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RESEARCH ARTICLE

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Piper (*Piperaceae*) in the Solomon Islands: the climbing species

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Key words

Piper
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Abstract Eleven climbing species of *Piper* in the Solomon Islands are recognized: *P. abbreviatum*, *P. betle*, *P. bosnicanum*, *P. caninum*, *P. celtidiforme*, *P. fragile*, *P. insectifugum* (syn. *P. austrocaledonicum*), *P. interruptum*, *P. macropiper*, *P. majusculum*, and, as the only endemic, *P. sclerophloeum*, for which a description is provided.

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INTRODUCTION

To judge from the label notes of the specimens this study is based on, most of the climbing pipers of the Solomon Islands are quite common in that region's primary and secondary forests. Rather few of these specimens, however, have been correctly identified by their collectors. The responsibility for this would again seem to lie mainly with *Piper* specialist Casimir de Candolle (cf. Gardner 2006), who simply named as new the bulk of the material that reached him from eastern Malesia in the early 1900s, without making critical comparisons with better-known taxa from island-groups to the west. In this review I retain endemic status for just one of the taxa he named from the Solomons, *P. sclerophloeum* C.DC. (De Candolle 1914).

I have not seen types of the following eight names De Candolle proposed in that work: *P. acutamentum*, *P. betle* var. *bukanum*, *P. erectum*, *P. erythrostachyum*, *P. fragile* var. *magnifolium*, *P. globulantherum*, *P. miniatum* var. *glabrum*, and *P. pubirache*. But because of the fair number of specimens seen by me and also by Chew (1972, 2003) I think it unlikely that any of these names will represent a taxon additional to those of this review.

The Solomon Islands are taken here to include Bougainville and Buka, and the Santa Cruz Is., but not the Banks Is., which are now part of the nation of Vanuatu.

METHODS

The study is based primarily on an examination of specimens from AK, B, BISH, BRI, CANB and K. Much of this material was determined by W.-L. Chew in the 1970s. The Solomon Islands Forestry Herbarium (BSIP) is currently held in safe storage at SUVA but on a visit there in 2006 I was able to locate only some of the BSIP *Piper* folders.

CHARACTERS AND IDENTIFICATION

As elsewhere in Malesia (Gardner 2003, 2006) the most easily appreciated diagnostic characters in the genus are found in the nervation of the leaves and in the infructescence (Fig. 1–3).

The following synopses and notes in the list of species further below, are directed principally towards the identification of dried Solomon Islands material.

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SYNOPSIS

A. Fruitlets largely concrescent with one another . . . . . *P. abbreviatum*, *betle*, *fragile*, *majusculum*
AA. Fruitlets free from one another at least in their upper two-thirds
B. Fruitlets subglobose, sometimes slightly sunk into rachis and fused with it . . . . . *P. insectifugum*
BB. Fruitlets ellipsoid to ovoid, free from rachis and from one another, sessile or stalked, relatively large . . . . . *P. bosnicanum*, *caninum*, *interruptum*
BBB. Fruitlets ellipsoid, free from rachis and from one another, sessile, crowded, relatively small . . . . . *P. celtidiforme*, *macropiper*, *sclerophloeum*

STIGMA CHARACTERS

A. Stigmas sessile, persistent
B. Stigmas 3–4(–6), narrowly ovoid, together (when straightened) 0.8–1 mm diam . . . . . *P. betle*, *bosnicanum*, *caninum*, *interruptum*
BB. Stigmas 3(–5), ellipsoid to ovoid, together not greater than 0.5 mm diam . . . . . *P. macropiper*, *majusculum*
BBB. Stigmas 3(–5), ellipsoid to ovoid, together c. 0.5–0.8 mm diam . . . . . *P. abbreviatum*, *fragile*, *insectifugum*
AA. Stigmas sessile, very fragile, 3(–6?), very narrowly ellipsoid, together c. 0.8 mm diam . . . . . *P. celtidiforme*
AAA. Stigmas on a columnar style to c. 1 mm long, persistent, 2(–4), broadly ellipsoid, together c. 0.8 mm diam . . . . . *P. sclerophloeum*

1. *Piper abbreviatum* Opiz — Fig. 1a

Piper abbreviatum Opiz (1828) 157; Quisumb. (1930) 59, pl. 20; Chew (1972) 1; (2003) 14; R.O.Gardner (2006) 579. — Type: *Haenke s.n.* (holo PR n.v.), Luzon.

Distribution — Philippine Islands east to the Solomon Islands.

Habitat & Ecology — In forest, to c. 800 m (Bougainville). Chew (1972) cited five collections of *P. abbreviatum* from Bougainville. In addition, *RSS 193* (Guadalcanal, c. 450 m), which Chew (1972) referred to *P. fragile*, seems to me more likely to be *P. abbreviatum*, but its spikes are too immature for certainty.

Fig. 1 *Piper* species. Fertile-shoot leaves and inflorescences/infructescences. — a. *P. abbreviatum* Opiz. Leaf and fruiting spike. – b. *P. betle* L. Leaf and male inflorescence. – c. *P. betle* L. Leaf and infructescence. – d. *P. caninum* Blume Leaf and infructescence. – e. *P. fragile* Benth. Leaf and infructescence. – f. *P. insectifugum* Seem. Leaf and infructescence. – g. *P. insectifugum* Seem. Leaf and male inflorescence. – h. *P. insectifugum* Seem. Leaf. – i. *P. majusculum* Blume. Leaf and (proximal 2/3 of) infructescence. – j. *P. macropiper* Pennant. Leaf and infructescence. – k. *P.* ? *lessertianum* (Miq.) C.DC. Leaf and infructescence (a: *Schodde & Craven 3771*, K; b: *BSIP 7980*, K; c: *ROG 7428*, AK; d: *BSIP 8106*, K; e: *BSIP 7919*, K; f: *BSIP 12247*, K; g: *BSIP 15401*, K; h: *RSS 2582*, K; i: *BSIP 7259*, K; j: *Craven & Schodde 246*, K; k: *BSIP 14829*, K). Scale bar: Fertile-shoot leaves = 5 cm (but 2.5 cm for a); inflorescences/infructescences = 2.5 cm (but 5 cm for k).

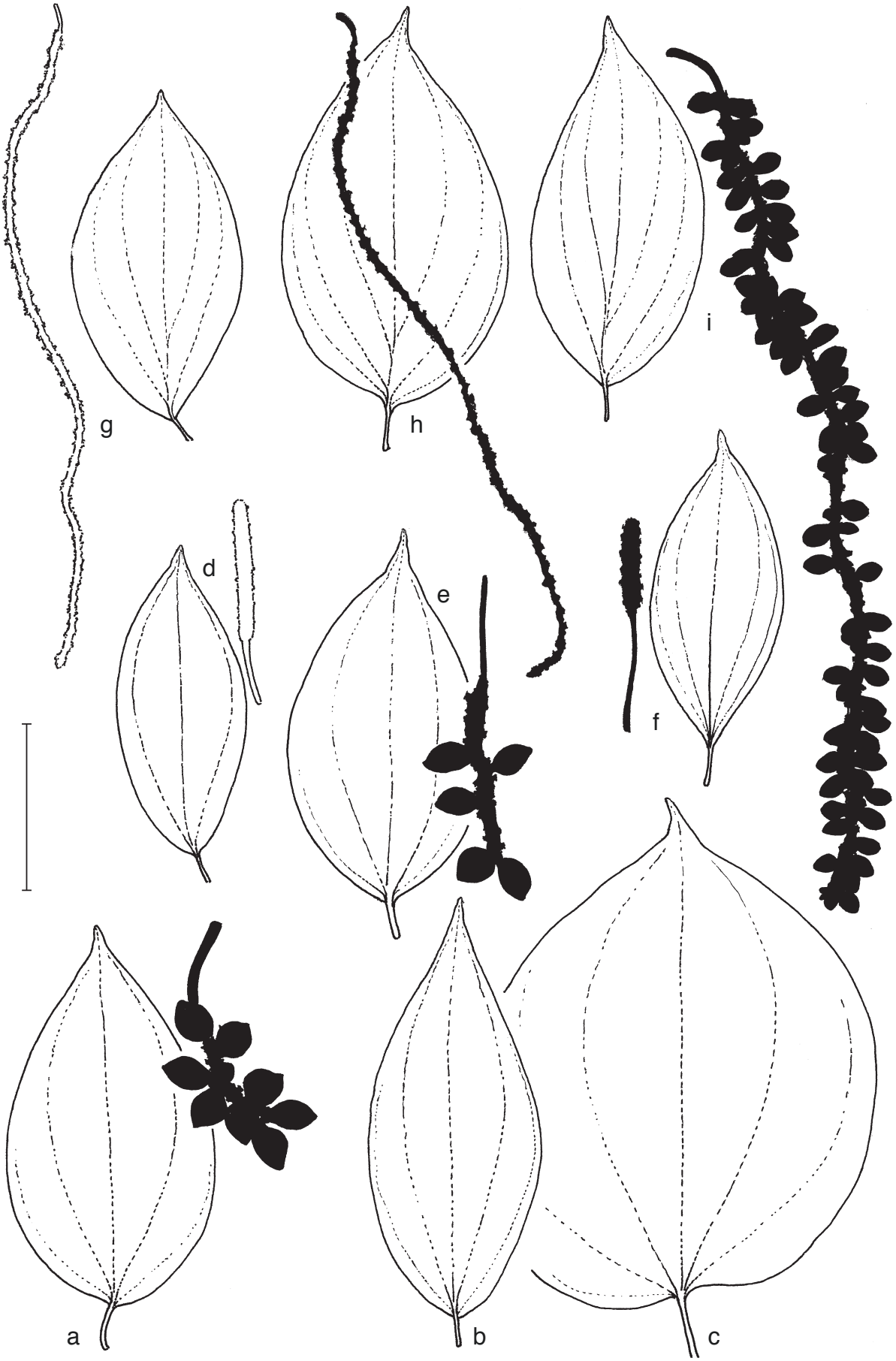

Fig. 2 *Piper* species. Fertile-shoot leaves and inflorescences/infructescences. — a. *P. bosnicanum* C.DC. Leaf and infructescence. – b. *P. bosnicanum* C.DC. Leaf. – c. *P. bosnicanum* C.DC. Leaf. – d. *P. bosnicanum* C.DC. Leaf and female inflorescence. – e. *P. bosnicanum* C.DC. Leaf and infructescence. – f. *P. bosnicanum* C.DC. Leaf and male inflorescence. – g. *P. interruptum* Opiz. Leaf and male inflorescence. – h. *P. interruptum* Opiz. Leaf and female inflorescence. – i. *P. interruptum* Opiz. Leaf and infructescence (a: *BSIP 2018*, K; b: *BSIP 15920*, K; c: *BSIP 2492*, K; d: *BSIP 4104*, K; e: *Schodde & Craven 3926*, L; f: *BSIP 16115*, K; g: *Waterhouse 66*, K; h: *Craven & Schodde 451*, K; i: *Craven & Schodde 3925*, K). Scale bar: Fertile-shoot leaves = 5 cm; inflorescences/infructescences = 2.5 cm.

Fig. 3 *Piper* species. Fertile-shoot leaves and inflorescences/infructescences. — a. *P. celtidiforme* Opiz. Leaf and infructescence. – b. *P. celtidiforme* Opiz. Leaves and male inflorescence. – c. *P. celtidiforme* Opiz. Leaf. – d. *P. sclerophloeum* C.DC. Leaf and female inflorescence, and infructescence. – e. *P. sclerophloeum* C.DC. Leaf and male inflorescence (a: *BSIP 18120*, K; b: *BSIP 4945*, K; c: *BSIP 6628*, K; d: female inflorescence = *BSIP 12116*, K, infructescence = *BSIP 3917*, K; e: *BSIP 16795*, K). Scale bar: Fertile-shoot leaves = 5 cm; inflorescences/infructescences = 2.5 cm.

Notes — Recognized by its small, usually symmetrical-based, acuminate leaves, and especially by the stubby fruiting spikes on relatively long peduncles.

Australian plants of this affinity have been described by Spokes (2007: 234, 457) as a new species, *P. fungiforme* Spokes. Its fruits are illustrated from life in Cooper (1994), under the name "*Piper* sp. Leo Creek".

Quisumbing (1930: 62, f. 25) emphasized the umbonate nature of the fruitlets of *P. abbreviatum*. This is not because the flower has a well-developed and persistent style, but because the apex of the fruitlet sometimes stands unswollen above the general level of fusion, and narrows on drying.

2. *Piper betle* L. — Fig. 1b, c

Piper betle L. (1753) 28; Quisumb. (1930) 85; R.O.Gardner (2006) 579. — Type: *Herb. Hermann 3: 32*, *4: 9* (BM n.v.).

Distribution — Widely cultivated in Asia and through Malesia to the Solomon Islands and Fiji.

Habitat & Ecology — In gardens, old clearings and forest, to c. 75 m at least. I have seen collections from Bougainville, Shortland Is., Treasury Is., New Georgia, Santa Isabel, Malaita, Guadalcanal and Bellona.

Notes — The brown rather than grey to black colour of the leaves will help distinguish vegetative material of *P. betle* from *P. caninum*, but their nervation is nearly identical. If longer hairs are present (as in *Waterhouse 192*, K) they are relatively flexuose compared to the bristly ones of *P. caninum.*

Most of the fertile Solomon Islands specimens I have seen are bisexual, but their labels do not say whether they were taken from wild or cultivated plants.

A collection from the Shortland Islands (*Guppy 134* , K) has the information: "Kolu ... Leaf chewed with betel-nut. Grown commonly throughout the group around the trunks of trees. In [Makira] and the eastern islands of the group, the leaves only are chewed, but the natives of the islands of Bougainville and [Shortland I. ?] prefer the fruits".

3. *Piper bosnicanum* C.DC. — Fig. 2a–f, 5a

Piper bosnicanum C.DC. (1917) 207; Chew (2003) 17. — Type: *Gibbs 6277* (holo K; iso L n.v.), New Guinea, Schouten Islands.

Distribution — New Guinea, Solomon Islands.

Habitat & Ecology — In forest, to c. 150 m (Bougainville). Chew (2003) cited specimens from Bougainville, New Georgia Group (Roviana Lagoon), Kolombangara, Wagina Is., Malaita and Guadalcanal. In addition I have seen specimens from Santa Isabel, Maramasike, Ngamanie Is., Tetepari Is. and Santa Ana.

Notes — The leaves of *P. bosnicanum* resemble those of *P. interruptum* in their dark grey colour and large silvery white gland-dots, but are generally slightly larger and firmer in texture, and always lack a suprabasal pair of nerves. The short female inflorescence of *P. bosnicanum* (spike c. 3 cm long, on a peduncle 1.5 cm long), with large, ovoid, slightly ridged sessile fruitlets, is distinctive.

I have seen only three male collections of *P. bosnicanum* (*BSIP 3068*, *5493*, *16115*). The mature inflorescences consist of spikes 1.5–3 cm long and 2–3 mm diam on peduncles 0.6–1 cm long. The bract-heads are sessile, c. 1.2 by 1 mm, and tend to be elongate across the axis of the spike rather than along it as in *P. interruptum*. The stamens are solitary, an unusual feature in the genus. The anthers, 0.5 mm diam, are shortly exserted at anthesis and tend to dehisce laterally.

Chew (2003) has suggested that *P. buruanum* Miq. of Maluku (Moluccas) might be identical. I have not seen any material so-named.

4. *Piper caninum* Blume — Fig. 1d, 4a

Piper caninum Blume (1826) 214; Quisumb. (1930) 120; Chew (1972) 5; R.O.Gardner (2006) 580; Spokes (2007) 239. — Type: *Blume s.n.* (holo L n.v.), Java.

Piper kietanum C.DC. (1914) 527, t. 4; Chew (1972) 5. — Type: *Rechinger 4797* (holo W n.v.), Bougainville, 1905.

Distribution — Western Malesia to the Solomon Islands, and also Australia.

Habitat & Ecology — In forest, to almost 500 m (Guadalcanal). Chew (1972) cited material from Bougainville, New Georgia, Guadalcanal and Makira (San Cristobal). In addition I have seen material from Petato Is. (near Buka), Shortland Is., Treasury Is., Choiseul, Ranonnga, Kolombangara, Santa Isabel and Maramasike.

Notes — Recognized vegetatively by its greyish to olive colour, and by the almost invariable presence of slender but rather bristly hairs (to c. 1 mm long) on the blade below and also often above at least on the midrib and nerves.

Narrow-leaved forms of *P. caninum* are much less frequent in the Solomons than in the Philippines (Gardner 2006). One such collection (Bougainville, *Kajewski 1977* , K), with blades 3 cm wide, was determined by Chew as *P. pubirhache* C.DC., a name he did not include (Chew 1972) in his synonymy of *P. caninum.*

The fruits are illustrated from life in Cooper (1994).

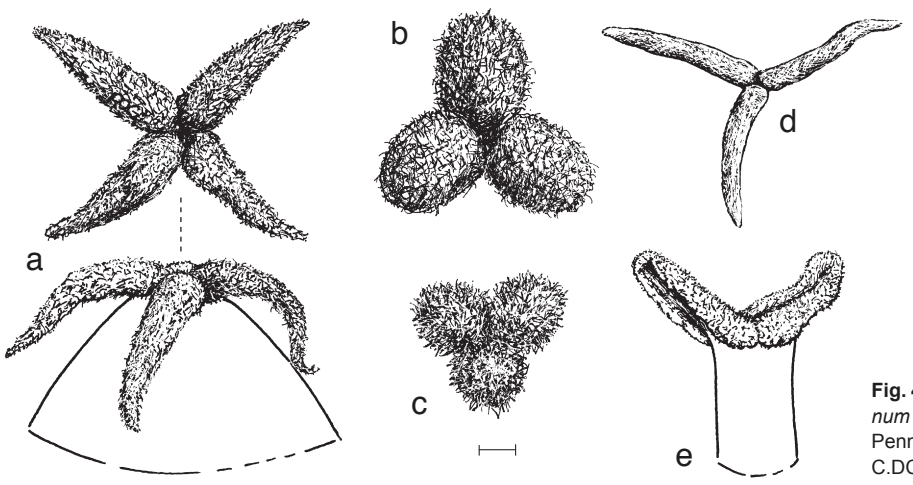

Fig. 4 Stigmas of *Piper* species. Idealized. — a. *P. caninum* Blume. – b. *P. insectifugum* Seem. – c. *P. macropiper* Pennant. – d. *P. celtidiforme* Opiz. – e. *P. sclerophloeum* C.DC. Scale bar = 0.1 mm.

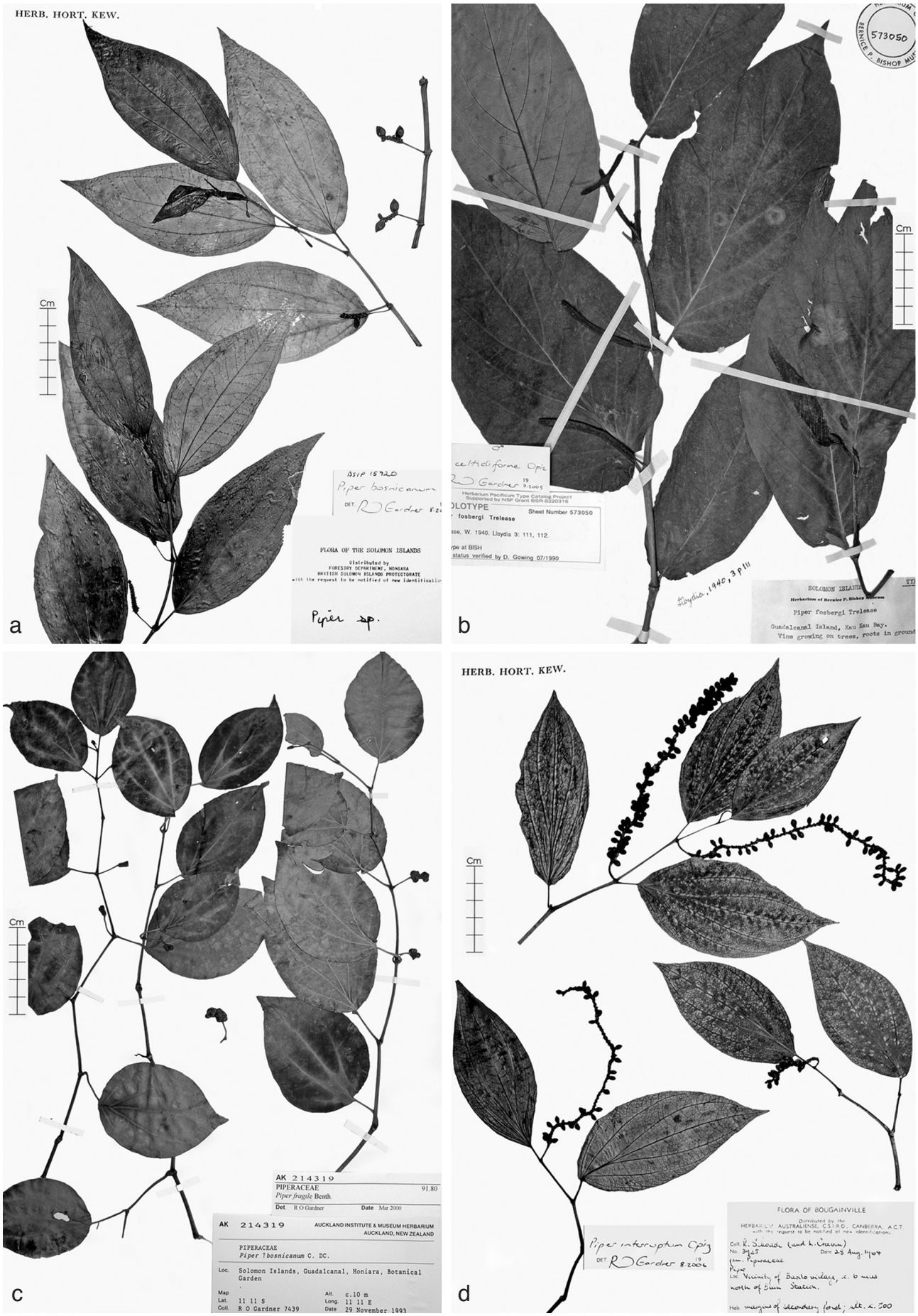

Fig. 5 Specimens of *Piper* species. — a. *P. bosnicanum* C.DC. – b. *P. celtidiforme* Opiz. – c. *P. fragile* Benth. – d. *P. interruptum* Opiz (a: *BSIP 15920*, K; b: *Stewart*, BISH 573050; c: *Gardner 7439*, AK; d: *Schodde & Craven 3925*, K).

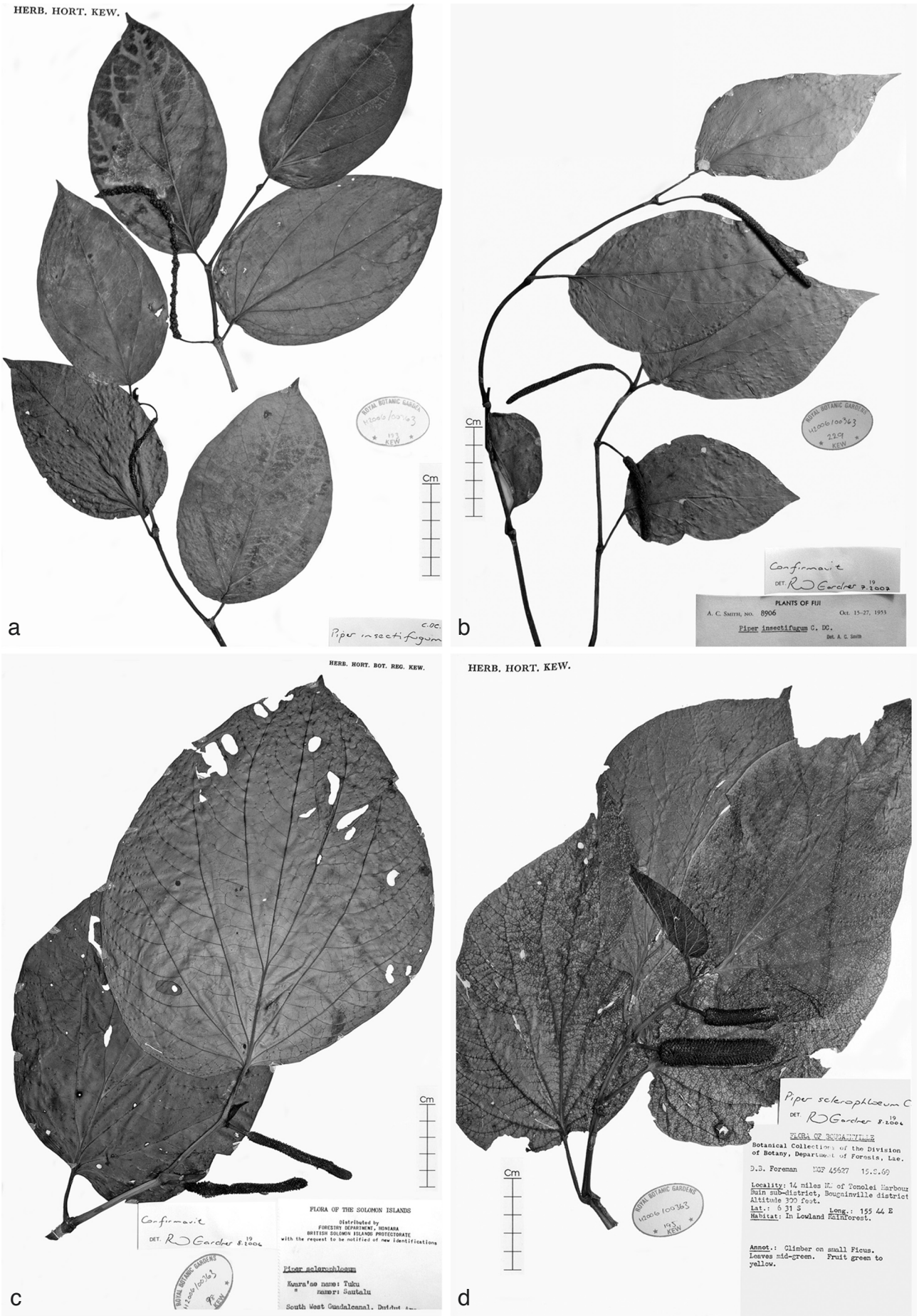

Fig. 6 Specimens of *Piper* species. — a. *P. insectifugum* Seem. (Solomon Is.). – b. *P. insectifugum* Seem. (Fiji). – c. *P. sclerophloeum* C.DC., flowering. – d. *P. sclerophloeum* C.DC., fruiting (a: *RSS 2582*; b: *Smith 8906*; c: *BSIP 12116*; d: *NGF 45627*; all K).

5. *Piper celtidiforme* Opiz — Fig. 3a–c, 4d, 5b

Piper celtidiforme Opiz (1828) 152; Quisumb. (1930) 177, pl. 22; R.O.Gardner (2006) 580. — Type: *Haenke s.n.* (holo PR n.v.), Luzon.
Piper fosbergii ('*fosbergi*') Trel. (1940) 111, pl. 1, *syn. nov.* — Type: *Stewart s.n.* (holo BISH 573050), Solomon Islands, Guadalcanal, Kau Kau Bay, 22 May 1933.

Distribution — Philippines, New Guinea, Solomon Islands.

Habitat & Ecology — In forest to c. 300 m (Guadalcanal). I have seen material of this species from Bougainville, New Georgia, Santa Isabel, Guadalcanal, Ulawa, San Christobal, Santa Catalina, Ririo and Santa Ana.

Notes — Vegetative material of *P. celtidiforme* might be misidentified as *P. majusculum* or *P. sclerophloeum*, but the leaves on its fertile shoots are seldom more than 10 cm wide and have a truncate, unequal base, the two sides of the blade being offset by several millimetres. The species is recognized especially by its unique floral morphology (Quisumbing 1930, Gardner 2006): the connective of the anther is swollen apically, and the stigmas are fragile slender structures.

Peekel (1984: 129) used the name *Piper singkojan* C.DC. ('*Piper singkojang*') for what he said was the most common species of pepper in the Bismarck Archipelago. He noted it had erect red fruiting spikes to 8 cm long, and that "where the plants find little support, the stems and branches spread widely over the ground ... ". These and other features of Peekel's description suggest his plant might be *P. celtidiforme.* Unfortunately, a recent loan from B failed to contain any relevant material.

Since *P. celtidiforme* is mostly described as a bushy low-sprawling climber, the label note on *BSIP 6628*, "climber reaching 100' above ground", is probably incorrect.

6. *Piper fragile* Benth. — Fig. 1e, 5c

Piper fragile Benth. (1843) 234; Quisumb. (1930) 99; Chew (1972) 7; Peekel (1984) 203; Fosberg & Sachet (1975) 19; R.O.Gardner (2006) 581. — Type: *Hinds s.n.* (K n.v.), New Guinea.

Distribution — Philippines east to Micronesia and Vanuatu.

Habitat & Ecology — In forest, usually near the shore, often on limestone, to at least 30 m. Chew (1972) cited material from Bougainville and Guadalcanal. In addition I have seen a collection from Mono Is. (= Treasury Is.).

Notes — In the Bismarck Archipelago Peekel (1984) described *P. fragile* as being "frequent on tree-trunks and on coral rocks behind beaches", while for Micronesia it is said to be known not just from the larger islands but from many of the atolls too (Fosberg & Sachet 1975). The label of *BSIP 14174* states that it may grow to c. 25 m above the ground and reach a diameter of c. 5 cm.

As a basis for extending the recorded distribution (Chew 1972) east to Vanuatu, a collection from the Banks Is. can be noted: *Curry 1379*, K, Loh I., in disturbed bush close to sea.

The relatively firm, glabrous and non-glandular nature of the leaf blades, and their more strictly basal nervation, distinguish vegetative material from that of *P. abbreviatum*. The characteristic peltate leaves are only found on juveniles and on the sterile (orthotropic) shoots of adults.

7. *Piper insectifugum* C.DC. ex Seem. — Fig. 1f–h, 4b, 6a, b

Piper insectifugum C.DC. ex Seem. (1868) 262; C.DC. (1869) 354; Smith (1981) 61. — Type: *Seemann 569* (BM, GH, K), Viti Levu, 1860.
Piper austrocaledonicum C.DC. (1869) 346; Chew (2003) 16, *syn. nov*. — Syntypes: *Forster s.n.* (BM n.v.), New Caledonia; *Vieillard 1227* (GH n.v., P), New Caledonia.
Piper peekelii C.DC. (1922) 354; Peekel (1984) 129; Chew (2003) 16. — Type: *Peekel 322* (holo B), Neu-Mecklenburg [New Ireland].

Distribution — New Guinea to Vanuatu, also New Caledonia, Fiji and Samoa.

Habitat & Ecology — In forest, from near the shore to c. 275 m (Guadalcanal). I have seen no material from Bougainville, and only one collection from each of Kolombangara, Santa Isabel, Guadalcanal, Small Nggela (Florida Is.) and Malaita.

Notes — The leaves of *P. insectifugum* are firmly chartaceous and tend to dry brownish and slightly glossy, and in the Solomons are always conspicuously red-glandular. The fruitlets (c. 2.5 mm diam) retain their sessile, plumose-papillose stigmas and may be slightly sunken into (and fused with?) the fleshy outer part of the rachis. The male inflorescence is typically c. 15–20 cm long and c. 2 mm diam at anthesis (though some material from New Caledonia reaches 6 mm diam). A similarly slender male inflorescence is also found in *P. macropiper*, but the anthers of this species are smaller (0.25 mm diam vs 0.4 mm) and shed their pollen from just below the level of the bract-heads rather than being distinctly exserted.

As a basis for including Vanuatu in the distribution of *P. insectifugum* three collections (K) from Erromanga can be noted: *Curry 620*; *RSNH137*, *RSNH153*. Presumably the species is also present in the Santa Cruz and Banks Is., but I have not seen any collections.

In Fiji, *Piper insectifugum* was noted by Smith (1981) as being the most common of the four native climbing pipers he recognized in that archipelago. On the basis of specimens identified by him (K!) I think it likely that the other three taxa of his treatment, *P. crispatum* A.C.Sm. *P. degeneri* A.C.Sm. and *P. stipulare* A.C.Sm., also represent *P. insectifugum*.

In Samoa, two collections from higher altitudes on the island of Upolu (*Whistler 793* & *7014*; K!) belong to *P. insectifugum*. However, most Samoan material represents the far eastern end of the distribution of *P. macropiper* – see Notes under that species.

With only the type collections of *P. austrocaledonicum* and *P. insectifugum* to hand, De Candolle (1869) placed these taxa some way apart, on account of a slight difference in the nervation of their leaves. The latter collection however, and at least some of the former, exhibit the characteristic slender male inflorescence.

8. *Piper interruptum* Opiz — Fig. 2g–i, 3d

Piper interruptum Opiz (1828) 157; Quisumb. (1930) 154, pl. 21; R.O.Gardner (2006) 581; Spokes (2007) 237. — Type: *Haenke s.n.* (holo PR n.v), Luzon.

Distribution — Taiwan, Philippines, east to the Solomons, Vanuatu (?), and Australia.

Habitat & Ecology — In forest, to at least c. 150 m (Bougainville). I have seen Solomons material only from Bougainville and Santa Isabel.

Notes — The leaf blades of *P. interruptum* are greyish-silvered like those of *P. bosnicanum*, but are smaller (to c. 10 by 5.5 cm) and chartaceous rather than firmly so. The species is recognized especially by its lax infructescence (spike to 20 cm long, on a peduncle 1.5 cm long). The male inflorescences, like the female ones, have elongate sessile bracts, and their stamens are in groups of 2 or 3 (cf. the solitary stamen of *P. bosnicanum*).

Philippines material of *P. interruptum* differs from that of the Solomons and New Guinea in being subpalmately nerved. But I have been unable to find other characters which might indicate that two taxa should be recognized.

The conjecture that Vanuatu might be part of the species' range is based on a single collection: *Unknown s.n.* (MEL 1523097, Herb. Mueller), "New Hebrides, Aijel".

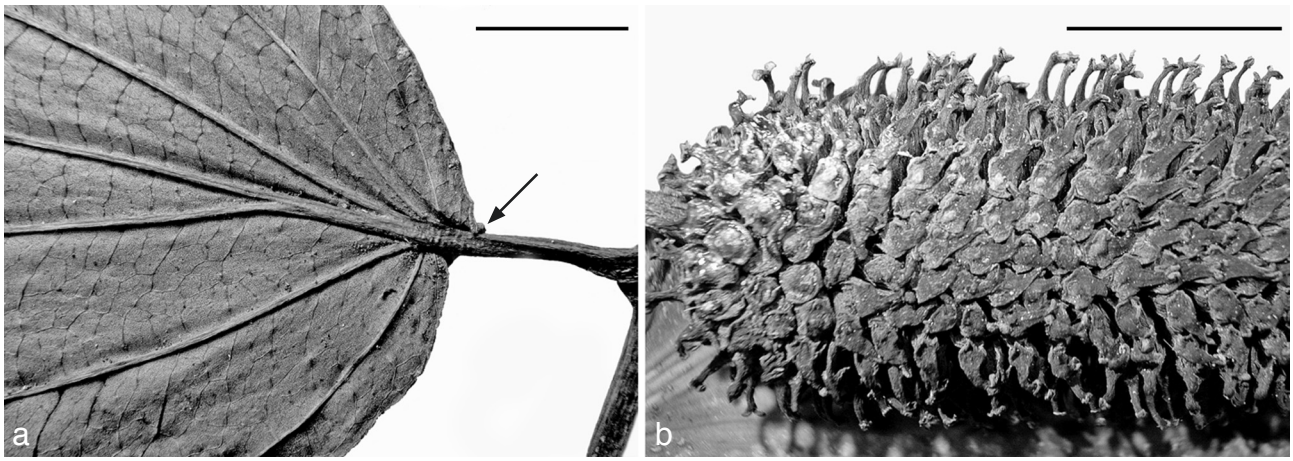

Fig. 7 *Piper*, various structures. — a. *P. macropiper* Pennant. Base of leaf, Samoa; abaxial surface, showing basal auricle (arrow) and subpalmate nervation. – b. *P. sclerophloeum* C.DC. Near-ripe infructescence, showing persistent styles and bifid stigmas (a: *Whistler 2035*, B; b: *NGF 45627*, K). Scale bars = 1 cm.

9. *Piper macropiper* Pennant— Fig. 1j, 4c, 7a

Piper macropiper Pennant (1800) 242; Merrill (1948) 191; Chew (1972) 10; Peekel (1984) 124; R.O.Gardner (2006) 582; Spokes (2007) 236. — Type: *Rumphius*, *Herb. Amb. 5* (1747) 46, t. 28 fig. 1.

Piper vaupelii Lauterb. (1908) 224, syn. nov. — Type: *Vaupel 235* (holo B), Samoa.

Distribution — Taiwan, Philippine Islands, south-east to Vanuatu and Micronesia, also Australia, Wallis and Futuna and Samoa.

Habitat & Ecology — In forest, to c. 650 m (Bougainville). I have seen material from most of the larger islands of the Solomons and also from several smaller ones, including Vanikoro (Santa Cruz Is.).

Notes — The species is recognized by its short-petioled, (sub)palmately veined, ovate to narrowly elliptic leaf blades, which always have a small unilateral basal auricle (lobule). In the Solomons, glabrous and hairy-leaved forms are about equally common. The long male and female spikes (to 15 cm or more) and the free but close-packed small fruitlets (c. 0.75 mm diam), are distinctive. The stigmas are sessile, small (c. 0.3 mm diam) and rather stiffly and conspicuously plumose-papillose.

De Candolle (1914: 530) identified a sterile specimen from Buka (*Rechinger 4369* n.v.) as *P. quinquenervium* Warb., a species described from New Guinea. The type of this name (Chew 1972; B!) represents *P. macropiper*, so it seems likely that *Rechinger 4369* does too.

The fruits of *P. macropiper* are illustrated from life in Cooper (1994) under the name *Piper rothianum* Bailey.

Collections from Samoa (K) and one from Futuna (*McKee 19781*, K), which have been identified as *P. graeffei* Warb. or *P. vaupelii* Lauterb., represent the eastern end of the distribution of *P. macropiper*. Their blades are relatively broad and are, perhaps as a consequence, not strictly palmately-nerved, but they do have the characteristic unilateral basal auricle (Fig. 7a). The female spikes conform to those of *P. macropiper* in their small 3-fid stigmas, but the fruitlets (c. 1.5 mm diam) are larger than is usual in the western part of the species' range.

The few specimens of this affinity that I have seen (K) from Micronesia also have relatively broad leaves. Some are nerved like the Samoan plants (e.g., *Ledermann 13266*, Ponape) but others have a strictly palmate nervation (e.g., *Kanehira 285*, Palau Is.).

It is surprising that this wide-ranging species appears to be absent from Fiji.

10. *Piper majusculum* Blume — Fig. 1i

Piper majusculum Blume (1826) 210; Quisumb. (1930) 45; Chew (1972) 12; R.O.Gardner (2006) 582. — Type: *Blume s.n.*(L n.v.), Java, Mt Salak.

Distribution — Indonesia, Philippines, New Guinea, Solomon Islands.

Habitat & Ecology — In forest to c. 80 m. Chew (1972) cites specimens from Guadalcanal and Santa Isabel. In addition I have seen a specimen from Maramasike (Small Malaita).

Note — Recognized by its shortly petiolate, pinnate-nerved leaves, which are seldom less than 15 cm wide on fertile shoots. The base of the blade is shortly cordate. The fruiting spikes are long and robust, with fully concrescent fruitlets.

11. *Piper sclerophloeum* C.DC — Fig. 3d, e, 4e, 6c, d, 7b

Piper sclerophloeum C.DC. (1914) 530, t.4 f. 6a; Chew (1972) 16. — Type: *Rechinger 4387* (holo W n.v.), Buka, 1905.

Piper sclerophloeum var. *scandens* C.DC. (1914) 530; Chew (1972) 16. — Syntypes: *Rechinger 4826*, *4865*, *4388* (W n.v.), Bougainville, 1905.

Climber to c. 15 m tall (often less ?), mostly glabrous; stems at flowering nodes c. 3–5 mm diam, weakly longitudinally ridged. *Fertile shoots*: stipules (1.5–2–)4 cm long; *leaf blades* broad-ovate, to 25(–30) by 20 cm, firmly chartaceous, drying dark brown to blackish, at base more or less equal and weakly asymmetrically truncate to shortly (rarely deeply) cordate, subacuminate at apex, the lower surface and sometimes the upper with scattered flexuose to straight hairs to c. 1 mm especially on the nerves proximally, red sessile glands seldom conspicuous but red mottling (in subepidermal layers) sometimes so especially on the upper surface; *lateral nerves* 4(or 5) pairs, the lower two pairs basal, the middle pair or pairs departing from within 1 cm of blade base and the upper pair alternate from c. 1/7 way up from base; petiole c. 1/8 as long as blade, to 3.5 cm long. *Male inflorescence* a spike (2–)5–10 cm long and c. 0.5 cm diam, on a peduncle 1–2 cm long, perhaps held erect at anthesis; bracts nearly sessile, glabrous to sparsely hairy, the bract-heads 1–1.2 mm diam. *Stamens* 2 together (*f.* C.DC.), the anthers 0.5–0.8 mm diam, slightly exserted at anthesis and the line of dehiscence sometimes continuous over the top of the anther. *Female inflorescence* a spike 3–7(–10) cm long and c. 1 cm diam, peduncle stout, c. 1.5 cm long, perhaps held erect at maturity; bracts as in male, nearly concealed at maturity; ovary superior; style columnar, to 1 mm long; *stigmas* 2(–4), spreading, broadly ellipsoid, obscurely papillose, together c. 0.75–1 mm diam. *Fruiting spike* cylindrical, to c. 10 by 1.2–1.8 cm (at least 2 cm diam in life), held erect (?), when ripe yellow (to red

?); *fruitlets* free, oblong, 2 mm diam, 3–4 mm long including the persistent style and stigmas. *Seed* 2 by 1.6 mm, oblong-elliptic, red-brown and obscurely reticulated (×20 magn.).

Distribution — Endemic to the Solomon Islands (including Bougainville). Chew (1972) recorded specimens from Choiseul, Guadalcanal, Makira (San Cristobal) and Santa Isabel. In addition I have seen specimens from Bougainville, Florida Is., Malaita, Maramasike (Small Malaita), New Georgia, Ranonnga, Rennell, and Tetepari Is.

Habitat & Ecology — In primary and secondary forest, from the shore to at least the lower montane zone at c. 750 m (Bougainville, *NGF 31366*).

Notes — The stout fruiting spike of *P. sclerophloeum* resembles that of *P. celtidiforme* and is composed of similar-sized fruitlets, but it is somewhat larger and the persistent styles give it a spiny appearance (Fig. 7b). Its colour at full ripeness is likely to be orange or red, but the label notes so far seen are inadequate in this respect.

In the shape and nervation of its leaves *P. sclerophloeum* bears a similarity to *P. subbullatum* K.Schum. ex Lauterb. and the cultivated derivative of this, the kava plant *P. methystichum* Forst.f. However, these plants are shrubs and have densely ciliate leaf margins.

The Kwara'ae names *(kwalo) tuku* and *ofa dio* have been recorded for *P. sclerophloeum* – these appear to be generics for climbing pipers at large.

Piper sclerophloeum is generally described as a lower-bole climber and can reach at least c. 15 m tall. Kajewski, cited by Chew (1972), described it as a robust climber that could form a self-supporting bush, but the collections I have seen do not mention such a habit.

INCERTAE SEDIS

Two collections, *BSIP 14829* from Rennell Is. (Fig. 1i) and *RSS 6247* from San Christobal, which are rather different from one another vegetatively, may represent *P. lessertianum* C.DC. The distribution of this species is noted by Chew (2003) as extending from the Philippines to easternmost Papua New Guinea. Chew (2003) was not willing to name the two collections above and neither am I, not yet having seen any authentic extra-Philippines material of *P. lessertianum*.

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REFERENCES

Bentham G. 1843. Enumeration of the plants collected by R. B. Hinds, Esq., and by Mr Barclay in the Feejee Islands, Tanna, New Ireland and New Guinea; to which are added a few species gathered in Amboina by Mr Barclay. The London Journal of Botany 2: 211–240.

Blume C. 1826. Monographie der Oost-Indische Pepersoorten. Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschappen 11: 139–245.

Chew W-L. 1972. The genus Piper (Piperaceae) in New Guinea, Solomon Islands and Australia 1. Journal of the Arnold Arboretum 53: 1–25.

Chew W-L. 2003. Studies in Malesian Piperaceae 3. Gardens' Bulletin Singapore 55: 13–25.

Cooper W. 1994. Fruits of the Australian tropical forest. RD Press, New South Wales.

De Candolle C. 1869. Piperaceae. In: A. P. de Candolle, Prodromus systematis naturalis regni vegetabilis 16, 1: 235–471.

De Candolle C. 1914. Piperaceae. In: K. Rechinger, Botanische und zoologische Ergebnisse .... Denkschriften der Kaiserlichen Akademie der Wissenschaften Wien 89: 527–532, t. 4.

De Candolle C. 1917. Piperaceae. In: Gibbs LS, A contribution to the phytogeography and flora of the Arfak mountains: 207–208. London, Taylor & Francis.

De Candolle C. 1922. Piper peekelii. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 57: 354.

Fosberg FR, Sachet M-H. 1975. Flora of Micronesia, 2. Piper. Smithsonian Contributions to Botany 24: 16–26.

Gardner RO. 2003. Piper (Piperaceae) in New Guinea: the non-climbing species. Blumea 48: 47–68.

Gardner RO. 2006. Piper (Piperaceae) in the Philippine Islands: the climbing species. Blumea 51: 569–586.

Lauterbach C. 1908. Beitrage zur Flora der Samoa-Inseln. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 41: 215–238.

Linnaeus C. 1753. Species plantarum. Stockholm.

Merrill ED. 1948. An overlooked Flora Indica. Journal of the Arnold Arboretum 29: 186–192.

Opiz PM. 1828. Piperaceae. In: Presl C, Reliquae Haenkeanae: 150–164. Prague.

Peekel PG. 1984. Flora of the Bismarck Archipelago for naturalists. Office of Forests, Lae.

Pennant T. 1800. Outlines of the Globe. Vol. 4. London.

Quisumbing E. 1930. Philippine Piperaceae. Philippine Journal of Science 43: 1–246, pl. 1–24.

Seemann B. 1868. Piper. Flora Vitiensis: 259–262. Reeve & Co, London.

Smith AC. 1981. Piper. Flora Vitiensis Nova 2: 57–65. Pacific Tropical Botanic Garden, Lawai.

Spokes TM. 2007. Piper. Flora of Australia 2: 233–239, 457–458. ABRS/CSIRO Publishing, Melbourne.

Trelease W. 1940. Piper. In: Fosberg FR, Melanesian vascular plants. Lloydia 3: 111–112.

LIST OF COLLECTIONS

1 = *P. abbreviatum*
2 = *P. betle*
3 = *P. bosnicanum*
4 = *P. caninum*
5 = *P. celtidiforme*
6 = *P. fragile*
7 = *P. insectifugum*
8 = *P. interruptum*
9 = *P. macropiper*
10 = *P. majusculum*
11 = *P. sclerophloeum*

Brass 2577: 11; 2583: 11; 2603: 4; 2700: 2; 3139: 11; 3345: 11 — Brown 133: 5; 311: 11; 1197: 9; 4190: 9; 5369: 2 — BSIP 905: 9; 1536: 3; 2018: 3; 2230: 4; 2492: 3; 3068: 3; 3285: 11; 3352: 4; 3827: 9; 3917: 11; 3970: 4; 4104: 3; 4269: 4; 4762: 4; 4851: 5; 4945: 5; 5046: 5; 5175: 4; 5493: 3; 5785: 4; 5838: 11; 6301: 9; 6384: 2; 6390: 4; 6577: 3; 6628: 5; 7259: 10; 7400: 7; 7511: 3; 7579: 10; 7636: 9; 7911: 4; 7914: 10; 7919: 6; 7920: 2; 8106: 4; 8132: 4; 8479: 11; 8480: 4; 8665: 11; 9104: 3; 9411: 5; 9478: 4; 9596: 11; 10370: 7; 10785: 3; 10786: 9; 11069: 5; 11341: 11; 11389: 11; 11456: 4; 11526: 9; 11635: 11; 11771: 9; 11845: 5; 12116:11; 12247: 7; 12705: 9; 12978: 9; 13017: 4; 13456: 11; 13457: 9; 13585: 9; 13656: 9; 13878: 11; 13983: 9; 14043: 4; 14133: 2; 14174: 6; 14413: 11; 14414: 4; 14492: 4; 15401: 7; 15572: 7; 15675: 4; 15744: 11; 15767: 9; 15920: 3; 16108: 11; 16115: 3; 16228: 8; 16266: 11; 16367: 4; 16369: 10; 16374: 4; 16795: 11; 17207: 3; 17212: 5; 17318: 3; 17440: 4; 18120: 5; 18137: 11; 18139: 11.

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De Coppet 105: 2.

Forster & Liddle 8767: 4.

Gardner 7248: 2; 7439: 6 — Guppy 134: 2.

Henderson 469: 2.

Kajewski 644: 9; 1532: 4; 1977: 4; 2077: 3; 2185: 11; 2529: 11; 2598: 11; 2646: 4.

Morrison 139: 5; 281: 4.

NGF 16395: 5; 31239: 11; 31366: 11; 45627: 11; 45670: 5.

Regalado & Sirikolo 694: 4; 741: 5; 767: 11 — RSS 187: 11; 197: 9; 208: 9; 2124: 11; 2392: 11; 2577: 4; 2582: 7; 3038: 11; 6109: 9; 6142: 5; 6144: 11.

Schodde & Craven 3771: 1; 3925: 8; 3926: 3; 4069: 5.

Waterhouse 4A: 9; 10: 4; 11: 2; 31: 11; 47: 9; 66: 8; 66A: 4; 87: 11; 93: 2; 155: 9; 155B: 9; 168B: 11; 191: 2; 192: 2; 266: 4; 277: 2; 329: 2; 331: 2; 332: 2; 344: 2; 360: 4; 639: 11; 700: 11; 702: 5; 702B: 5; 850: 8; 851: 4 ; 852: 4.

Yen 18120: 5.