest, with an undergrowth of bamboo and juniper (Kermode, 1945), and according to Farrer (1920 e) a *Tsuga,* a 'glaucous pine' (presumably *Pinus armandii* Franchet) and a *Larix* also occur at about 9,000 ft (2743 m). Above 10,000 ft (3048 m), *Juniperus recurva* Buch.-Ham. var. *coxii* (Jacks.) Melville is present.

Kingdon-Ward (1920) records that the region is much dissected by streams, mountain ridges and spurs, and characteristic heavy local precipitation resulting in heavy epiphytic growth is commented upon several times by Farrer (1920, a–c). The Feng-Shui-Ling Valley leads to the low limestone pass which itself defines the watershed between the headwaters of the Shweli River of Yunnan and the Ngawchang-Hka River of Upper Burma (both distant tributaries of the Irawaddy). Such limestone areas are rare in this part of Upper Burma. Both the valley and pass are described by Farrer (1920 d) as rising from, and descending to, rainforest on either side, thus adding further to the ecological isolation of *P. farreri.*

Closest affinities of *P. farreri* are clearly almost equally with *P. brachytyla* and *P. spinulosa.* Of these, *P. brachytyla* is geographically nearer, with stations occurring along the Mekong-Salween divide and eastwards. By contrast, *P. spinulosa* of Sikkim, Bhutan and Assam, occurs

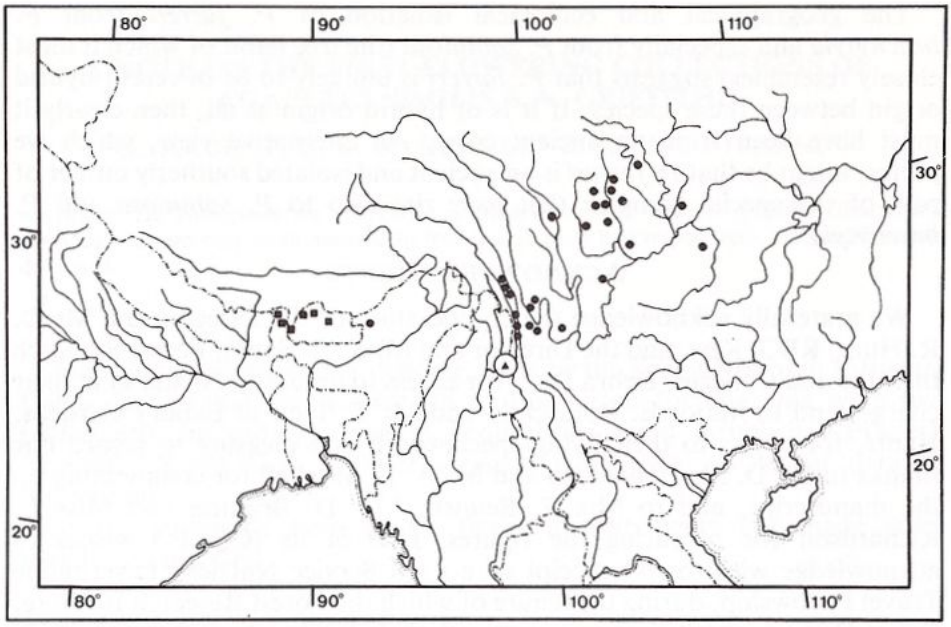

FIG. 3. Map of the known distribution of *Picea farreri* (encircled triangle), *P. spinulosa* (squares) and *P. brachytyla* aggregate (spots), compiled from herbarium material at BM, DD, E & K.

no nearer than several hundred kilometres, and is separated from *P. farreri* by the low broad Assam Valley (fig. 3).

P. spinulosa is a relatively constant species in its morphology, whilst *P. brachytyla,* throughout its much wider range, over a topographically highly dissected area, is morphologically much more variable. Amongst this variation, most specimens from along the Mekong-Salween divide (and thus geographically nearest to those of *P. farreri*, e.g. *F* 19788, *F* 19966, E) are from trees of considerably more pendulous habit than those elsewhere in the *P. brachytyla* range. But the leaves of these specimens are much shorter (mostly less than 15 mm) than those of *P. farreri* (mostly over 20 mm), and their cones, which are much larger with coarsely toothed,wavy-edged scales, are clearly of *P. brachytyla* type. For these reasons, we exclude these specimens from *P. farreri. Forrest* 24828 (E) from the western slopes of the Hpimaw Pass on the Salween-Nmai Hka divide (about 20 km north of the Feng-Shui-Ling) and *KW* 10411 (K) and *KW* 19270 (BM), from the Lohit Valley on the Assam-Tibet border may be *P. farreri,* but we have no information on their cones to confirm this—the species may thus have a range extending further northwards than the present records indicate.

Phytogeographically, Kingdon-Ward (1920) comments particularly on the region of occurrence of *P. farreri,* near the headwaters of the Shweli River, as 'remarkable for the number of its endemic species'. The relationships of the flora are described as partly with the Yunnan plateau to the east, partly with the Indo-Malayan region, and partly with the Sino-Himalayan flora to the north, forming a transition zone between these regions. The endemism of *P. farreri* in this area and its affinities with *P. spinulosa* of the Sikkim-Bhutan Himalayas and *P. brachytyla* of Assam, Yunnan, Szechuan and W Hupeh undoubtedly fit this pattern closely.

The geographical and ecological isolation of *P. farreri* from *P. brachytyla* and especially from *P. spinulosa* (the tree habit of which it most closely resembles) suggests that *P. farreri* is unlikely to be of recent hybrid origin between these species. If it is of hybrid origin at all, then clearly it must have been from an ancient cross. An alternative view, which we prefer, might be that *P. farreri* is an ancient and isolated southerly outlier of part of the species complex that gave rise also to *P. spinulosa* and *P. brachytyla*.

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