

## How many bean species are in Costa Rica today?

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While the common bean has been key to the daily intake of proteins for the Costa Rican people for millennia (Pittier 1978), answering the above question is not straightforward, although important for Costa Rica as a nation for effective sovereignty. Table 1 shows the progress of floristic knowledge for the genus *Phaseolus* over time and it is not sure that the number of species can now be claimed final. Between the two comprehensive reviews of the legume family for Costa Rica (that of 1937 and of 2010), the number of *Phaseolus* species (Figure 1) has doubled and continues to climb.

Table 1 – Number of *Phaseolus* bean species indicated in different works.

Works	Standley 1937	Delgado-Salinas 1985	Debouck et al. 1989	Freytag & Debouck 2002	Zamora 2010	this work
Taxa			<i>acutifolius</i>	<i>acutifolius</i>	<i>acutifolius</i>	<i>acutifolius</i>
						<i>albicarminus</i>
						<i>anguciana</i>
	<i>coccineus</i>	<i>coccineus</i>	<i>coccineus</i>	<i>coccineus</i>	<i>coccineus</i>	<i>coccineus</i>
			<i>costaricensis</i>	<i>costaricensis</i>	<i>costaricensis</i>	<i>costaricensis</i>
		<i>dumosus</i>	<i>dumosus</i>	<i>dumosus</i>	<i>dumosus</i>	<i>dumosus</i>
						<i>hygrophilus</i>
	<i>leptostachyus</i>	<i>leptostachyus</i>	<i>leptostachyus</i>	<i>leptostachyus</i>	<i>leptostachyus</i>	<i>leptostachyus</i>
	<i>lunatus</i>	<i>lunatus</i>	<i>lunatus</i>	<i>lunatus</i>	<i>lunatus</i>	<i>lunatus</i>
						<i>microcarpus</i>
	<i>oligospermus</i>	<i>oligospermus</i>	<i>oligospermus</i>	<i>oligospermus</i>	<i>oligospermus</i>	<i>oligospermus</i>
				<i>talamancensis</i>	<i>talamancensis</i>	<i>talamancensis</i>
		<i>tuerckheimii</i>	<i>tuerckheimii</i>	<i>tuerckheimii</i>	<i>tuerckheimii</i>	<i>tuerckheimii</i>
			<i>vulgaris</i>	<i>vulgaris</i>	<i>vulgaris</i>	<i>vulgaris</i>
	<i>xanthotrichus</i>	<i>xanthotrichus</i>	<i>xanthotrichus</i>	<i>xanthotrichus</i>	<i>xanthotrichus</i>	<i>xanthotrichus</i>
<b>Total</b>	<b>5</b>	<b>7</b>	<b>10</b>	<b>11</b>	<b>11</b>	<b>15</b>

### Results and Discussion

The five cultivated species of the genus are or have been planted in Costa Rica, namely the common bean *P. vulgaris* L. and the Lima bean *P. lunatus* L. Their wild forms are present too, the former being found recently (Debouck et al. 1989). *P. acutifolius* A. Gray has been known as a cultigen only, from the dry Guanacaste area, possibly as a relict now. *P. coccineus* L. has been seen in the cool Central Valley as an ornamental, while *P. dumosus* Macfady. is grown there as 'cubá' or present as a weedy escape in humid montane secondary habitats. *P. costaricensis* Freytag & Debouck has been shown to be distinct from *P. coccineus* and growing wild in the low montane moist forest around the Central Valley (Araya-Villalobos et al. 2001). These authors report *P. xanthotrichus* Piper growing in the premontane humid forests of the central part of the country. The abundant wild Lima bean has been reported from low to mid altitude dry forests (Freytag & Debouck 2002), while *P. oligospermus* Piper is more restricted to a humid premontane forest, and thus with much fewer populations (Araya-Villalobos et al. 2001).

*P. leptostachyus* Benth from the central oak grasslands and taluses has often been passed unnoticed because of its sprawling habit (Freytag & Debouck 2002). Another inconspicuous vine *P. microcarpus* Mart. was indicated as possible in the work by Zamora (2010), and its presence was confirmed by the one specimen *B Hammel 24516* found at the herbarium INB. The wild form of *P. vulgaris* L. was found late as compared to wild *P. lunatus*, in habitats with some human disturbance in the Central Valley (Debouck et al. 1989). *P. talamancensis* Debouck & Torres has been a relatively recent addition to the flora of Costa Rica (Torres-González et al. 2001) with six populations known to date.

*P. tuerckheimii* Donnell-Smith was found in low montane rain forest, relatively abundant if the forest is left intact (Araya-Villalobos et al. 2001). A few more species were found recently in the southern part of San José province, with the main differences summarized in Table 2. While *P. anguciana* Debouck & Araya and *P. hygrophilus* Debouck are known by two populations each to date, there is only one population reported for *P. albicarminus* Debouck.

Table 2 – Main differences between three recently found bean taxa.

Trait	<i>P. anguciana</i>	<i>P. albicarminus</i>	<i>P. hygrophilus</i>
terminal leaflet	lanceolate acuminate 63x22 mm	lanceolate apiculate 76x45 mm	lanceolate apiculate 77x50 mm
leaflet base	truncate	rounded	rounded
central variegation	present	absent	present
raceme length	155-200 mm	40-70 mm	110-170 mm
primary bract	lanceolate 4x2 mm	triangular lanceolate 4x1.5 mm	rounded cupped 5x5 mm
no. 1 <sup>ary</sup> bracts	6-8	3-6	9-18
bracteole	scale-like rounded 2 mm	triangular 1 mm	cordiform 3.5 mm
calyx lobes	broadly triangular 1.5x2mm	lip, 1 mm or less	prominent 4x4 mm
flower color	standard purple, wings white	standard carmine, wings white	standard pinkish white, wings white
pod	boat-shaped stipitate 55x12 mm	shortly boat-shaped 43x12 mm	boat-shaped stipitate 62x12 mm
seed	rounded squarish; 6.5 g/ 100 seed	oval; 23 g/ 100 seed	circular lenticular, 6.4 g/100 seed

One can note that widely distributed species (e.g. *microcarpus*, *tuerckheimii*, *vulgaris*) were somehow expected to be found in Costa Rica, and field explorations eventually confirmed their presence. Field work was the only way to disclose new species with very few populations (e.g. *albicarminus*, *anguciana*, *hygrophilus*). GIS packages can probably help (Jarvis et al. 2005; Ramírez-Villegas et al. 2010), but explorers are on their own to find the first twelve populations to build the mathematical models upon!

Figure 1 – Close-ups of flowers of the fifteen *Phaseolus* species in descending order as per the last column of Table 1.

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