

## Three new endemic species of *Crematosperma* (Annonaceae) from the Rio Marañon basin, Amazonas, Peru

MICHAEL D. PIRIE

Nationaal Herbarium Nederland,  
Universiteit Utrecht branch,  
Heidelberglaan 2, 3584 CS Utrecht,  
The Netherlands  
m.d.pirie@bio.uu.nl

MARIO ZAPATA CRUZ

Museo de Historia Natural,  
Universidad Privada Antenor Orrego  
Trujillo – PERÚ  
mzapatac@upao.edu.pe

### Abstract

Subsequent to a field expedition to the Peruvian department of Amazonas, and in advance of a revision of the genus, three new species of *Crematosperma* (Annonaceae), endemic to the Río Marañon basin in Peru, are described here: *C. bullatum* Pirie, *C. yamayakatense* Pirie and *C. cenepense* Pirie & Zapata.

### Resumen

Como resultado de los trabajos de campo realizados en el Departamento de Amazonas (Perú); y en avance a la revisión del género, describimos tres nuevas especies de *Crematosperma* (Annonaceae): *C. bullatum* Pirie, *C. yamayakatense* Pirie y *C. cenepense* Pirie & Zapata, endémicas de la cuenca del río Marañon.

### Introduction

The genus *Crematosperma* was described by Fries 1930, and phylogenetic analyses using DNA sequence data suggest that its species comprise a monophyletic group (Pirie & al., in press). It can be distinguished from other Neotropical Annonaceae by its raised midrib with a unique longitudinal groove. Although at the time of writing only 18 species of *Crematosperma* are recognised, the results of ongoing systematic research suggest that the total number of distinguishable species may in fact exceed 30. The distribution of

species of *Crematosperma* can be summarised according to Gentry (1982) as ‘Andean centred’: they are largely absent from Amazonia, but diverse in middle elevation cloud forests and in the lowlands near the base of the Andean mountain chain. These regions coincide with two of the twenty-five areas worldwide designated as biodiversity hotspots by Myers & al. (2000): the Chocó/Darién/Western Ecuador region and the tropical Andes. The area of the tropical Andes in Peru is particularly rich in species of *Crematosperma*, housing 12 of the 18 currently recognised species.

Three new species of *Crematosperma* from Peru are described here: *C. bullatum* Pirie, *C. yamayakatense* Pirie, and *C. cenepense* Pirie & Zapata. *Crematosperma bullatum* and *C. yamayakatense* were collected by the authors during a field expedition in northern Peru at the end of 2003. Both were found in the area of the community of Yamayakat in Bagua, Amazonas, from where a further species of *Crematosperma*, *C. peruvianum* (described by Fries, 1934, and distinguished in particular by its long, relatively narrow leaves with cordate base, and long stipes), has also been collected. These three and *C. cenepense* (the third new species described here) are only known from herbarium specimens collected in the Río Marañón basin in Peru. This region appears not only to be unusually rich in often narrowly endemic species of Annonaceae, but also until recently to have been relatively overlooked in terms of both collections and taxonomic work. Collections of the genera *Unonopsis*, *Rollinia*, and *Guatteria* made during the same expedition appear to represent a number of as yet undescribed species (P. Maas, pers. com.).

**1. *Crematosperma bullatum* Pirie spec. nov. – Fig. 2, 3-5**

Typus: Pirie, M.D.; Zapata C., M.; Apanu N., *R.* 71 (holo: U; iso AAU, AMAZ, CUZ, E, F, HAO, K, MO, MOL, NY, HUT, US, USM, WU), Perú. Amazonas: Bagua, District Imaza, community Yamayakat, trail to Putuim, 22 Nov 2003 (fl).

Foliis bullatis margine ciliata, indumento e pilis longis composito, pedicellis longis, petalis interioribus petala exteriora superantibus distinctum

**Tree** 2-10 m tall; young twigs and petioles densely covered with mainly erect golden hairs up to 1 mm long. **Leaves:** petioles 3-7 mm long, 2.5-3 mm diam.; lamina elliptic or narrowly so to slightly obovate, 17-28 by 6-11 cm (leaf index 2.4-3.5), chartaceous, mid brown, occasionally slightly grey above (immature leaves drying black), glabrous or sparsely covered with mainly erect golden hairs up to 1 mm long on upper surface, densely so on all veins below and on edge of lamina, base rounded to subcordate, apex acuminate (acumen 5-20 mm long), extreme tip obtuse, primary, secondary, and tertiary veins sunken in depressions in leaf surface, primary vein raised along entire leaf length, 1.5-2 mm wide at widest point, densely covered with mainly erect golden hairs up to 1 mm long above

and below, secondary veins 15-20 (intersecondary veins rare), distance between from 6 mm at the base to 16 mm closer to the apex, angles with primary vein consistently around 60-70°, occasionally branching, forming distinct loops, smallest distance between loops and margin 1-1.5 mm, tertiary veins largely percurrent. **Inflorescences** of single, successively produced, pendulous flowers, axillary on leafy branches, on leafless branches and produced from the main trunk (then extending from a structure comprising the woody remnants of old inflorescences); short axillary shoot, 17-20 mm long, 1-1.5 mm diam. (in flower), 18-25 mm long, c. 1.5 mm diam. (in fruit); pedicels 100-140 mm long, c. 1 mm diam. at the base, 2 mm diam. at the apex (in flower), c. 1.5 mm diam. at the base, 2 mm diam. at the apex (in fruit); short axillary shoot and pedicel sparsely to rather densely covered with mainly erect golden hairs up to 1 mm long, single lower bract, elliptic to ovate, 2.5 mm long, 1 mm wide, acute, persistent or partially caducous, densely covered with mainly erect golden hairs up to 1 mm long; upper bract within central third of pedicel length, elliptic to ovate, 2-3 mm long, 1-2 mm wide, acute, densely covered with mainly erect golden hairs up to 1 mm long; flower buds depressed ovoid developing to conical, green in vivo, brown in sicco; flowers green, maturing to yellow with a basal orange patch on the outside of the outer petals in vivo, golden brown in sicco, outer sides and apical portion of the inner sides of petals and outer sides of sepals densely covered with appressed golden hairs up to 1 mm long, inner sides otherwise glabrous; sepals basally connate, deltate, 5-7 by c. 6 mm, acute, caduceous; outer petals broadly ovate, c. 18 by c. 15 mm, inner petals ovate, concave, c. 25 by c. 12 mm wide; receptacle ovoid; androecium c. 5 mm diam., stamens 1-1.5 mm long, connective appendage of inconsistent and irregular shape, c. 0.5 mm wide, glabrous. **Monocarps** 8-10, dark brown in sicco, ellipsoid, slightly assymmetrical, c. 15 mm long, 11 mm diam., apicule (where visible) excentric; stipes 14-16 mm long, c. 1.5 mm in diam; fruiting receptacle ovoid, 5-6 mm in diam., monocarps, stipes and receptacle sparsely to rather densely covered with erect golden hairs 0.1 mm long. **Seeds** ellipsoid, orange-brown with many shallow pits, c. 13 mm long, c. 10 mm in diam., raphe raised, encircling seed longitudinally, rumination spiniform.

**Distribution:** *C. bullatum* is known only from the Bagua province of Amazonas in Peru.

**Habitat and ecology:** Trees or shrubs from 2 m tall have been collected in primary forest in flower in February and November, in fruit in November and June.

#### **Other specimens examined:**

**PERU: Amazonas, Bagua:** 20 Jan 1996 (fl, fr), *Jaramillo, N.; et al.* 942 (MO, U); 25 Jan 1996 (fr), *Jaramillo, N.; et al.* 972 (HUT, MO, U); District Imaza, community Yamayakat, trail to Putuim,

22 Nov 2003 (st), Pirie, M.D.; et al. 66 (F, HAO, U, USM); (fr), Pirie, M.D.; et al. 68 (HAO, U, US, USM); District Imaza, community Putuim, path leading west along Quebrada Shimutaz, 25 Nov 2003 (fl), Pirie, M.D.; et al. 94 (AMAZ, CUZ, HAO, HUT, K, MO, MOL, NY, U, USM); District Imaza, community Aguaruna de Putuim, 20 Jun 1996 (fr), Rodriguez R., E.; et al. 1152 (U); District Imaza, community Yamayakat, 15 Nov 1997 (fr, fl), Vásquez, R.; et al. 24891 (U).

**Notes :** *Crematosperma bullatum* can easily be distinguished from all other species of *Crematosperma* by any one of the number of unique and striking characteristics it displays. The leaf blade has a blistered or bubbled appearance, both in the field and when pressed, which is due to the deeply sunken nature of the primary, secondary, and tertiary venation. The indument present on many of its parts is far longer than in any other species in the genus, and, also uniquely in the genus, densely inserted in a halo-like formation around the leaf margin. Other notable characteristics are the unusually long pedicel, the orange colouring of the base of the outer petals of mature flowers, the inner petals considerably longer than the outer petals, and the rounded to subcordate shape of the leaf base.

**Etymology :** The specific epithet reflects the bubbled appearance of the leaves.

**2. *Crematosperma yamayakatense* Pirie spec. nov. – Fig. 2, 6-8**

Typus: Pirie, M.D.; Zapata C., M.; Apanu N., R. 57 (holo U; iso CUZ, HAO, HUT, K, MO, NY, USM), Perú. Amazonas: Bagua, District Imaza, community Yamayakat, trail to Putuim, 22 Nov 2003.

*A. gracilipes* pedicellis brevioribus, alabastris glabris ante anthesin inapertis differt.

*A. cenepense* stipitibus monocarpiis longioribus differt.

**Tree** 1.5-8 (-20) m tall; young twigs and petioles shallowly grooved, glabrous. **Leaves:** petioles 5-10 mm long, 1-5 mm diam.; lamina elliptic, 11-24 (-38) by 3.5-8 (-13) cm (leaf index 2.4-3.4), chartaceous, olive-grey green above, light brown below, glabrous on both sides, base acute, apex shortly acuminate to acuminate (acumen 10-25 mm long), extreme tip rounded, primary vein raised over entire leaf length, grooved for first 25-30% from base, 1-4 mm wide at widest point, glabrous, secondary veins 8-10 (-14), intersecondary veins occasional, distance between from 5-10 mm at the base to 10-30 mm closer to the apex, angles with primary vein from 70-80°, the angle thereafter

decreasing and subsequently increasing towards the leaf margin, not branching, forming distinct loops, smallest distance between loops and margin 2-6 mm, tertiary veins largely percurrent with some reticulation. **Inflorescences** of single, successively produced, flowers, axillary on leafy branches and on older (leafless) branches (then extending from a structure comprising the woody remnants of old inflorescences); short axillary shoot c. 1 mm long, 1 mm diam. (in flower), 1-3 mm long, 2-2.5 mm diam. (in fruit); pedicels 5-7 mm long, c. 1.5 mm diam. at the base, 2 mm diam. at the apex (in flower), 8-15 (20) mm long, 2-2.5 mm diam. at the base, 3-4 mm diam. at the apex (in fruit); short axillary shoot sparsely covered with golden hairs 0.1 mm long, pedicels glabrous; single lower bract broadly triangular, 1-2 by 1-2 mm, acute, mostly caducous in fruit, rather densely covered with golden hairs 0.1 mm long; upper bract inserted within basal half of pedicel, broadly triangular, 1-2 by 1-2 mm, acute, glabrous; flower buds depressed ovoid; flowers green maturing to yellow in vivo, black in sicco, surfaces of sepals and petals glabrous, margins ciliate with golden hairs 0.1-0.2 mm long; sepals basally connate, deltate, not reflexed, c. 3 by c. 3 mm, rounded, caducous, rarely persistent; outer petals ovate, 10-15 by 8-12 mm, inner petals elliptic, c. 12 by c. 6 mm; receptacle depressed ovoid; androecium 6-7 mm diam., stamens c. 1 mm long, connective appendage of inconsistent and irregular shape, 0.5 mm wide, glabrous; carpels number, length, and indument unknown. **Monocarps** 10-22, green maturing through red to black in vivo, black in sicco, ellipsoid, slightly asymmetrical, 12-14 mm long, 7-8 mm diam., apicule ex-central, glabrous or sparsely covered with very short golden hairs; stipes green maturing to red in vivo, 11-12 mm long, c. 1.5 mm diam. increasing to c. 3 mm diam. when mature, glabrous or with sparse indument of very short golden hairs; fruiting receptacle depressed ovoid, 5-10 mm in diam, glabrous. **Seeds** ellipsoid, reddish-brown with small black pits surrounded by a slightly raised rim, 9-13 mm long, 6-7 mm diam., raphe sunken, encircling seed longitudinally, rumination unknown.

**Distribution:** *Crematosperma yamayakatense* is found only in the watershed of the upper Río Marañón in the department of Amazonas in Peru.

**Habitat and ecology :** Primary and secondary forest between 200 and 1000 m elevation. *C. yamayakatense* has been collected in flower in November and January-March. Fruiting specimens have been collected throughout the year except December and April.

#### **Selection of other specimens (21) examined:**

**PERU: Amazonas, Bagua:** Along roadside from Chiriaco to Puente Venezuela, 43 km (by road) NE of Chiriaco, 5 Feb 1996 (fl), *Barbour, P.J.* 4432 (MO, U, USM); District of Imaza, 22 Sep 1997 (fr), *Chávez A., E.* 70 (U); Aguarana de Yamayakat, 14

Jul 1994 (fr), *Díaz S., C.; et al.* 6851 (U, USM); Imaza, community Yamayakat, Jan 1995 (fl), *Hodges, V.; et al.* 111 (HUT); District Imaza, community Yamayakat, 6 Mar 1995 (fl, fr), *Jaramillo, N.* 584 (HUT, U, USM); District Imaza, community Yamayakat, trail to Putuim, 22 Nov 2003 (fr), *Pirie, M.D.; et al.* 60 (HAO, U, USM); Yamayakat, margin of Marañon river, 16 Oct 1995 (fr), *Rodriguez R., E.* 724 (HUT). **Condorcanqui:** River Cenepa, vicinity of Huampami, 7 Aug 1978 (fr), *Ancuash, E.* 1324 (U); East of Cenepa, South of Aintami Creek on ridge, 15 Jul 1974 (fr), *Berlin, B.* 1588 (U); Quebrada Basusinuk, tributary of Huampami, 2 Nov 1972 (fr), *Kayap, R.* 33 (U); Valley of river Santiago, Quebrada Caterpiza, 2-3 km from community Caterpiza., 12 Jan 1980 (fr), *Tunqui, S.* 573 (MO); 8 Sep 1994 (fr), *Vásquez, R.; et al.* 19055 (MO).

**Notes:** *Crematosperma yamayakatense* resembles two other species of *Crematosperma*; *C. gracilipes*, which has been collected in the departments of Napo and Pastaza in Ecuador, Loreto in Peru and in adjacent Colombia, and *C. cenepense*, also described here, from the Cenepa region of Amazonas, Peru, with which its distribution therefore overlaps. The most important differences between *C. yamayakatense* and *C. gracilipes* are in the flowers. *C. gracilipes* is characterised by flower buds which open during development and which bear indument on all parts. In contrast, the flower buds of *C. yamayakatense* bear virtually no indument and appear to remain closed throughout development, the petals only opening slightly when the flowers are mature. Additionally, the flowers of *C. gracilipes* are borne on longer more slender pedicels than those of *C. yamayakatense*. *C. yamayakatense* differs from *C. cenepense* in the shape of the leaf base (acute in *C. yamayakatense*, cordate to subcordate in *C. cenepense*) and the length of the stipes (longer than the monocarps in *C. yamayakatense*, shorter than the monocarps in *C. cenepense*). The lack of flowering material of *C. cenepense* makes further distinction currently impossible.

Flowering and fruiting specimens of *C. yamayakatense* of around 1.5 m tall were observed in the province of Bagua, though specimens collected both in this area and particularly those collected further north into the province of Condorcanqui, in the areas of the Rivers Cenepa and Santiago, have been recorded as reaching heights of 6–8 m and in one case 20 m tall. Differences between collections from these two regions have been observed: The leaves of Condorcanqui specimens are generally larger and the fruits have a slight indument whereas those of the Bagua collections are glabrous. In the absence of floral material from Condorcanqui it is assumed that these specimens do represent the same species due to the short pedicel, leaf base shape (which excludes the possibility of their representing specimens of *C. cenepense*) and leaf venation.

**Etymology :** *Crematosperma yamayakatense* is named after the community of Yamayakat, the type locality of the species.

**3. *Crematosperma cenepense* Pirie & Zapata spec. nov. – Fig. 2, 9**

Typus: Rojas, R.; et al. 269 (holo, U, iso, AMAZ, HUT, MO, USM);  
Peru: Amazonas, Prov. Condorcanqui: Río Cenepa region,  
community Mamayaque, 11 Aug 1997 (fr).

Lamina basi cordata vel subcordata distinctum. A *C. yamayakatense* fructibus indumento vestitis et stipitibus monocarpiis brevioribus differt. A *C. gracilipes* pedicellis brevioribus differt.

**Tree**, c. 10 m tall; young twigs and petioles sparsely (axillary buds densely) covered with appressed golden hairs c. 0.1 mm long. **Leaves:** petioles 4-7 mm long, 1-2 mm diam.; lamina narrowly elliptic, 12-22 by 4-8 cm (leaf index 2.7-3), chartaceous, grey-yellow green above, light brown or yellowish green below, glabrous on both sides, base cordate to subcordate, apex shortly acuminate (acumen 8-10 mm long), extreme tip obtuse, primary vein raised over entire leaf length, 1-1.5 mm wide at widest point, glabrous, secondary veins 7-12, intersecondary veins occasional, distance between from 2-5 mm at the base to 15-25(35) mm closer to the apex, angles with primary vein from 90-80° at the base to 60-50° closer to the apex, forming distinct loops, smallest distance between loops and margin 2-5 mm, tertiary veins more or less percurrent. **Inflorescence** of single flowers, axillary; short axillary shoot, c. 2 mm long, c. 2 mm diam. (in fruit); pedicels c. 8 mm long, c. 2 mm diam. at the base, c. 2.5 mm diam. at the apex (in fruit), short axillary shoot and pedicels sparsely covered with appressed golden hairs c. 0.1 mm long; 2 lower bracts, caducous; upper bract attached midway along pedicel, caducous; flowers not observed. **Monocarps** 8-10, blackish brown in sicco, ellipsoid, asymmetric, 14-15 mm long, 9-11 mm diam., apicule excentric, rather densely covered with appressed golden hairs c. 0.1 mm long; stipes 7-8 mm long, c. 1.5 mm diam., rather densely covered with appressed golden hairs c. 0.1 mm long; fruiting receptacle depressed ovoid, 4-7 mm diam., rather densely covered with appressed golden hairs c. 0.1 mm long. **Seeds** ellipsoid, golden brown shallowly wrinkled (immature), c. 12 mm long, c. 7 mm diam., raphe sunken, encircling seed longitudinally, rumination unobserved.

**Distribution:** *C. cenepense* has, to our knowledge, only been collected in the Condorcanqui Province of Amazonas in Peru, in the area of the Cenepa River, a tributary of the River Marañón.

### Other specimens examined:

**PERU: Amazonas, Prov. Condorcanqui:** Río Cenepa region, Quebrada Nahem, 15 Jul 1974 (fr), *Kayap, R. 1078* (U); Río Cenepa region, community Mamayaque, 9 Aug 1997 (fr), *Rojas, R.; et al. 255* (HUT, MO, U, USM).

**Notes :** *C. cenepense* is similar to *C. yamayakatense*, also described here, and therefore also to *C. gracilipes* (see above). It differs in the shape of the leaf base (cordate or subcordate as opposed to acute in *C. yamayakatense* and *C. gracilipes*), the indument on the fruits (rather dense as opposed to almost always absent in *C. yamayakatense*), and lengths of the pedicel (shorter than that of *C. gracilipes*) and stipes (shorter than those of *C. yamayakatense*).

**Etymology :** This species is named after the Cenepa River, in the area of which it has been collected.

### Acknowledgements

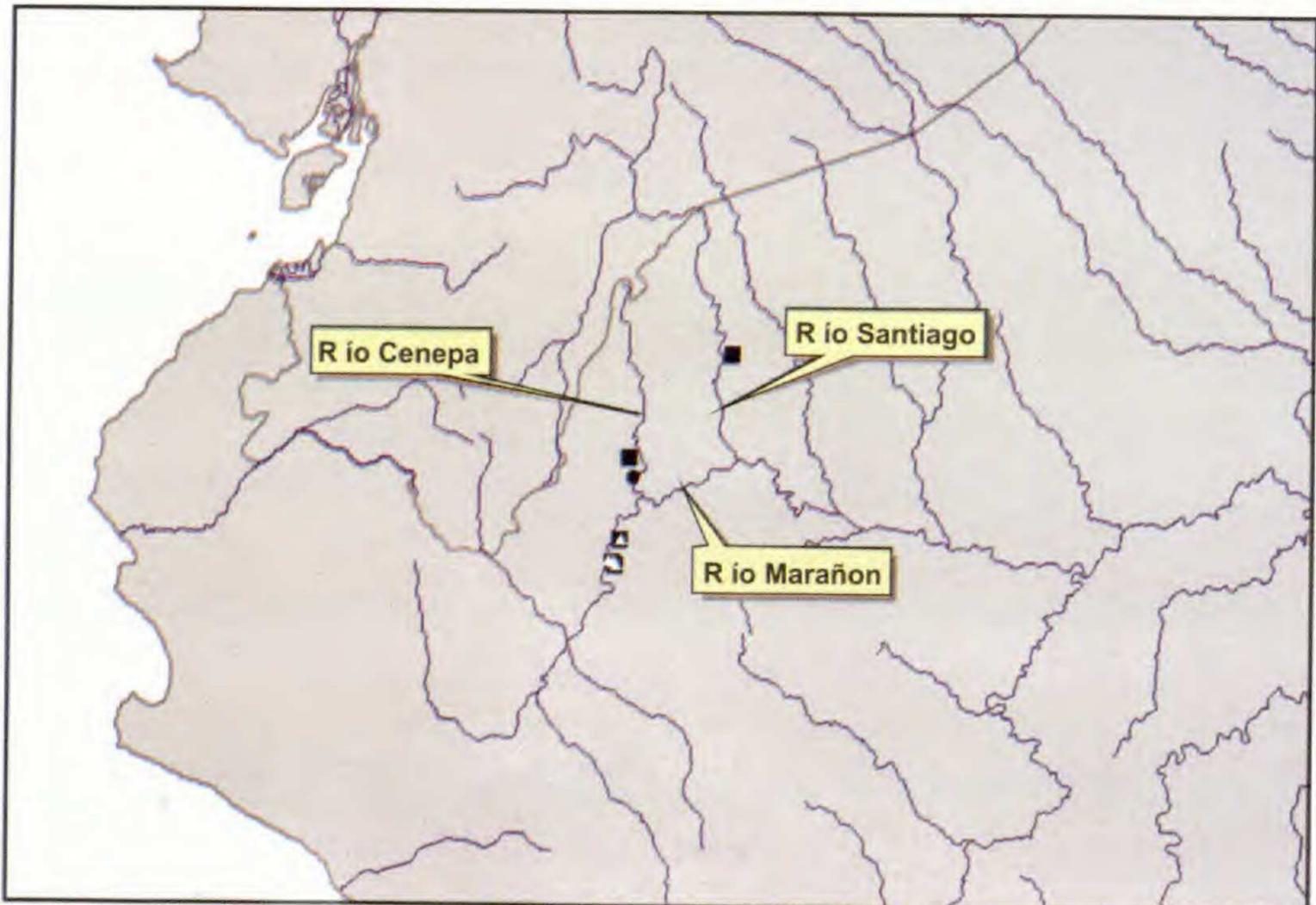
Two MSc students from the University of Wageningen, the Netherlands; Marleen Botermans and Robin van Velzen, accompanied MDP in Peru: their assistance ensured the success of the expedition. MB and RvV were supported through grants from the 'Stichting Levenswetenschappen' (grant 805-40.201) and the 'Miquel Fonds'; MB, RvV and MDP by grants from the 'Alberta Mennega Stichting', and the expedition was further financed by the Utrecht University branch of the National Herbarium of the Netherlands. The help of a number of people in Peru during the field expedition is gratefully acknowledged: the staff of the Museo de Historia Natural (Universidad Nacional Mayor de San Marcos, Lima), especially Magda Chanco Estela, Oscar Tovar Serpa, Asunción Cano Echevarria, Hamilton Beltrán Santiago and Haydee Montoya Terreros; the staff of the Jardín Botánico de Missouri, Oxapampa, Peru, especially Rocío del Pilar Rojas Gonzales; Abundio Sagástegui Alva (Universidad Privada Antenor Orrego, Trujillo); the staff of the Herbarium Truxillense, Trujillo, in particular Eric F. Rodríguez Rodríguez and Victor Medina Ibañez; and the people of the Comunidad Aguaruna de Yamayakat, Imaza, especially Apu Efrain Wisum Yagkug, Ricardo Apanú Nampin, and Julio Saan Kasen. The herbarium curators of HUT, MO, and USM are acknowledged for the loan of collections. Maps were produced using ESRI data made available by the New York Botanical Garden's 'Digital Basemap of the Americas'. Paul J. M. Maas gave valuable comment on the descriptions and Lubbert Y. Th. Westra translated the Latin diagnoses.

## Literature cited

- Fries, R.E. 1930.** Revision der Arten einiger Anonaceen-Gattungen I. Acta Horti Berg. 10: 1-128.
- \_\_\_\_\_. **1934.** Revision der Arten einiger Anonaceen-Gattungen. Acta Horti Berg. 12: 203-207.
- Gentry, A. H. 1982.** Neotropical floristic diversity: phytogeographical connections between Central and South America, Pleistocene climatic fluctuations, or an accident of the Andean Orogeny? Ann. Missouri Bot. Gard. 69: 557-593.
- Myers, N., C.G. Mittermaier, G. A. B. da Fonseca, & J. Kent. 2000.** Biodiversity hotspots for conservation priorities. Nature 403: 853-858.
- Pirie, M.D., L.W. Chatrou, R. H. J. Erkens, J. W. Maas, T. van der Niet, J. B. Mols, & J. E. Richardson. In Press.** Phylogeny reconstruction and molecular dating in four Neotropical genera of Annonaceae: the effect of taxon sampling in age estimations in Plant species-level systematics: new perspectives on pattern and process (Bakker, F.T., L. W. Chatrou, B. Gravendeel, and P. B. Pelsner, eds.) Regnum Vegetabile 142, Koeltz, Vienna, pp. 149-174.



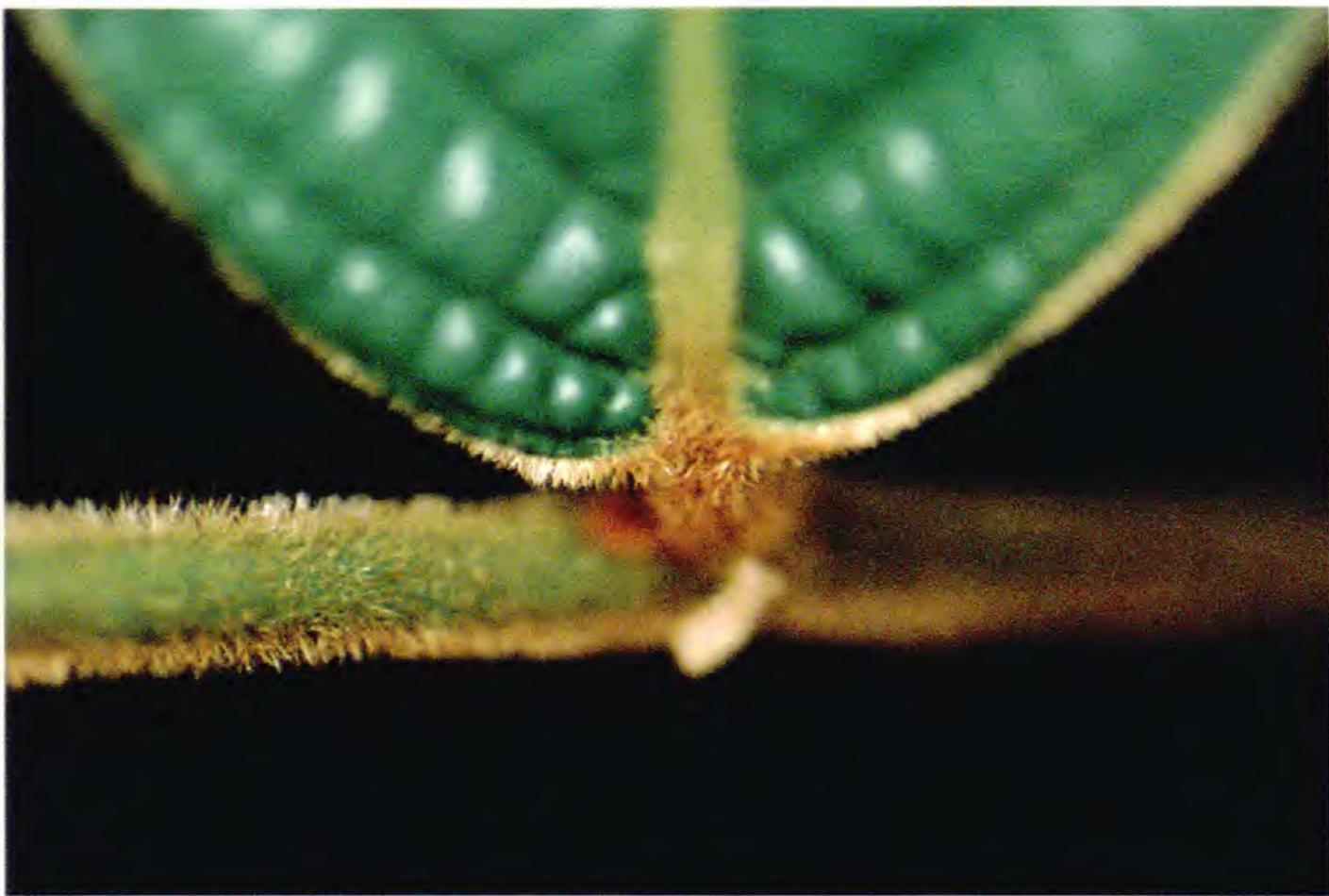
**Fig 1:** Department of Amazonas in Peru. Distributions of all three species are denoted by black circles.



**Fig 2:** Detail of Marañón basin in Amazonas. Distributions of *C. bullatum* Pirie denoted by white triangles, *C. yamayakatense* Pirie by black squares and *C. cenepense* Pirie & Zapata by black circles.



**Fig 3:** *C. bullatum* Pirie: habit (Pirie & al. 94)



**Fig 4:** *C. bullatum* Pirie: leaf detail, illustrating bubbled appearance, cordate base, and long indumenta, particularly around the margin (Pirie & al. 94)



Fig 5: *C. bullatum* Pirie: flower, at anthesis, illustrating orange patch on outer petals



Fig 6: *C. yamayakatense* Pirie: flower bud (Pirie & al. 57)



Fig 7: *C. yamayakatense* Pirie: habit and fruit (Pirie & al. 58)



Fig 8: *C. yamayakatense* Pirie: ripe fruit, illustrating colour change in monocarps and thickening of stipes (Pirie & al. 60)

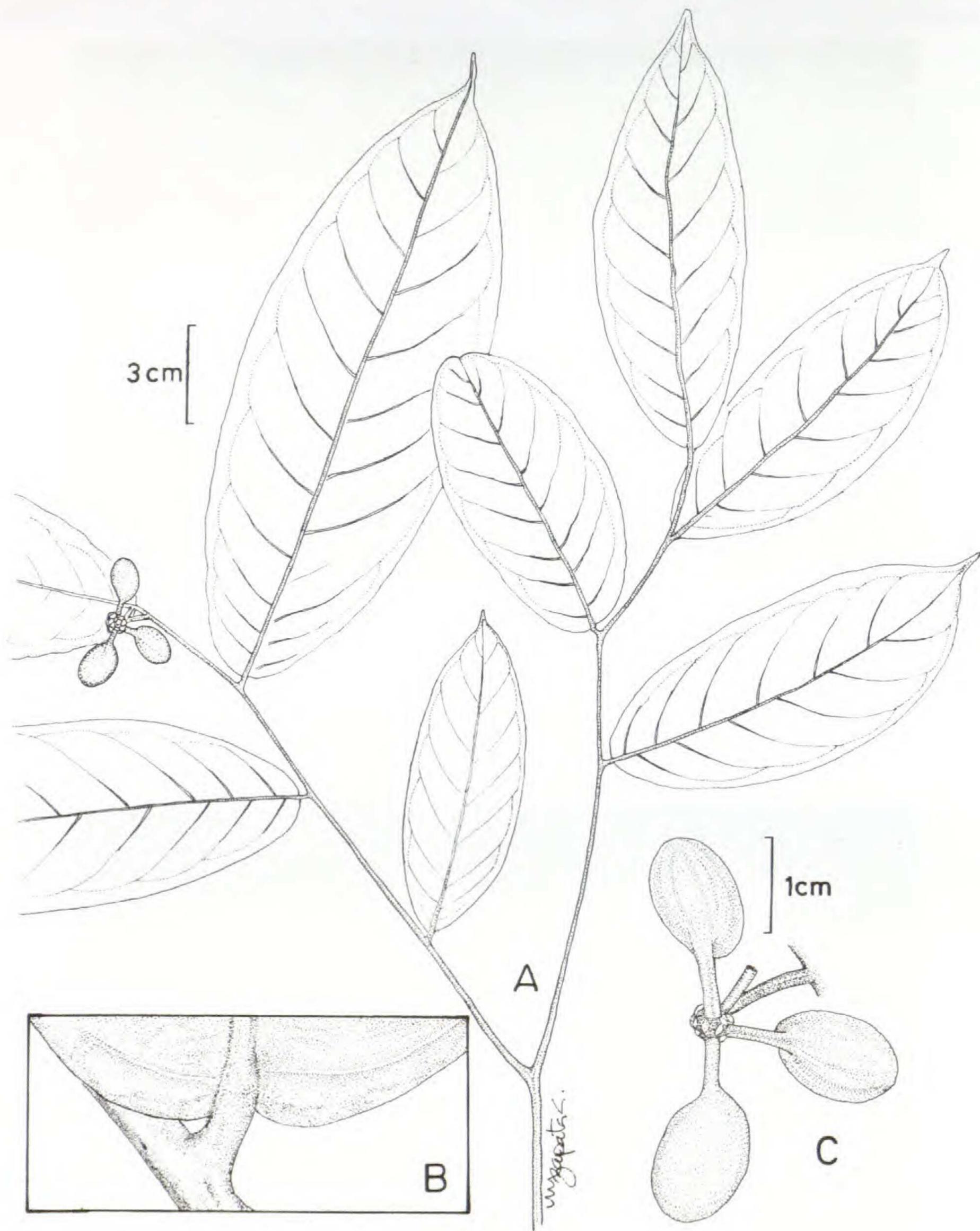


Fig 9: *C. cenepense* Pirie & Zapata (illustration M. Zapata. A,C: Rojas 269; B: Kayap 1068)