

## Distribution and phenology of *Bomarea* (Alstroemeriaceae) in the relict forests of northwestern Peru

### Distribución y fenología de *Bomarea* (Alstroemeriaceae) en los bosques relictos de la vertientes noroccidentales del Perú

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#### Abstract

The distribution, phenology and diversity of *Bomarea* in the relict forests of northwestern Peru is discussed and compared to the cloud forests of the eastern slope of the Andes. Most species of subgenus *Bomarea* and all species of subgenus *Sphaerine* have southernmost distribution limit in the Cordillera Occidental in the relict forests of NW Peru. The phenology of some species of *Bomarea* species differs between the relict forests and the eastern slopes of the Andes, whereas no differences are observed in *Sphaerine*.

**Keywords:** *Bomarea*, phenology, Peru, relict forests, Amotape-Huancabamba Zone.

#### Resumen

Se discute la distribución, fenología y diversidad de *Bomarea* en los bosques relictos de las vertientes occidentales del norte del Perú, y compara con las especies presentes en los bosques nublados de las vertientes orientales. Se considera que los bosques relictos son el límite de distribución meridional en la Cordillera Occidental para el subgénero *Bomarea* s.str., con pocas excepciones y para el subgénero *Sphaerine*. La fenología de una parte de las especies de *Bomarea* s. str., es diferente en las vertientes occidentales y orientales; sin embargo, para las especies de *Sphaerine*, no se encontraron tales diferencias.

**Palabras clave:** *Bomarea*, fenología, Perú, bosques relictos, región Amotape-Huancabamba.

#### Introduction

The genus *Bomarea* (Alstroemeriaceae) is largely restricted to the American Cordillera. Its representatives are found from near sea-level to 5200 m in most vegetation types ranging from rain forests to semidesert and from open habitats to the deep shadow of the cloud forests understorey.

The genus *Bomarea* is subdivided into four subgenera and various informal «species groups» (Hofreiter & Tillich, 2002): subg.

*Baccata* (3 spp.), subg. *Bomarea* (ca. 70 spp.), subg. *Sphaerine* (12 spp.) and subg. *Wichuraea* (18 spp.). Subgenera *Bomarea*, *Sphaerine* and *Wichuraea* have their centres of diversity in Peru, only subgenus *Baccata*, a group of large lowland lianas, is absent from the country. Species of subgen. *Wichuraea* grow mostly in open habitats in puna and jalca and their distribution patterns are essentially identical on the western and the eastern Cordillera (Hofreiter & Tillich, 2003). Species of subgen. *Sphaerine* are found both in páramo and cloud forest habitats, but are restricted to the understorey of cloud forests in northern Peru. Species of subg. *Bomarea* are mostly climbers from the edges of cloud forests.

Whereas many species of *Bomarea* flower more or less throughout the year, there are other taxa which have a certain flowering period,

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which is usually dictated by the rainy season. In the northwestern Peru most precipitation falls between December and April, but the rainy season can extend into May, especially in the wetter relict forests (e.g., Monte Seco).

There are several species of this genus in the relict forests of northwestern Peru and the present article deals with their distribution, affinities and phenology.

## Material and methods

For this study several hundred herbarium specimen of more than 20 herbaria have been studied. (Appendix 1; the acronyms of the herbaria follow Holmgren et al. 1990). Additional the plant were studied in the field, between October 2004 and June 2005 various relict forests were examined (see Table 1). Additional, material was conserved in alcohol or FAA to study the flower and trichome structure in detail. The distribution and phenology of 10 *Bomarea* species who are restricted to the relict forest of the Amotape-Huancabamba-region according to Weigend (2002, 2004) is presented and discussed.

## Distribution Patterns

In northwestern Peru both subgenera (*Bomarea* and *Sphaerine*) are restricted to relict forests with one exception in *Bomarea* s.str. (*B. ovata*). Both subgenera reach their southern distribution limit in the western Cordillera in northwestern Peru, with some exceptions in *Bomarea* s.str. (*B. ovata* in the western Cordillera of central and southern Peru and *B. ovallei* and *B. salsilla* in Chile). In the relict forests occur 10 *Bomarea* s.str. species (Table 1). They are members of 3 different groups: *Edulis* group (*B. campanularia*, *B. cf. cornuta* and *B. tribrachiata*), *Goniocaulon* group (*B. angulata*, *B. goniocaulon* and *B. multipes*) and *Multiflora* group (*B. densiflora*, *B. dissitifolia*, *B. setacea* and *B. superba*). The *Multiflora* group is distributed from Mexico to Bolivia and all species are restricted to cloud forests. In northwestern Peru the species of

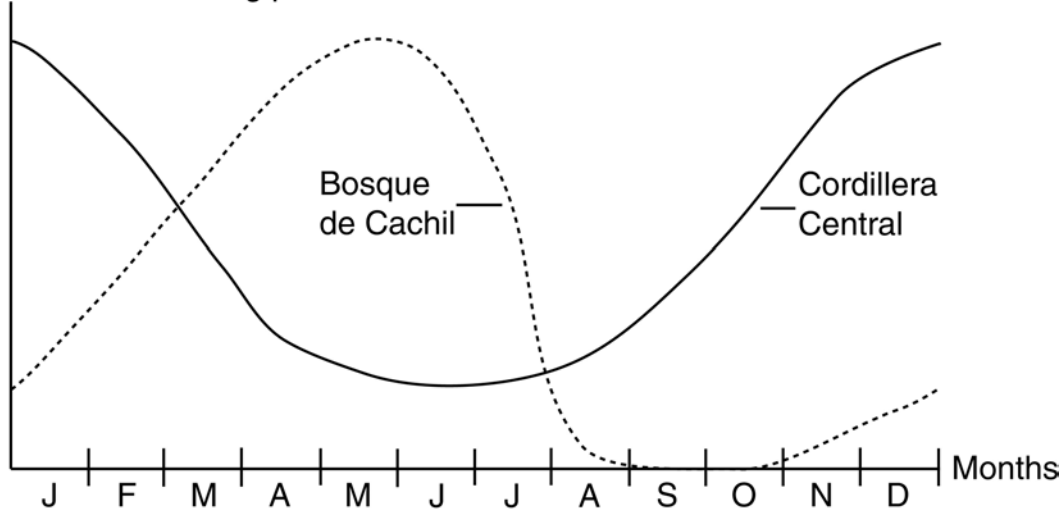
this group occur reach south to San Miguel (Province San Miguel, Department Cajamarca). In the Bosque de Cutervo there are five typical cloud forest species, all four species of the *Multiflora* group and *B. distichifolia* of subg. *Sphaerine*, all these species are absent from the Bosque de Cachil (Province Contumazá, Department Cajamarca) and further south. Some species of the *Multiflora* group are restricted to the eastern slopes of the western Amotape-Huancabamba Zone (west of the Marañón valley): Thus one species of the *B. setacea* complex is very abundant in Cutervo, but no species of this group is found in the Bosque de Monte Seco. *B. distichifolia* (*Sphaerine*) occurs on the eastern side of the Andes from southern Ecuador to central Bolivia and on the western slopes finds its southern limit in the Bosque de Monte Seco (Department Cajamarca).

Both *B. distichifolia* and the species of the *Multiflora* group have their centres of diversity in the cloud forests of the Cordillera Oriental: In the eastern cloud forests at least 4 *Multiflora* species and 5 *Sphaerine* species occur which are found not in the relict forests. In the relict forests these groups appear to have relict populations and are there restricted to the wettest forests. Many typical cloud forest species and species groups of *Bomarea* are completely absent from the northwest Peruvian relict forests: *B. pardina* is distributed in lower cloud forests from southern Colombia to southern Peru. Its westernmost known population is in the cloud forests of Tabaconas (Province Jaén, Department Cajamarca). There is also a group of undescribed species with pendent red or orange flowers, aberrantly actinomorphic flowers and an umbel as inflorescence which are restricted to the cloud forests of the eastern Amotape-Huancabamba Zone. *B. tribrachiata* is endemic in the western relict forests. The closest relatives of this species are the widely distributed species of the *Edulis* group. *B. cf. cornuta* is very similar to the wide distributed *B. ovata*.

**Table 1.** Characteristics of the species of *Bomarea* of the relict forest of northwestern Peru.

Subgenus	Species Group	Species	Distribution	Relict Forests	General Distribution	Relict Forests	Flowering Time	Elsewhere
<i>Bomarea</i>	<i>Goniocaulon</i>	<i>angulata</i>	<b>San Andrés</b> (Cutervo)	Amotape-Huancabamba Zone (Ecuador, Peru)	June-July	all year, peak at the end of the dry season		
<i>Bomarea</i>	<i>Goniocaulon</i>	<i>goniocaulon</i>	<b>Agua Blanca</b> (San Miguel)	N Peru, Ecuador	End of the rainy season	End of the dry season		
<i>Bomarea</i>	<i>Goniocaulon</i>	<i>multipes</i>	<b>Cachil</b> (Contumazá)	N Peru Ecuador	End of the rainy season	End of the dry season		
<i>Bomarea</i>	<i>Edulis</i>	<i>campanularia</i>	<b>Chorro Blanco</b> (Huancabamba)	NW Peru, W Ecuador	April-June	April-June		
<i>Bomarea</i>	<i>Edulis</i>	<i>cf. cornuta</i>	<b>Cachil</b> (Contumazá)	NW Peru (Cajamarca, La Libertad)	<b>April-May</b>	<b>September</b>		
<i>Bomarea</i>	<i>Edulis</i>	<i>ovata</i>	<b>Cachil</b> (Contumaza)	Peru, Bolivia, northern Argentina	End of the rainy season	all year, peak at the end of the rainy season, in the lomas: September-December		
<i>Bomarea</i>	<i>Edulis</i>	<i>tribrachiatata</i>	<b>Cachil</b> (Contumazá)	NW Peru, SW Ecuador	End of the rainy season	End of the rainy season		
			<b>Huranchal</b> (Otuzco)					
<i>Bomarea</i>	<i>Multiflora</i>	<i>densiflora</i>	<b>Cuyas</b> (Ayabaca)	N Peru, Ecuador	All year, less in May-July	All year, less in May-July		
			<b>El Pargo</b> (Chota)					
			<b>Montesecco</b> (Santa Cruz)					
			<b>Tongod</b> (San Miguel)					
			<b>Chinama</b> (Feirreñafe)					
			<b>Cuyas</b> (Ayabaca)					
<i>Bomarea</i>	<i>Multiflora</i>	<i>dissitifolia</i>	<b>San Andrés</b> (Cutervo)	N Peru, Ecuador	September-December	September-December		
			<b>Tongod</b> (San Miguel)					
<i>Bomarea</i>	<i>Multiflora</i>	<i>setacea</i>	<b>San Andrés</b> (Cutervo)	Peru, Colombia, Ecuador	All year, less in May-July	All year, less in May-July		
			<b>Agua Blanca</b> (San Miguel)	Amotape-Huancabamba Zone (N Peru)	All year	All year		
<i>Bomarea</i>	<i>Multiflora</i>	<i>superba</i>	<b>San Andrés</b> (Cutervo)	Peru, Colombia, Ecuador	All year	All year		
<i>Bomarea</i>	<i>Pardina</i>	<i>pardina</i>	<b>Tabaconas</b> (San Ignacio)	Peru, Ecuador, Bolivia	All year	All year		
<i>Sphaerine</i>	<i>Distichifolia</i>	<i>distichifolia</i>	<b>San Andrés</b> (Cutervo)		All year	All year		
			<b>Montesecco</b> (Santa Cruz)					

Number of flowering plants



**Figure 1.** Comparison of the phenology in the time between the species of *Bomarea* of the relict forests of northwestern (e.g. Bosque de Cachil, Prov. Contumazá, Depto. Cajamarca) and eastern slopes of Peru.

Weigend (2004) roughly groups the plant species of the relict forests into four distributional types: 1. Species typical for the forest of western Ecuador, 2. species typical for the eastern cloud forests, 3. species which its next relatives occur in open habitats and 4. old groups which occur only in the relict cloud forests.

*B. campanularia* is a member of the first group, *B. distichifolia* and the *Multiflora* group are members of the second group and *B. cf. cornuta* and *B. tribrachiata* are members of the third group. The species of the *Goniocaulon* group fit best in the third group, but they are not different enough to be classified as different species.

**Phenology**

The ecology of some of the species of the subg. *Bomarea* on the western and eastern side of the Andes is very different. The twining species on the eastern slopes are evergreen and they have their peak in flowering at the end of the dry season and the beginning of the rainy season (September—October, December), but individual flowering plants can be found nearly the all around the year, with little flowering in May—July (Table 1). In the relict

forest of Contumazá the plants of subg. *Bomarea* are completely dry at the end of the dry season and their peak flowering period is at the end of the rainy season in May—June (Fig. 1).

The species of the *Multiflora* group have also in the relict forest their peak in flowering at the end of the dry season or are flowering the whole year around, but they only occur in the wetter northern part. Other species like *B. tribrachiata* (*Edulis* group) flower at the end of the rainy season in the whole area. So we can distinguish 3 different forests in northern Peru according to the phenology of *Bomarea*. The wet cloud forests were all species have their peak in flowering at the end of the dry season and the beginning of the wet season, the relict forests in Piura and the northern half of Cajamarca, where the *Multiflora* group has its peak at the end of the dry season and the beginning of the wet season and the other species of *Bomarea* flower at the end of the rainy season, and the relict forest in southern Cajamarca and La Libertad were all species flower at the end of the wet season. *B. distichifolia* (*Sphaerine*) flowers in the eastern and the western cordi-

http://sisbib.unmsm.edu.pe/BVRevistas/biologia/biologiaNEW.htm

llera the whole year around. It only occurs in permanently wet cloud forests.

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## Appendix 1. List of *Bomarea* specimens seen from northwestern Peru.

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### *B. angulata* Benth.

Pl. Hartw.: 156. 1845. Figure 2a - Holotype: Ecuador, Prov. Loja, Chuquiribamba, *Hartweg s.n.* (K!).

**Material examined:** Depto. Cajamarca, Prov. Cajamarca, Chotén, 2800-2850 m, 11.02.1987, *Sánchez Vega 4208* (MO); Prov. Chota, Chota to Tacabamba, 2800 m, 19.02.1983 *Smith & Vasquez 3541* (NY); Prov. San Miguel, Agua Blanca, Tingo, 2750 m, 12.05.1977, *Sagástegui et al. 8807* (F, NY); Prov. Contumazá, Cascabamba above Contumazá, 3100 m, 12.06.1981, *Sagástegui et al. 10022* (MO, NY). - Depto. Lambayeque, Prov. Ferreñafe, Dist. Incahuasi, Sinchigual, 2650 m, 11.09.1985,

*Sagástegui et al. 12759* (MO, NY); Prov. Ferreñafe, Dist. Incahuasi, Huasicaj, 3200 m, *Quiroz 1334* (F); Prov. Ferreñafe, Bosque de Chinama, 2500-2600 m, 23.08.1988, *Cano 2157* (MO); Prov. Ferreñafe, Uyurpampa, 2850 m, 12.12.1992, *Quiroz 3208* (F, MO); - Depto. Piura, Huancabamba, 3000 m, 1.07.1948, *Scolnik 1406* (MO); Prov. Huancabamba, Cerro la Viuda, 2300 m, 21.07.1975, *Sagástegui et al. 8220* (MO).

**Phenology:** *B. angulata* flowers the year around with peak at the end of the rainy season, in the Bosque de Cachil it is completely dry at the end of the dry season.

***B. campanularia*** Harling & Neuendorf,

Fl. Ecuador 71: 33—35. 2003. - Holotype: Ecuador, Prov. Loja, Almor-Celica road, 1400—1500 m, *Harling & Andersson 17934* (GB).

**Material examined:** Depto. Piura, Prov. Huancabamba, Canchaque, Chorro Blanco, 1250 m, 5.04.1939, *Stork 11402* (G, GH, K); Prov. Huancabamba, above Palambra, 1500—1600 m, *Ferreira 10844* (USM).

**Phenology:** *B. campanularia* seems to flowers only at the end of the rainy season.

***B. cf. cornuta spec. nov. ined.***

**Material examined:** Depto. Cajamarca, Prov. Contumazá, El Molino (Cascas – Contumazá), 1800 m, 4.04.1985, *Sagástegui et al. 12553* (HUT, MO, NY); Prov. Contumazá, Las Chirimoyas, 1400 m, 20.04.1984, *Sagástegui 11402* (HUT, MO); Prov. Contumazá, Cascas, 1845-1900 m, 14.04.1986, *Dillon et al 4500* (F); Prov. Contumazá, Cerro Chungarrán, 2700 m, 24.05.1978, *Sagástegui & Mostacero 9175* (HUT, MO); Prov. Contumazá, Bosque de Cachil, 2410 m, 16.04.1992, *Sagástegui et al. 14546* (F, HAO); Depto. La Libertad, Lomas de Virú, 550 m, Sept. 1945 *Lopez 382* (USM); Prov. Otuzco, near Sinsicap, 1300 m, 22.04.1995, *Sagástegui et al. 15656* (F, HAO).

**Phenology:** *B. cf. cornuta* flowers in the lomas in September, in the relict forests at the end of the rainy season.

***B. densiflora*** Herb.

Amaryllidaceae 399. 1837. - Holotype: Peru, Depto. Amazonas, *Mathews 1667* (K!).

**Material examined:** Depto. Cajamarca, Prov. Chota, below Las Palmas, 2750 m, 18.04.1993, *Dillon et al. 6393* (F, MO); Prov. Chota, below Las Palmas, 2750 m, 18.04.1993, *Dillon et al. 6393* (F, MO); Prov. Chota, road Querocoto-La Granja, near Paraguay, 2500 m, 8.08.1994, *Leiva et al. 1412* (F); Prov. Chota, La Paccha, Rejopampa, 2450 m, *Cabanillas 743* (F); Prov. Chota, Bosque El Pargo, above Huarimarca, 18.03.1997, *Sagástegui et al. 16002* (F); Prov. Chota, road Chota-Tacabamba, 2800 m, 2800 m, 19.02.1983, *Smith & Vásquez 3564* (F, MO); Prov. Santa Cruz, Bosque de Montesecco, 1600 m, *Leiva & Lezama 929* (F); Prov. San Miguel, Niepos, camino a Lanchez, 2500 m, 1.11.1985, *Llatas 1569* (F); Prov. San Miguel, near Quellahorco, Tongod, 2650 m, 14.09.1991, *Sánchez & Briones 5781* (F); Prov. San Miguel, above Agua Blanca, Cerro Guion, 3320-3500 m, 14.10.2000, *Weigend et al. 2000/737* (HUT, MSB);

Depto. La Libertad, Prov. Ferreñafe, Bosque de Chinama, 2500-2600 m, 23.08.1988, *Cano 2116* (MO); Depto. Piura, Prov. Ayabaca, Bosque Cuyas, 2480 m, 21.09. 1996, *Leiva & Quipuzcoa 1869* (F).

**Phenology:** *B. densiflora* flowers at the western and the eastern slopes the whole year around less in May, June and July.

***B. dissitifolia*** Baker

J. Bot. 20: 203. 1882. - Holotype: Ecuador, Tambo de Vanilla, 2800 m, *Andre 4522 bis* (K!).

**Material examined:** Depto. Cajamarca, Prov. Cutervo, Socota-Tambillo, 3000-3200 m, 14.12.1938, *Stork & Horton 10188* (F); Prov. Cutervo, La Pucarilla, 2350-2500 m, 15.10.1987, *Sánchez 4552* (F); Prov. San Miguel, Bosque Quellahorco, Tongod, 2700 m, 14.09.1991, *Sánchez & Briones 5797* (F, MO, NY).

**Phenology:** *B. dissitifolia* was so far only found flowering between September and December.

***B. distichifolia*** (Ruiz & Pav.) Baker

J. Bot. 20: 202. 1882. Figure 2b

**Basionym:** *Alstroemeria distichifolia* Ruiz & Pav., Fl. Peruv. Chil. 3: 1802. - Type: Peru, Dep. Huánuco, Muña, *Ruiz & Pavón s.n.* (holotype MA!, isotype K!).

**Material examined:** Depto. Cajamarca, Prov. Cutervo, San Andrés, 2200 m, 25.05.1965, *López & Sagástegui 5441* (HUT, MO, MSB); San Andrés, 2600 m, 10.08.1987, *Díaz & Osoreo 2588* (MO, NY); San Andrés, 2550 m, 11.01.1990, *Díaz et al. 3925* (MO); Grutas de San Andrés, 2200 m, 15.7.1990, *Llatas & Suárez 2731* (HAO); Alrededores Gruta San Andrés, 2460 m, 15.11.1986, *Mostacero et al. 1681* (HUT); San Andrés, 2200 m, 25.06.1989, *Sánchez 4885* (F); Prov. Santa Cruz, Dist. Catache, Upper Rio Zaña valley, 1800 m, *Dillon et al. 4885* (F, HUT, NY); Dist. Catache, upper Rio Zaña valley, 1500-2000 m, 16-18.03.1986 *Dillon et al. 4384* (F, MO, NY); Dist. Catache, Bosque de Montesecco, 1600 m, 10.10.1993, *Leiva & Lezama s.n.* (F); Bosque de Montesecco, 1800 m, 9.05.1987, *Santisteban & Guevara s.n.* (F, MO); Bosque de Montesecco, 1880 m, 20.01.1996, *Leiva et al. 1749* (HUT, F, HAO); Prov. Jaen, above Tabaconas, 2600—2800 m, 12.06.1947, *Fosberg 27802* (US); Prov. Jaen, Colasay, 2100 m, 21.02.1985, 5 58 S, 79 03 W, *Stein & Todzia 2237* (USM). Specimen of the figure 2B: Depto. Pasco, Prov. Oxapampa, road to cumbre de estación telefónica, 2500 m, Sept. 2002, *Hofreiter & Kóbele s.n.* (MSB).

**Phenology:** *B. distichifolia* flowers the year around.

***B. goniocaulon*, Baker**

J. Bot. 20: 204. 1882. - Type: Ecuador, Prov. Pichincha, Cerro Corazón, 2500 m, *André 3646* (holotype K!, isotype NY).

**Material examined:** Depto. Cajamarca, Prov. San Miguel, El Tingo, Dist. Unión Agua Blanca, 3200 m, 17.2.2000, *Rodríguez et al. 2316* (F, HUT, M, MO) Depto. Cajamarca: Prov. Cajamarca, 43 km east of Cajamarca, 27 km north of San Marcos, 2765 m, 11.01.1983, *Dillon et al. 2859* (US); carretera entre Cajamarca y Celendín, 2950-3500 m, 18.10.1986, *Díaz 2178* (MO); Prov. Contumazá, Hacienda Lledén, 2500 m, *Leiva et al. 1948* (F); Prov. Contumazá, 2700 m, 24.04.1966, *Sagástegui & Fukushima 6101* (MSB); Dep. La Libertad, Prov. Otuzco, Usquil, 3000-3100 m, 10.06.1950, *Ferreira 7665* (USM).

**Phenology:** *B. goniocaulon* flowers on western slopes at the end of the rainy season, at eastern at the end of the dry season/the beginning of the rainy season.

***B. multipes* Benth.**

Pl. Hartw.: 156. 1845. - Holotype: Ecuador, Prov. Loja, Chuquiribamba, 1841, *Hartweg 854* (K!).

**Material examined:** Depto. Cajamarca, Prov. Contumazá, Cascabamba, 2700 m, 12.06.1981, *Sagástegui et al. 9995* (MO, NY); Prov. Contumazá, Cascas, 2550 m, *Lopéz & Sagástegui 7659* (NY).

**Phenology:** *B. multipes* flowers on western slopes at the end of the rainy season, at eastern at the end of the dry season/the beginning of the rainy season.

***B. ovata* (Cav.) Mirb.**

Hist. Nat. 72. 1804.

**Basionym:** *Alstroemeria ovata* Cav., Icon. 1(2): 54. 1791. - Holotype: habit. Peru. h R M (MA, photo BM!, F!).

**Material examined:** Depto. Cajamarca: Prov. Contumazá, Guzmango, 2400 m, *Sagástegui 12723b* (MO); Prov. Contumazá, Cascas, 1835-1900 m, *Dillon et al. 4501* (F); Prov. Santa Cruz, Montesecco, 1550 m, *Santisteban & Guevara 0191* (F); Prov. Celendín, Sucre, Quintanilla, 3000 m, *Chamán s.n.* (NY).

**Phenology:** *B. ovata* flowers in the lomas mostly in September, October and November, in the other areas the peak of flowering is at the end of the rainy season.

***B. pardina* Herb.**

Amaryllidaceae 120. 1837. - Holotype: Ecuador, Prov. Pichincha, Patacocha, 1800 m, *Hall 19* (K!).

**Material examined:** Depto. Cajamarca: Prov. San Ignacio, San José de Lourdes, 2210 m, 28.10.1995, *Díaz & Torres 7784* (USM); Caserío Santo Tomás, 2270 m, 31.10.1995. *Rodríguez 686* (HUT, MO)

**Phenology:** *B. pardina* flowers the whole year around.

***B. setacea* (Ruiz & Pav.) Herb.**

Amaryllidaceae 117. 1837. Figure 2c.

**Basionym:** *Alstroemeria setacea* Ruiz & Pavón, Fl. Peruv. Chil. 3: 62. 1802. - Type: Peru, Pillao, *Ruiz & Pavón s.n.* (holotype MA! photo F!, isotypes BM!, G photo F!, Barcelona photo B!).

**Material examined:** Depto. Cajamarca, Prov. Cutervo, Socota-Tambillo, 3100 m, 14.12.1938, *Stork & Horton 10187* (F, G, K); Dep. Piura, Prov. Huancabamba, Huancabamba-Tabaconas, 2600 m, 18.5.1998, *Weigend & Dostert 98/227* (M, USM). Specimen of the Figure 2C: Depto. Huánuco, Tantamayo, Laguna Negra, 3800 m, Oct. 1999, *Hofreiter & Franke 4/11* (USM).

**Phenology:** *B. setacea* flowers at the western and the eastern slopes the whole year around less in May, June and July.

***B. superba* Herb.**

Amaryllidaceae 117. 1837. - Holotype: Peru, Mathews 1663 (K!).

**Material examined:** Depto. Cajamarca, Prov. San Miguel, above Agua Blanca, Tingo, 3084 m, 14.10.2000, *Weigend et al. 2000/730* (HUT, MSB); Prov. Cutervo, al Norte de San Andrés, 2200 m, *Sánchez Vega & Miranda 6315* (MO); Prov. Cutervo, San Andrés, 2100 m, *Llantas 2721* (F); Prov. San Miguel, Niepos, 2200 m, *Llantas 1524* (F).

**Phenology:** *B. superba* flowers on western and eastern slopes the whole year around.

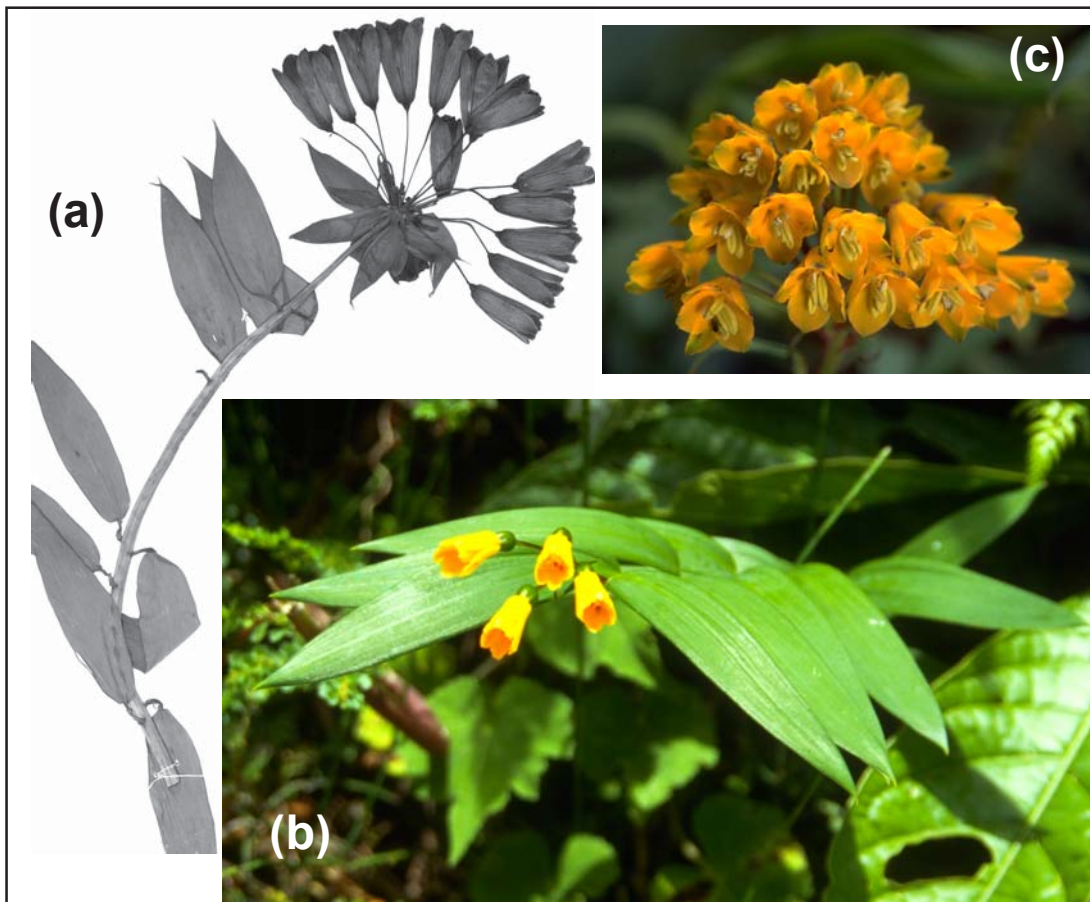
***B. tribrachiata*** Kraenzl.

Bot. Jahrb. Syst. 40: 235. 1908. Holotype: Peru, Dep. Ancash, Cajatambo, between Tallanga and Piscapaccha, 3600-3800 m, *Weberbauer 2884* (B!).

**Material examined:** Depto. Cajamarca, Prov. Contumazá, Guzmango, 2900 m, *Sagástegui 3931* (MSB); Prov. Contumazá, Bosque Cachil, 2400 m,

*Dillon et al. 6510* (F, MO); Prov. San Miguel, Lives-Payac, 1850 m, *Sagástegui et al. 8790* (F); Depto. La Libertad, Prov. Otuzco, Huaranchal, 2750 m, *López et al. 2654* (MSB); Dep. Piura: Prov. Ayabaca, Yacupampa-Cuyas, 2500 m, 26.05.1971, *López et al. 7755* (HUT, NY).

**Phenology:** all *B. tribrachiata* so far examined flower at the end of rainy, the beginning of the dry season.



**Figure 2.** (a) *Bomarea angulata* (*Sánchez Vega 4208* (MO)). (b) *B. distichifolia* (*Hofreiter & Köbele s.n.* (MSB)). (c) *B. setacea* (*Hofreiter & Franke 4/11* (USM))