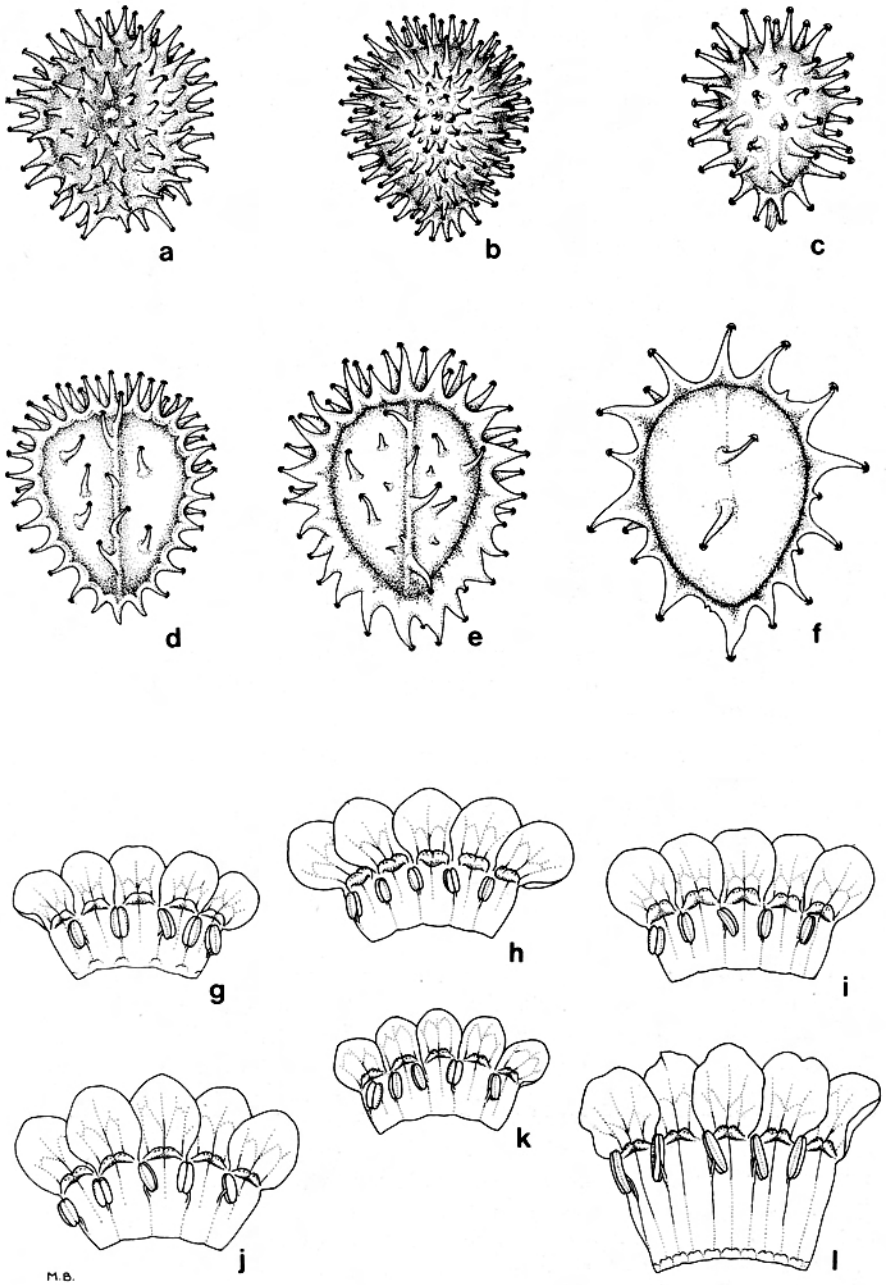


FIG. 1. Nutlets: a, *Paracynoglossum yemenense* × 8; b, *P. afrocaeruleum* × 8; c, *P. lanceolatum* × 12; d, *P. geometricum* × 8; e, *P. bottae* × 8; f, *P. sabirense* × 8. Corollas: g, *P. yemenense* × 5; h, *P. afrocaeruleum* × 4; i, *P. bottae* × 4; j, *P. geometricum* × 5; k, *P. lanceolatum* × 5; l, *P. sabirense* × 4.

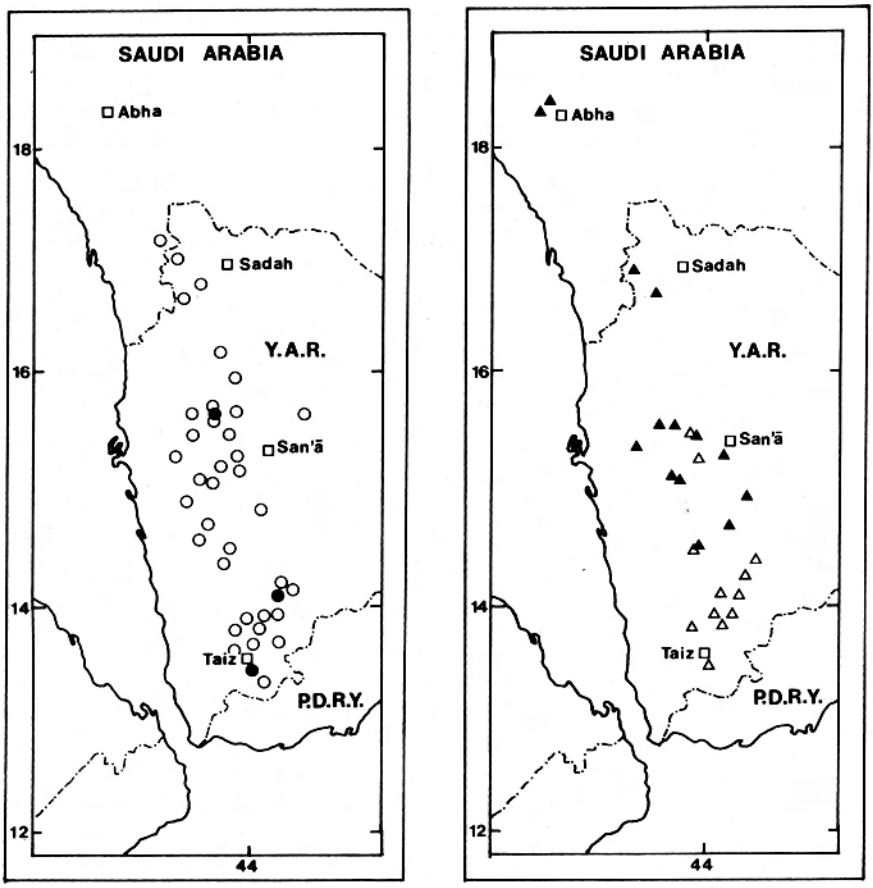


FIG. 2. Distribution of *Paracynoglossum sabirense* ●; *P. lanceolatum* ○; *P. bottae* ▲; *P. yemenense* △. (*P. bottae* also 20°31′ N 41°05′ E).

Type: [Yemen Arab Republic] Hadîe, *Forsskål* s.n. (n.v.).

SAUDI ARABIA. Jabal Fayfa, 100 km NE of Jizan, among shrubs on rocky hillside, 1615 m, 18 ii 1982, *S. Collenette* 3262 (E).

YEMEN ARAB REPUBLIC. Nr Al Qa'ala, J. Razih, Khawlan As Shan, 2000 m, 27 ix 1979, *J. Wood* 2936 (E); Shaharah, field margins, 2200 m, 22 ix 1978, *Miller* 179 (E); ibid., N slope to village, field margin, 2300 m, 22 ix 1978, *Miller* 192 (E); J. Nabi Schwaib, S ridge to summit, rocky slopes and terrace walls, 3000 m, 20 ix 1979, *Miller* 151 (E); Menacha, Hajarah to Attarah, S facing rocky slopes, 2000 m, 12 x 1978, *Miller* 485a (E); J. Masar in the Haraz, 2600 m, 8 vi 1979, *J. Wood* 2834 (E, K); J. Schibam, Menacha, 2400–2600 m, 28 ii 1889, *Schweinfurth* 1752 (K); Sumara Pass, W facing gulley, 2600 m, 9 x 1978, *Miller* 425 (E); Wasab region, J. Hisn Madnan, rocky slopes, 2200 m, 16 ix 1978, *Miller* 113 (E); N side of J. Kuburu nr Gerger above Hadia in J. Raymah, 2000 m, *J. Wood* 2805 (E, K); above Suddah in Wadi Banna, 2500 m, 29 v 1979, *J. Wood* 2768 (E); Mashwara, on the Ibb–Udayn pass, 2500 m, *J. Wood* 75/465 (BM);

Ibb region, c. 35 km N of Taiz, around Dhisufal, 1800–2100 m, 20 x 1975, *Hepper & J. Wood* 5903 (K); J. Sabir, 1837, *Botta* s.n. (K); J. al Amal, Otomah, 2500 m, 18 x 1979, *J. Wood* 2989 (E); below Ban-an, 2900 m, 19 ix 1979, *J. Wood* 2915 (E); nr the hospital, Turba, 1900 m, 26 x 1974, *J. Wood* 74/162 (BM).

P. lanceolatum is the most widespread of the Arabian species of *Paracynoglossum,* extending from Arabia to South Africa and eastwards to India. Previously, a very broad view was taken of this species in Arabia, but we have restricted the name to plants with small immarginate nutlets readily separating from each other at maturity and with the ultimate pairs of inflorescence branches divaricate (i.e. not narrowly divergent as in the other Arabian species). *Miller* 151 is atypical in having larger nutlets, and branches less widely divaricate; it was growing near typical *P. bottae* (*Miller* 154–see below).

In N Yemen *P. lanceolatum* has a distribution typical of an 'escarpment plant', being very rare (only one record) east of the inner escarpment. It grows at lower altitudes than the other species, down to 1100 m, but reaches 3000 m. It is not closely allied to the other Arabian species, being nearer to certain Indian and Far Eastern species of the genus.

2. P. bottae (Deflers) R. Mill & A. G. Miller, **comb. nov.** Figs 1e, 1i, 2.
Syn.: *Cynoglossum bottae* Deflers, Voyage au Yemen 173 (1889).

Scabrid biennial herb. *Stems* 20–45 cm, simple or branched from below, scabrid, hairs antrorse in region of inflorescence, retrorse or patent below. *Leaves* lanceolate or oblanceolate, apex acute; lower 70–105 × 14–18 (–20) mm, base long-attenuate, ±petiolate; upper 15–40 × 5–16(–24) mm, ±sessile, base more rounded; indumentum spreading or patent, scabrid; venation of only one main vein, with no obvious lateral veins. *Inflorescence* a lax ebracteate panicle with acutely divergent branches. *Pedicels* lengthening and becoming recurved in fruit, 8–10 mm. *Calyx lobes* oblong-ovate, c. 2 × 1 mm, with short antrorse hairs. *Corolla* subrotate, white with blue centre, 3–5 mm long, lobes 1·25–1·5 mm × c. 2 mm, oblong-ovate. *Faucal scales* semilunar, emarginate. *Nutlets* 3·5–5 × 3–4 mm excl. glochids, 4·5–5 × 5 mm incl. glochids, marginate, separating with difficulty from gynobase at maturity; glochids blackish-tinged, on dorsal surface (disc) usually restricted to median keel; style obscure in fruit.

Syntypes: [Yemen Arab Republic] Hab. ad fauces montis Schibâm (Haraz), 2400–2800 m, *Deflers* 300, 363 (P).

SAUDI ARABIA. Between Abha and J. Sudah, 2600 m, 10 iii 1980, *S. Collenette* 2041 (E): Al Sudah, 15 km N of Abha, 2600 m, 14 iv 1979, *S. Collenette* 1380 (E); Asir Province, Al-Sawdah, 13 v 1977, *A. K. Nasher* H53 (E); Zabna nr Al-Sawdah, 31 i 1980, *A. K. Nasher* H30 (E); Shabwa village, J. Ibrahim, 15 iii 1982, *J. Grainger* 433 (E).

YEMEN ARAB REPUBLIC. Sadah–Khawlan track, Al Mejasin, 16°48′ N 43°23′ E, 6 ii 1979, *D. Wood* Y 1051 (E); J. Razih nr Al Qa'ala, 2000 m, 27 ix 1979, *J. Wood* 2935 (E); below Kuhlan, 2200 m, 26 iii 1981, *Miller & Long* 3223 (E); Bait Udhaqa, 20 km W of Amran under J. Miswar, 1700 m, *Miller* 246 (E); Bait al Alama, J. al Mahdad, 20 km W of Amran,

rocky slopes, 3000 m, 26 ix 1978, *Miller* 237 (E); between Kaukaban and Shibam, 2900 m, *J. Wood* 2756 (E); Hadda, 4 km SW of Sanaa, on terraces around town, 2400 m, 15 x 1978, *Miller* 566 (E); J. Nabi Schwaib, S ridge to summit, terrace walls, 3000 m, 20 ix 1978, *Miller* 154 (E); nr summit of J. Melhan, Shahir, 2300 m, 14 vi 1979, *J. Wood* 2862 (E); frequent around the Hisn nr the summit of J. Masar, Haraz, 2800 m, 8 vi 1979, *J. Wood* 2831 (E, K); Menacha, J. Schibam, overgrown terraced fields, 2700 m, 5 x 1978, *Miller* 381 (E); Nachl al Hamra, Kumain, NE of Dhamar, edge of irrigated 'Qat' field, 2600 m, 25 v 1979, *J. Wood* 2783 (E, K).

The application of the name *Cynoglossum bottae* Deflers has presented a problem. In SW Arabia there are two taxa which are possible candidates for the name. The first has marginate nutlets and white flowers with blue centres; the second has immarginate nutlets and blue flowers. Only one of the two syntypes has a fruit and this is rather immature. *Miller* 381 from the type locality of J. Schibam is very similar in facies to the syntypes of *C. bottae* and is of the first taxon. The immature nutlet on *Deflers* 300 is apparently marginate and consequently we have linked this taxon with the name *C. bottae*. Defler's description of the flower colour as 'yellow' is very misleading and certainly refers to the colour when dry. The second taxon, with blue flowers and immarginate fruits, we have separated as the new species *P. yemenense*.

In N Yemen *P. bottae* is a mountain plant of 2500 m and higher. It has a strong northern tendency, i.e. it is absent from the Ibb region and further south. A number of plants have similar distribution patterns in N Yemen, including *Galium yemenense* Kotschy, *Pavonia patens* (Andr.) Chiov., and *Festuca obturbans* St.-Yves. One collection (not on Fig. 2), *Grainger* 433, has considerably extended the range of *P. bottae* north to J. Ibrahim, 20°31′ N 41°05′ E.

The relationship between *P. bottae* and the African species *P. geometricum* (Baker & C. H. Wright) R. Mill needs consideration. The latter is blue-flowered, with larger, more distinctly marginate nutlets. It was considered by Brand (1921) to be a subspecies of *Cynoglossum lanceolatum* but his concept of that species is now considered to be unacceptably broad and heterogeneous. Baker & Wright (1906) had separated *P. geometricum* from *P. lanceolatum* on the nutlets having glochids confined to the margin and central keel, rather than being evenly scattered over the surface. Most African floras, e.g. Agnew (1974) and Robyns (1948–55), follow them and treat the two as distinct species. There would seem to be ecological justification for this view; Robyns (op. cit.) states that in the Albert National Park *P. geometricum* is nitrophilous and prefers humid habitats, while *P. lanceolatum* is a pioneer ruderal species. The necessary new combination is made below.

Paracynoglossum geometricum (Baker & C. H. Wright) R. Mill, **comb. nov.**
Syn.: *Cynoglossum geometricum* Baker & C. H. Wright in Thiselton-Dyer, Fl. Trop. Africa 4 (2):52 (1906).

3. P. yemenense R. Mill & A. G. Miller, **sp. nov.** Figs 1a, 1g, 2, 3c.

A *P. bottae* (Deflers) R. Mill & A. G. Miller floribus concoloribus caeruleis (non discoloribus albidis fornicibus caeruleis) et nuculis immarginatis (non marginatis) distincta. A *P. afrocaeruleo* R. Mill (= *Cynoglossum caeruleum* Hochst. ex A. DC., non *C. caeruleum* Buch.-Ham. ex D. Don) et *P. geometrico* (Baker & C. H. Wright) R. Mill nuculis immarginatis et foliis lanceolatis differt; a *P. afrocaeruleo* etiam foliis lanceolatis, non lingulatis, insignis.

Herba biennis vel perennis. *Caules* erecti, ad 60 cm alti, superne ramosi; indumentum scabridum, e pilis plerumque antrorsis vel patentibus compositum. *Folia* anguste elliptica, apice acuta; inferiora 50–140 × 7–18 mm, basi in petiolum gradatim angustato; superiora 5–30 × 2–8 mm, basi ± rotundato; indumentum scabridum, e pilis adpressis e basibus bulbosis exorientibus compositum; folia costa centrale et venis lateralibus duobus ± distinctis parallelis provisa. *Inflorescentia* terminalis, paniculata, parce ramosa, in statu fructifero valde elongata, ± ebracteata, in parte inferiore bracteis 1–2 adsunt. *Pedicelli* floriferi 1–2 mm, in statu fructifero recurvati et ad 8 mm elongati. *Lobi calycis* ovati, in statu fructifero accrescentes. *Corolla* caerulea, rotata, 2·75–4 mm; lobi oblongi, 1·25–2 × 1·25–2 mm. *Fornices* semilunares emarginati. *Stylus* quam lobi calycis dimidio brevior. *Stigma* capitatum. *Nuculae* 3–4 × 2–2·5 mm, immarginatae, ad stylum inconspicuum non cohaerentes, e gynobase maturo liberae sed difficiliter separantes; glochidia omnia in disco aequaliter dispersa.

Type: Yemen Arab Republic: Shibam, by irrigation ditches, 2600 m, 28 v 1979, *J. Wood* 2784 (holo. E, iso. K).

YEMEN ARAB REPUBLIC. Around mosque on summit of J. Nabi Schwaib, 3620 m, 20 ix 1978, *Miller* 165 (E); J. Nabi Schwaib, terraced fields, 3300 m, 17 ix 1979, *J. Wood* 2908 (E); Yarim, on a hill W of town, 3000 m, 26 ix 1972, *J. Wood* 72/23 (BM); Sumara Pass, rocky slopes, 2900 m, 9 x 1978, *Miller* 445 (E); ibid., *Miller* 438 (E); Mashwara nr Ibb, 2500 m, 5 viii 1975, *J. Wood* 75/464 (BM); Wasab region, J. Hisn Madnan, rocky slopes, 2800 m, 16 ix 1978, *Miller* 112 (E); J. Sabir, above Taiz, rocky cultivated terraces, 2400–2700 m, *Hepper* 5936 (K); J. Sabir nr Taiz, 2000–3000 m, 23 ix 1977, *Lavranos* 15951 (E).

P. yemenense is confined to the mountains of N Yemen where it has a distribution with a 'southern tendency' typical of some high altitude escarpment plants, e.g. *Senecio sumarae* Deflers. In facies it closely resembles *P. bottae* which, however, shows a marked northern tendency in its distribution. From this latter species *P. yemenense* differs in its bright blue flowers and immarginate nutlets. In Africa it most closely resembles plants currently known as *Cynoglossum coeruleum* Hochst. ex A. DC., *nom. illegit.* The latter taxon has more rounded nutlets which break away from the gynobase readily at maturity; moreover, the leaves are strap-shaped, not lanceolate as in *P. yemenense*. *C. coeruleum* is widespread at high altitudes in Kenya and Tanzania. However, Hochstetter's type of *Cynoglossum coeruleum* comes from Ethiopia and, at least superficially, there may be differences between the Ethiopian plants and those from Kenya and Tanzania. It is clear that the Ethiopian plant also belongs to *Paracynoglossum*. As *C. coeruleum* Hochst. ex A. DC. is an illegitimate

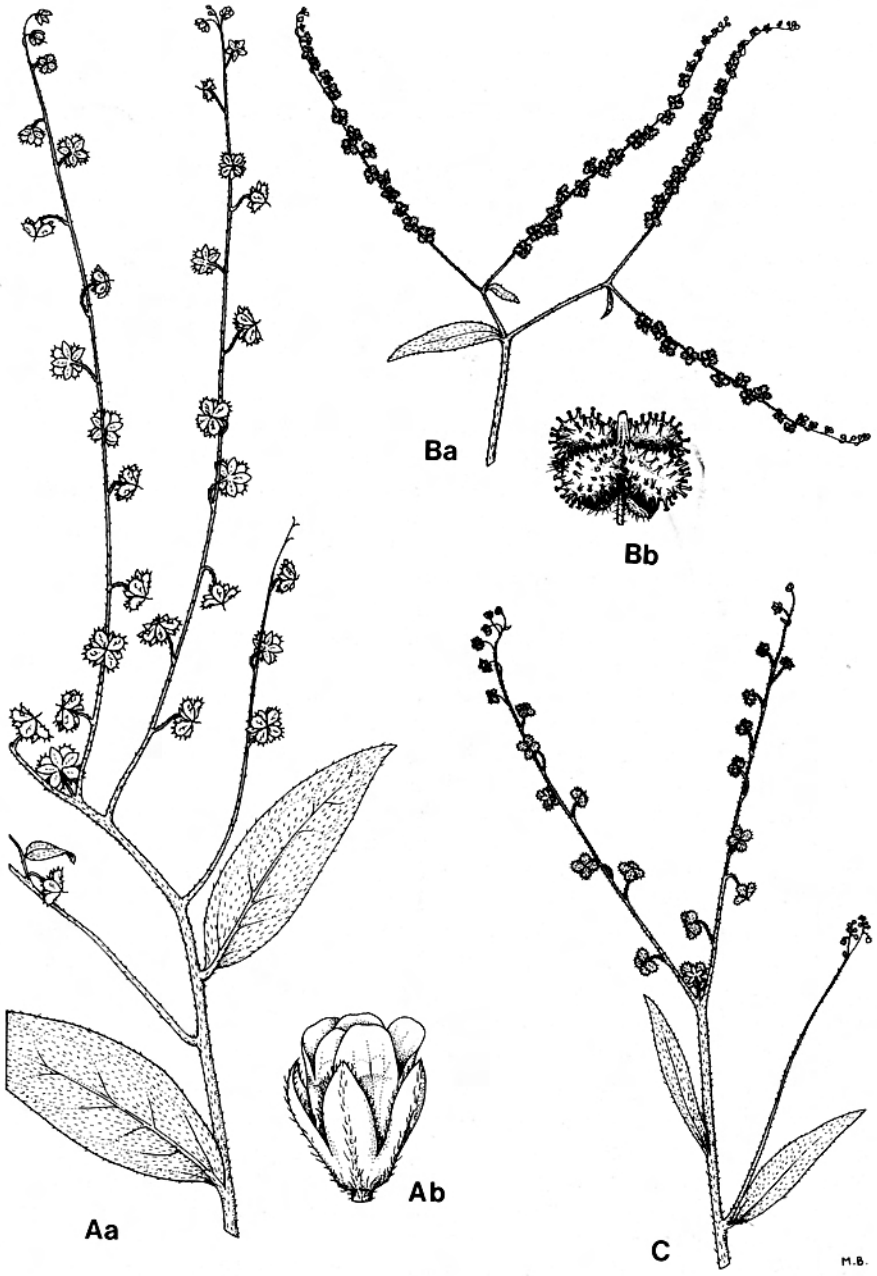


FIG. 3. *Paracynoglossum sabirense*: Aa, fruiting branch × ⅔; Ab, flower × 6. *P. lanceolatum*: Ba, fruiting branch × ⅔; Bb, fruit × 4. *P. yemenense*: C, fruiting branch × ⅔.

name the new name *Paracynoglossum afrocaeruleum* R. Mill is proposed here.

Paracynoglossum afrocaeruleum R. Mill, **nom. nov.**
Syn.: [*Cynoglossum coeruleum* Hochst. ex A. DC. in DC., Prodr. 10:148 (1846) non *C. caeruleum* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal 100 (1825)].
Type: [Ethiopia] in agris Abyssiniae, *Hochstetter,* Pl. Schimper abyss. sect. 2 no. 542 (type of *C. coeruleum* Hochst. ex A. DC.; n.v.).

4. P. sabirense R. Mill & A. G. Miller, **sp. nov.** Figs 1f, 1l, 2, 3Aa–b.

A *P. lanceolato* (Forssk.) R. Mill nuculis maioribus marginatis, ramis inflorescentiae angulam acutam divergentibus differt; a *P. bottae* et *P. yemenense* nuculis maioribus disco parcissime glochidiato refert.

Herba biennis vel perennis. *Caules* e basi ramosi, ad c. 60 cm ascendentes, inferne ± glabrescentes, superne pilis retrorsis tecti, veteri nitentes. *Folia* pallide viridia, anguste elliptica vel elliptica, 50–230 × 10–40 mm, integra, apice acuta, inferiora basi ± in petiolum angustata, superiora basi ± rotundata; indumentum tenue, e pilis ± adpressis e basibus bulbosis exorientibus compositum; folia uninervata. *Cymi* terminales vel in axillis cincinni foliorum superiorium, parce ramosi, rami ex axe inflorescentiae ad angulam acutam divergentes, inferne bracteati, omnes in statu fructifero elongati; indumentum pilis patentibus vel ± retrorsis compositum, quam caulem densiore. *Pedicelli* quam calyces breviores, c. 1–2 mm, fructiferi a 3 mm elongati, recurvati. *Lobi calycis* 2–3 × 0·75–1·5 mm, oblongo-elliptici, in statu fructifero accrescentes, 5 × 3 mm, elliptici, secus margines loborum et costas ciliati. *Corolla* pallide caerulea, rotata, 6–8 mm; lobi oblongi, 2·5–3 × 2·5–3 mm, tubus 3·5–5 mm. *Fornices* semilunares, emarginati. *Stylus* calycem brevior vel aequans. *Stigma* capitatum. *Nuculae* 4–5 × 2·5–3 mm (glochidiis exclusis), albido-tinctae, circa marginem glochidiatae, in disco 1–2 glochidia solum provisa.
Type: Yemen Arab Republic: J. Sabir, nr Taiz on amphibole granite, 2500–3000 m, 23 ix 1977, *Lavranos* 15937 (holo. E).
YEMEN ARAB REPUBLIC. J. Manar nr Ibb, in a stream bed, on volcanic soil, flowers blue, scorpioid, 2900 m, 22 vi 1979, *J. Wood* 2876 (E); damp densely shaded gully separating Shernana from the main mountain of J. Hiswar, on limestone, flowers pale blue, leaves pale green, stem brown, bracts enclosing flower buds, 2900 m, 20 vi 1980, *J. Wood* 3319 (E).

P. sabirense is readily distinguished from the other Arabian species by its generally larger leaves and stature, and by its whitish, strongly marginate nutlets which are relatively sparsely glochidiate on the disc. In flower it is characterized by the buds which are covered by bracts, and by the calyx lobes being more or less glabrous except for a line of hairs on the midvein and fringing the margin.

P. sabirense is a very local plant and consequently it is difficult to generalize about its ecology and distribution. On J. Miswar it grows in a deeply shaded gully which is an outlying locality for *Arisaema bottae* Schott, a rare plant which also occurs at both its other localities.