TRIP REPORT – Phaseolus Germplasm Collection in Central Costa Rica January 4 – January 16, 1987

D. G. Debouck

Summary

Forty-six samples for eleven different taxa of Phaseolus were collected during a collection trip in central Costa Rica. Of particular interest are: P. vulgaris both as wild and escaped forms, the type of P. oligospermus and the presence of a new form of the P. coccineus complex, P. striatus.

Resumen

Se colectaron 46 muestras de 11 diferentes especies de Phaseolus durante un viaje de recolección de germoplasma en la parte central de Costa Rica. Cabe señalar la presencia de: vulgaris como silvestre y como escapada, el tipo de P. oligospermus y una forma nueva del complejo coccineus, P. striatus.

C O N T E N T S

Introduction

Costa Rica occupies a special place within the Mesoamerican Center (Debouck, 1986b), since together with the Chiriquí Province of Panamá it is its southern border. Also are relevant to our purpose some physiographic characters of this country: relatively small area (51.100 km^2), lower extension in latitude in comparison to longitude, high contrast in altitude (0-3829 m.a.s.l., at Cerro Chirripo) and in amount of rainfall (1300-9500 mm/year), high variation of rainfall over short distances (6000 mm/year over 30 km, Atlas climatológico, 1985). Not less than 55 groups of different soils were defined for Costa Rica (Gómez, 1986). As a consequence of these traits, the flora of Costa Rica has more plant species than Canada and the USA altogether (Wulff, 1937). Of practical consequence for the plant collector: when using the grid technique in order to plot the area of collection (Debouck, in press), the distance between the stops should be short.

We will review here in relation to germplasm explorations in Costa Rica:

-- some background related to the interest of native varieties and wild ancestors;

-- the present situation about the cultivated species;

-- the results of an exploration carried out in January 1987.

Since this work was part of the outgoing program of the Genetic Resources Unit of the Estación Experimental Fabio Baudrit of the Universidad de Costa Rica, a main emphasis was put on some didactical aspects in order to allow this program to perform its job. These aspects cover: revision of herbariums, identification of species, techniques of field germplasm exploration, multiple inquiries with farmers.

Timing:

January 4: arrival at San José

January 5-6: discussions with Ing. R. Araya and Biol. R. A. Ocampo, visit to the Instituto Meteorológico Nacional, plant identification at the Museo Nacional and at the University of Costa Rica (revision of both Herbariums).

January 7: collections in the sector of Cartago (# 2090 to 2093)

January 8: collections in the sector of San Ignacio (#2094 to 2101)

January 9: collections in the sector of Naranjo (# 2103 to 2107).

January 10: inquiries with farmers near Chiraca and collections in the sector of Monterrey (# 2108 to 2110)

January 11: collections in the sector of Aserri and Tres Rios (# 2111 to 2119)

January 12: collections in the sector of Santa Maria (# 2120 to 2123)

January 13: collections in the sector of San Isidro El General (# 2124 to 2130)

Janaury 14: collections in the sector of Providencia (# 2131 to 2135).

January 15: seed and herbarium distribution in San José

January 16: travel San José-Cali

Background

1. **What to collect and why?**

In the traditional American farming systems, from a genetic resources point of view, one of the most interesting material is the native varieties. Why? The interest of a material is partly in the time span it was affected by adverse conditions and at the same time selected for desirable traits. Another aspect is the raw material from which it derived in some cases thousands of years ago. A final

aspect is in these thousands of reproductive cycles and the original selective pressures applied during this duration.

In the case of beans, this can be summed up into five conditions which appear to us necessary for the development of interesting native varieties. These are:

1) growth conditions: they must not be so marginal that a net yield will constantly be obtained, and at such an ecological cost that farmers with low incomes can well afford planting.

2) space: large areas should be planted in order to provide enough biological material upon which natural and artificial selection processes will apply. Large areas are also a kind of guarantee for biological continuity: in the case farmers lose their seed in one place, they can still recover it from another one.

3) time: the number of reproductive cycles should be sufficient (hundreds or even thousands) so that non-lethal or non negative gene mutations have some chance to appear, to spread in the population and to maintain themselves.

4) original human culture: no doubt that an original selective pressure has to be applied constantly in order to fix the characters and to maintain some new recombinants. This original pressure is linked to the existence of a numerous and culturally independent human group (Nabhan, 1979).

5) conditions for seed conservation: poor conditions often interrupt the biological continuum. The survival of a human group as original entity - and thus the continuity in the original selective pressure - is also the survival of its seed. There is thus low probability of finding native varieties where farmers do not have good means to maintain their seed stock.

Note that the raw material can be diverse: cultivars, wild ancestors, regressive forms. But in the case of the native American bean varieties, it is most probable that the raw material was the distinct wild populations which still exist in the natural vegetations (Gepts et al, 1986). These authors have shown that particularly in the case of common bean, varieties were domesticated in multiple centers in the Americas and from the wild material at hand. Several authors (Burkart and Brücher, 1953; Gentry, 1969; Vanderborght, 1983) observed that strong morphological differences exist between the wild forms of Mesoamerica and those of South America. We know now that they are biochemically different too (Gepts, et al., 1986).

Indication about the duration came from archeological evidence. Kaplan (1956) showed that over a period of nearly 2000 years some common bean types in the southwestern USA did not change in their seed color and shape, but in their frequency. The same observation was made later on common beans in Tehuacan, Puebla, Mexico (Kaplan, 1965) with no change over 7000 years. Again something similar was seen in the Central Andes of Peru (Kaplan, 1980) for a period of about 8000 years. Wherever the conditions were appropriate for the long term conservation of plant remains, it is possible to find bean types which do not change over thousands of years.

These works (Kaplan, 1956, 1980) showed that some types were introduced in the areas of traditional farming in comparison to prehistoric times. This would indicate that when collecting in the traditional American countrysides one can find non mobile and interesting old varieties and mixed altogether materials introduced from other parts in probably more recent times. Confirmation about these results has been obtained biochemically (Gepts and Bliss, 1986) for Colombia, "one of the major crossroads of cultural exchange in the Americas."

A key-element is the moment they were introduced: a very short duration gives little possibility for an original evolution process to take place. With the help of cross inquiries with the farmers, the materials introduced in recent historic times can be easily discarded or collected separately. Materials introduced in earlier times for which there is no folk memory anymore, are a problem. They could be of interest because they could represent a kind of extra-variation in comparison to their region of origin, or because they do not exist anymore in it. The collector should collect them in these two cases, once the gene bank informed him that these types are not already present in the collection. This case well illustrates the degree of characterization of the accessions, since the comparison is no more on the materials coming from a single region, but on the whole collection.

Why should the collection of land races be as complete as possible? Recent studies (Gepts, et al., 1986; Gepts, personal communication) have demonstrated that the diversity as measured by the variability in phaseolin types, is greater in the wild forms than in the landraces evaluated so far. This would mean that through domestication a lot of genetic variation was lost and/or not retained. Bean domestication can thus be seen as a genetic bottleneck. One should thus try to broaden the genetic base of this crop, looking in priority for all the landraces throughout the whole area of multiple domestication in the Americas (Gepts and Debouck, submitted). The complementary priority is of course in all the wild relatives of the domesticated species.

The collection of the wild relatives is justified basically for these two reasons: they can serve as true geographic markers and they are the most direct way to broaden tremendously the genetic basis of their cultivated relatives (Harlan, 1976). Several works in breeding (Shii, et al., 1980; Singh and Gutierrez, 1984; Gepts and Bliss, 1985) have pointed out the problem of transferring genes from one cultigroup of common bean into another. It is thus quite necessary to know which

cultigroup any progenitor in a crossing program belongs to. Only wild ancestors can provide this kind of information because they are supposed to not have travelled extensively thanks to human intervention. On the other hand, wild ancestors are known as best sources of variability for their cultivated relatives (Harlan, 1976).

2. Cultivated Bean Germplasm of interest in Costa Rica

P. acutifolius

This species has been diffused not only in the Greater Southwest (Nabhan, 1985) where it was probably domesticated (Manshardt and Waines, 1983), but also in the tropical American lowlands. This latter distribution was evidenced by the collection held in Pullman, USA, by the collections made by the writer in the Mayan milpas of Campeche, Mexico and by the collections made by Ing. R. Araya Villalobos in Guanacaste, Costa Rica.

More germplasm should be looked for in Guanacaste because of the interest of tropical germplasm for the improvement of the Tepary. Data about rainfall (amount and distribution; Herrera, 1986), and altitude let low probability of finding it outside Guanacaste. There were only 4 accessions held in germplasm bank for this species.

P. coccineus

This species is distributed in the humid highlands of Costa Rica (San José and Cartago) at elevations higher than 2000 m.a.s.l. A very related species - P. polyanthus - is distributed in the same areas, somewhat at lower altitudes. The germplasm bank at CIAT holds 18 and 25 accessions, respectively, partly obtained from CATIE. An appraisal about the rate of duplication would be useful prior to further collection.

P. lunatus

This species is distributed in the lowlands of Costa Rica, at elevations below 1500 m.a.s.l. The collection presently held in the germplasm bank is of 20 cultivated materials, with 4 sieva types (Baudet, 1977), 7 big limas (!), and 9 mixtures. Documentation is very poor, since several accessions were obtained from markets.

Hazlett (1986) observed a few genotypes of lima beans, cultivated by the Guaymi Indians near Soloy in Panama, but not where the Guaymi have settlements in Puntarenas, Costa Rica. This should be carefully checked when collecting in the Coto-Brus area in the future, keeping in mind that the Guaymi came from Panama to Costa Rica at the beginning of this century (Hazlett, 1986). Hazlett (1986), also noted the success of the pigeon pea versus the lima bean and concluded: "Further Phaseolus sp. collections from this area are required to avoid losing potentially useful genetic material."

P. vulgaris

This species is widely grown in Costa Rica mainly in Puntarenas (southeast), the Meseta Cental (Valle de San José, Alajuela, Cartago), the zone of Upala and the peninsula of Nicoya. It is frequently planted as mixtures of genotypes in a traditional farming practice called "tapado". The bean is sowed among the weed which is cut afterwards.

The germplasm bank at CIAT received some 1512 materials from Costa Rica, of which 518 are cultivated P. vulgaris, 203 with some information about locality and 315 without such information. Such a collection is already an important one, when considering the relatively low variability expressed in morphological characters. For instance there is no wide variation in seed characters - perhaps the most performant and accessible descriptors - color and size: small blacks and small reds are dominant in mixtures.

Prior to further collection for this category of germplasm, it could be useful:

-- to recover information (passport data) for the 60% which lack them;

-- to plot the collections for which passport data are available;

-- to screen the accessions for which there is no morphological variability in order to find out whether there is biochemical variability or not.

Material coming from Indian reservations (e.g. the collections recently made by Haslett and co-workers where the Guaymi and the Cabecar) should be included in priority in this kind of screening as well as the wild forms.

Gomez (1986), published alarming figures related to deforestation of natural vegetations in Costa Rica, with a rate of 20.000 Ha a year. He also cited Fournier who said that 65% of Costa Rica has been deforested to some degree. Given that situation and also the urgency, we began to sample areas in the Meseta Central, maybe the zone of highest priority, with emphasis on the remaining wild forms and species.

3. Results of the exploration carried out in January 1987.

As it can be seen in the following list, 46 populations were encountered for 11 taxa. With the exception of wild P. lunatus, germplasm was collected for the first time for all the other species. For both scientific and didactical purposes, a total of 233 herbarium samples were collected, 127 of which were left in the Herbario Nacional of Costa Rica.

List of the Phaseolus materials found in Costa Rica in January 1987, classified according to the taxa.

Phaseolus anisotrichus Schlecht.

2107, 2109

Phaseolus lunatus L. (wild)

2092, 2094, 2099, 2100, 2103, 2104, 2106, 2108, 2113, 2117, 2120, 2123, 2124, 2127.

Phaseolus oligospermus Piper

2091 (at the type locality)

Phaseolus polyanthus Greenman (escaped)

#2121

Phaseolus striatus Brandegee

2093, 2095, 2102, 2116, 2118, 2119, 2122, 2126, 2128, 2132, 2135.

Phaseolus tuerckheimii Donn. Smith

2110, 2125, 2129, 2131, 2133, 2134

Phaseolus vulgaris L. (wild)

2097, 2111

Phaseolus xanthotrichus Piper

2090, 2096, 2101, 2105, 2112

P. sp. (close to P. vulgaris wild)

2098, 2115

P. sp. (natural hybrid between P. polyanthus and P. striatus)

2114

P. sp. nov.

2130

Total materials: 11 taxa, 46 samples.

Phaseolus leptostachyus Bentham.

This species formerly called P. anisotrichus Schlecht (Delgado, 1985), has a wide distribution throughout the Mesoamerican center. It starts from the Sonoran Desert (Shreve and Wiggins, 1964), continues in southern Mexico, Guatemala (Debouck, 1986a), and ends in Costa Rica (Standley, 1937). Costa Rica is thus its southernmost habitat, and hence worth studying. There it has been reported from the Meseta Central and the region of San Ramon (Standley, 1937).

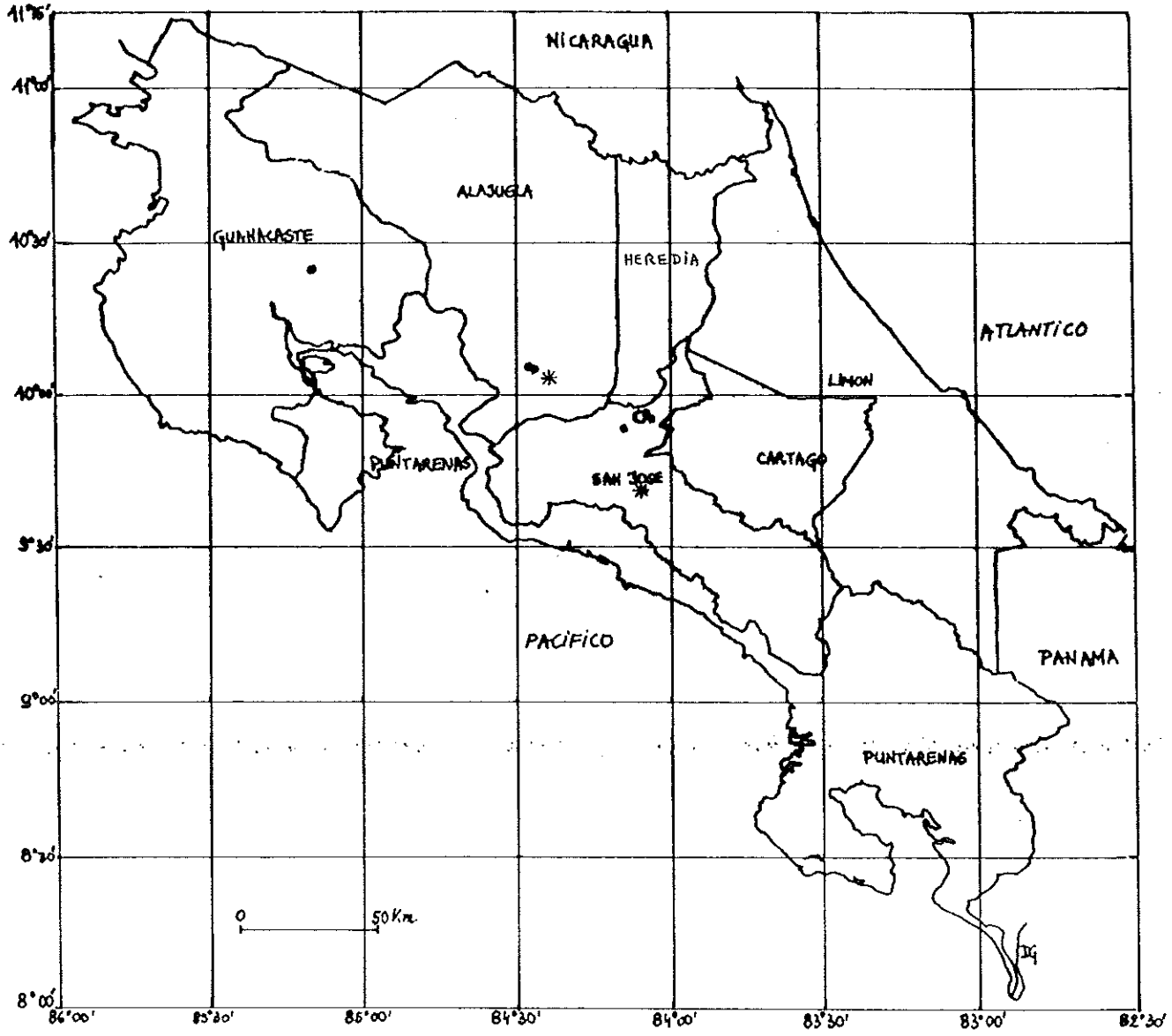
During our visit to the Herbario Nacional de Costa Rica and to the Herbario de la Universidad de Costa Rica, we were able to see 7 materials of P. leptostachyus and to draw a distribution map.

As it can be seen, it was distributed in the region of San Ramon (where we were able to find another population # 2107) and in the vicinity of San Jose. Three populations were seen at the beginning of this century in what is now the suburbs of San Jose (Guadalupe, San Pedro, and Rio Virilla) and could therefore be considered as lost. Interestingly enough, one population was found (# 2109) close to Monterrey, extending the known distribution southwards.

It was found at intermediate elevations (1000 m - 1400 m), principally in semi deciduous woody shrubs (Gomez, 1986), less in tropical submontane rain forest. A couple of weeks of dry season per year seem necessary. Since it is a sprawling postrate determinate non climbing vine, it cannot be found in dense forest vegetations and shady places, but in open habitats. We found it with some success on deep slopes and cliffs.

A particular trait of these populations is the large width of the primary bracts and of the pods in comparison to the reduced size of the seeds. It is not present in populations in the central and northern parts of its range in Mesoamerica. It could be an adaptative

Map 1. Distribution of P. leptostachyus in Costa Rica



● = herbarium samples

* = collections made in 1987

mechanism in humid environments where transpiration is a problem.

Both populations were at green pod - maturity stage when visited, with some damages of powdery mildew and bean pod weevil. Problems of chrysomelids, rust and possibly web blight were also observed.

Phaseolus lunatus L. (wild form)

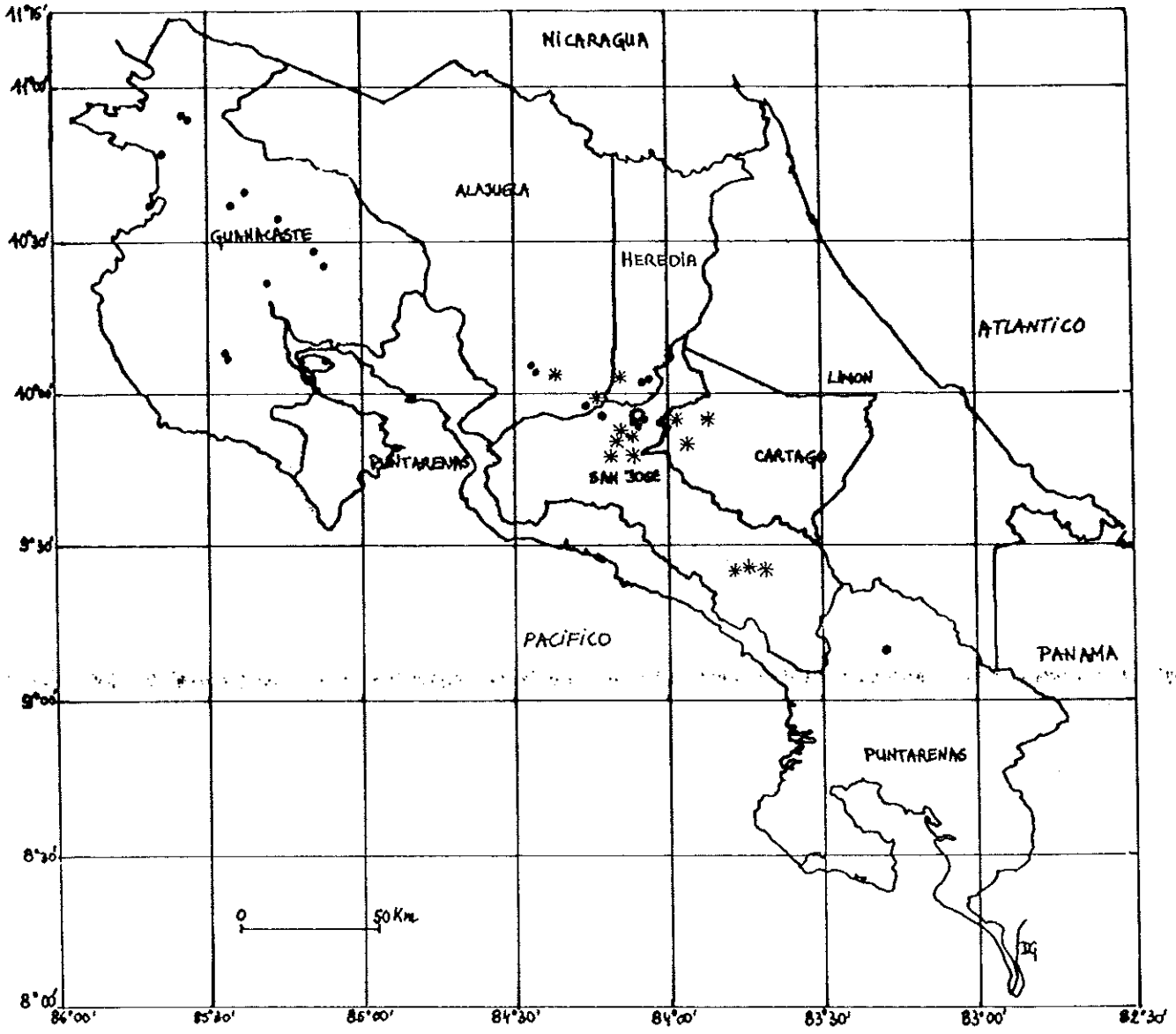
This species also called P. lunatus var silvester Baudet, has a wide distribution in tropical Central America. In Costa Rica, it is "common in thickets, Meseta Central to the Pacific coast, and probably also the Atlantic" (Standley, 1937, p. 552). Its representation in germplasm banks has been so far limited (1 accessions!) and thus worth the complement.

After our visit to the two herbariums of Costa Rica, we were able to draw a distribution map for the 29 specimens examined. It was mainly from Guanacaste and the surroundings of the cities of San Ramon, Heredia, and San Jose (where four sites are now included within the suburbs; these populations could thus be considered as lost). Our exploration added more sites (a total of 14 samples) south and east of San Jose, and also further south in the region of San Isidro.

The range of altitudes is very large (1000-1800 m in our collections), probably starting at sea level. The wild lima bean is present in the lowland tropical deciduous forest (e.g. Guanacaste)(Gomez, 1986), in the evergreen seasonal forest (e.g. Valle del General) and in the tropical deciduous forest (e.g. Meseta Central, Alajuela, San Jose).

It was found at flowering stage for 5 populations (with intense pink wings) and at pod harvesting stage for the others. Seed color can vary a lot: black (# 2103), cream (# 2099), and tan (# 2127). On the basis of seed weight (100 seeds = aprox. 7.0 g) and pod

Map 2. Distribution of P. lunatus (wild) in Costa Rica.



● = herbarium samples

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dehiscence, it can be considered as truly wild. It is a strong vine, 2-3 m high, growing in sunny and open habitats on thorny bushes and small trees, or sprawling on the ground of cliffs.

Problems caused by thrips, chrysomelids, mexican bean beetle, caterpillars of Geometridae and maybe web blight were also observed; the first two were the most frequent.

Phaseolus oligospermus Piper

This species has been reported from Chiapas, Guatemala, Honduras, and Nicaragua. Although the type is from Cartago, Cartago in Costa Rica (Oersted # 30, in 1857), it seems that it has not been collected anymore in that country. No more records in other herbariums nor in Costa Rica.

During this trip, we were able to collect seeds at the type locality (# 2091), which will be most useful in any future taxonomical work.

The material was already dried when found. It looks as a small climber (2 m high) growing on thickets of Acacia. The vegetation at the colleciton site is classified as evergreen seasonal forest (Gomez, 1986). Soil derives from volcanic ashes.

Phaseolus striatus Brandegee

In his revision of the genus Phaseolus, Delgado (1985) divided P. coccineus into 5 subspecies:

-- subsp. coccineus: the cultivated scarlet runner bean

-- subsp. darwinianus: another cultivated bean (sometimes as an escape) better known as P. polyanthus

-- subsp. formosus: a polymorphic group of wild and weedy forms distributed in nearly all the montainous areas of Mexico, provided that they are not too dry

-- subsp. glabellus: a wild and glabrous form distributed throughout a montainous arc along the Gulf of Mexico

-- subsp. griseus: another wild pubescent form distributed in western Mexico from Jalisco up to Oaxaca.

It should be noted that the subsp. formosus includes wild forms with red or mauve corollas in this treatment, and, on the other hand, that the following species were now listed as synonyms within this subsp. formosus: P. obvallatus, P. striatus, P. strigillosus, P. leiosepalus. Finally, that Delgado (1985, p. 206-207) admits that this could be a provisional conservative treatment since he wrote: "However, among the considerable variation shown by this taxa, several varietal-ranked taxa are recognized. These will be described in future publications."

In a work in progress, Freytag (personal communication) divides the P. coccineus complex into two species: P. coccineus with scarlet corollas, and P. striatus with purple corollas. In the latter several groups were identified, presently ranked as subspecies: striatus, purpurascens, pringlei, guatemalensis, chiriquinus. The latter is of direct interest to us, since we knew 5 herbarium specimens (outside and in Costa Rica) with "brilliant fuschia", "red-violet", "bright crimson" corollas, which could correspond to this taxon, although they were classified as P. coccineus, P. obvallatus, P. sp.

From the herbarium labels - and confirmed by our field work - it appears that this form, although included within the P. coccineus complex, is worth being distinguised, for the following reasons:

-- morphological: strong vine, wide leaflets, stout peduncles, constantly brilliant fuschia corollas, big pods, medium size speckled seeds.

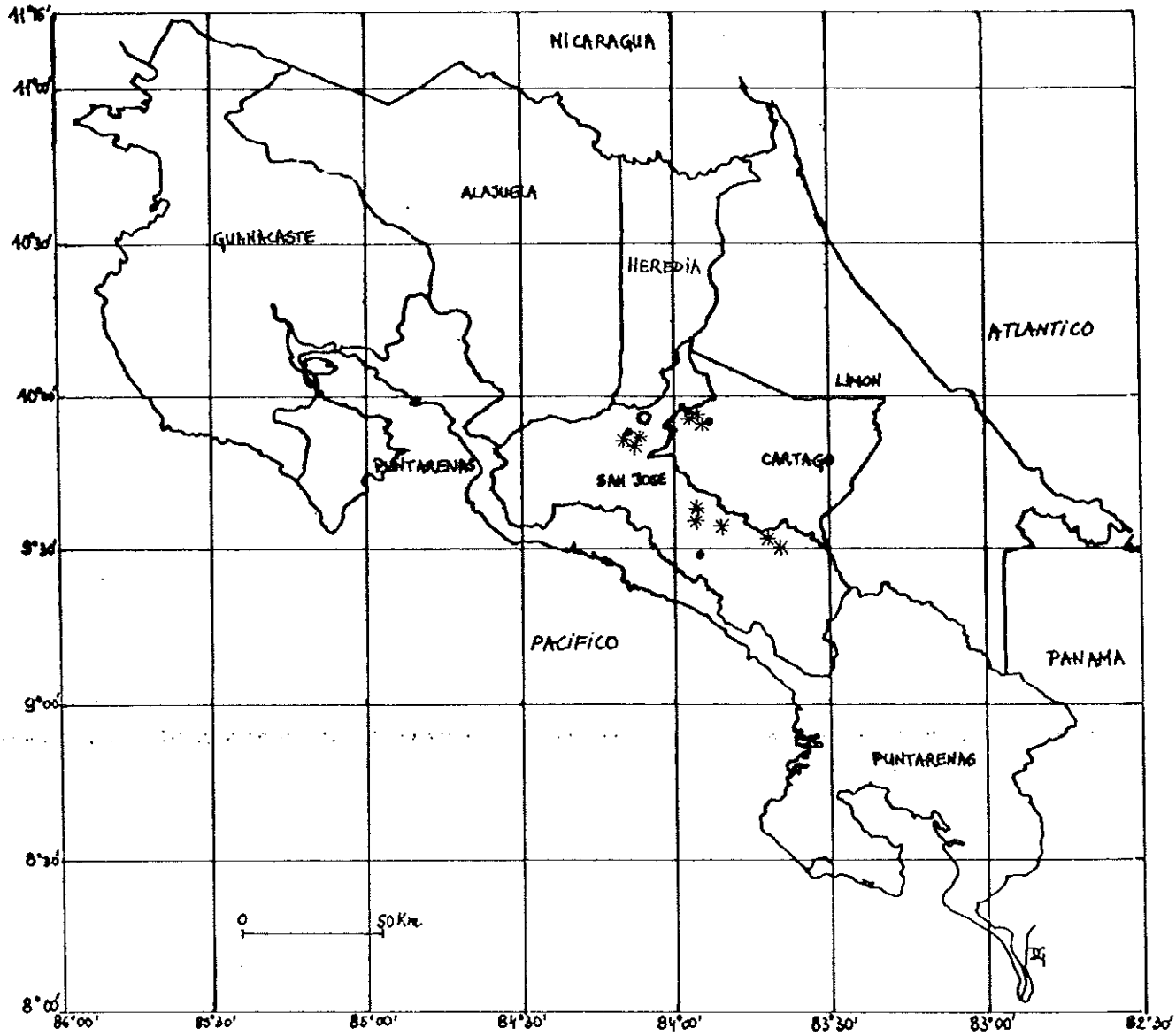
-- ecological: montane rain forest, shady habitats, humid and organic soils, limited human intervention.

Confusing it with all the wild forms existing in Mexico in the subsp. formosus would not reflect the reality. But the present taxonomical treatment, i.e. P. striatus subsp. chiriquinus, could be too rigid and maybe misleading. Indeed, the reader will remember P. chiriquinus Standley, a synonym for P. tuerkheimii. Moreover, we have seen some material as natural hybrid between this striatus form and P. polyanthus, indicating that some gene flow is possible (# 2114). Consequently, the subspecific rank would not be the most adequate, but the varietal one, maybe inside P. coccineus. We must admit that our knowledge is not sufficient enough for a definitive naming. We will thus adopt a provisional - and maybe archaic - position using P. striatus.

Previous records (see map # 3) mentioned this taxon in 5 places: in Escasu (SW of San Jose), near Tres Rios (between San Jose and Cartago), and near Canaan (N of San Isidro El Genero). We were able to collect 11 samples, extending the known distribution around those places and southwards in the province of San Jose.

The range of altitudes of our collections was 1400-2100 m, although the majority of the populations were found at 1600-1800 m. It is a typical strong vine (up to 6 m high, # 2115) belonging to the typical rain submontane forest and above 2000 m, the rain montane forest. It can be found in shady as well as sunny places; in the latter case, the number of sunshine hours is reduced for those sites (Atlas climatológico, 1985).

Map 3. Distribution of P. striatus in Costa Rica



● = herbarium samples

* = collections made in 1987

Although it was possible to get some seeds for nearly all populations visited, it should be noted that they are quite late in their peak production of seeds, which takes place in mid-February-March. Damages of anthracnose, angular leaf spot, bean pod weevil, mexican bean beetle, thrips, lacebugs and a particular orange fungi infection have been seen. Cross pollination within the population by carpenter bees and humming-birds has been observed on several occasions.

Interestingly enough, it is known by local people and small farmers as "frijol de montaña" (in the surroundings of Cot, Cartago) or "cuba de venado" (south of Alajuelita). The name "cuba" is generally used for P. coccineus subsp. coccineus, the cultivated scarlet runner bean. But this wild bean was not eaten locally. It should be noted that it quickly disappears once the bush has been cut down and that it cannot stand grazing.

On the other hand, as evidenced by a collection in Aserri, San Jose, at 1850 m.a.s.l., # 2114, this species can cross naturally with P. polyanthus, resulting in a natural hybrid with pink flowers and floral bracts as in P. polyanthus. It was abundant at that site, both parental species were also present. Crosses could have been made by wild bees, present at the site: xylocopidae, apidae. Seeds are brightly colored: orange-yellow background with red spots. Comparison of seed sizes gives us:

Taxon	Seed length	Width	Thickness	Weight 100 seeds
P. polyanthus # 2121	14 mm	11 mm	6 mm	53 g
P. striatus # 2122	10	8	4	18
P. hibrido # 2114	13	7	7	62

The existence of such hybrids should be taken into account when considering a definitive name for the material called here "striatus".

Phaseolus tuerkheimii Donnell Smith

This species is distributed in the southern part of the Mesoamerican center: from Chiapas up to western Panama. It was frequently confused with P. oligospermus Piper, so the records must be checked carefully.

In Costa Rica, it was known only from recent botanical surveys, since it was not reported in the Flora of Costa Rica by Standley (1937). We had only two records from the Missouri Botanical Garden and did not find specimens in the Herbariums of Costa Rica (see map # 4). There was no germplasm available for this country so far.

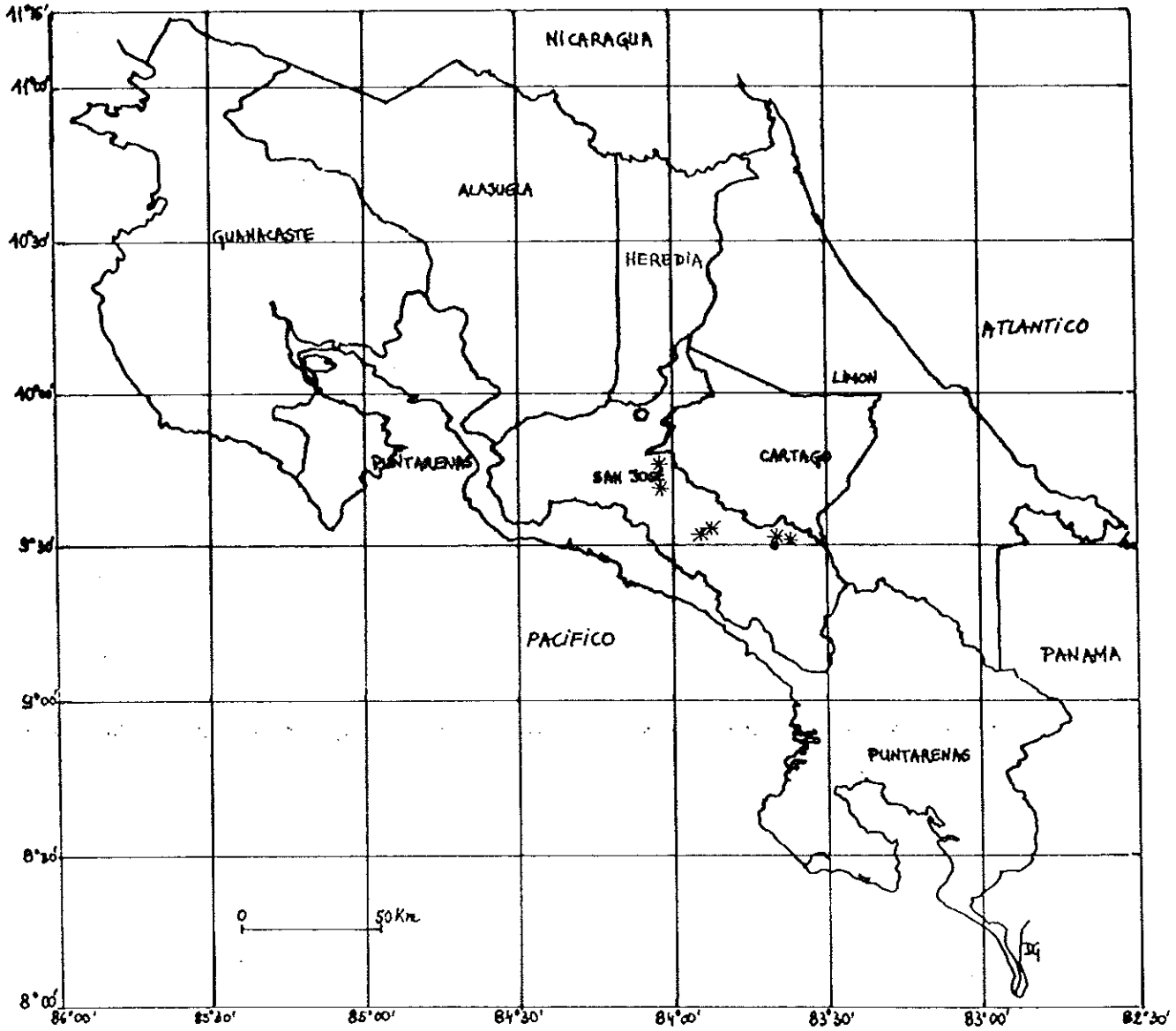
During this exploration, 6 populations were sampled, distributed in the province of San Jose (see map # 4).

This is again a wild bean growing at higher elevations: 1500-2500 m was the range of altitudes for our collections. This distribution is within the montane rain forest, in open clearings or in mid-shade places below large trees. In these sites, hours of sunshine is about 3-4 a day (Atlas climatológico, 1985).

The different populations were encountered at the pod setting stage; it was already possible to find enough seed for two of them. Interestingly enough, in one population # 2131, we found several plants with pure white corollas. Also of interest was the fact that all the different populations were almost completely free of any disease and pest, with the possible exception of rust present in # 2131.

This species seems to be part of the montane rain forest ecosystem. It would disappear with the forest once it is cut down. It could survive, however, in old coffee plantations (# 2110) provided that this artificial habitat is not well cleaned against weeds, etc.

Map 4. Distribution of P. tuerckheimii in Costa Rica



● = herbarium samples

* = colelctions made in 1987

Phaseolus vulgaris L. (wild form)

In his Flora of Costa Rica, Standley (1937) mentioned about the common bean: "a plant of American origin, but unknown in a wild state; no doubt cultivated since the beginnings of American agriculture" (p. 553).

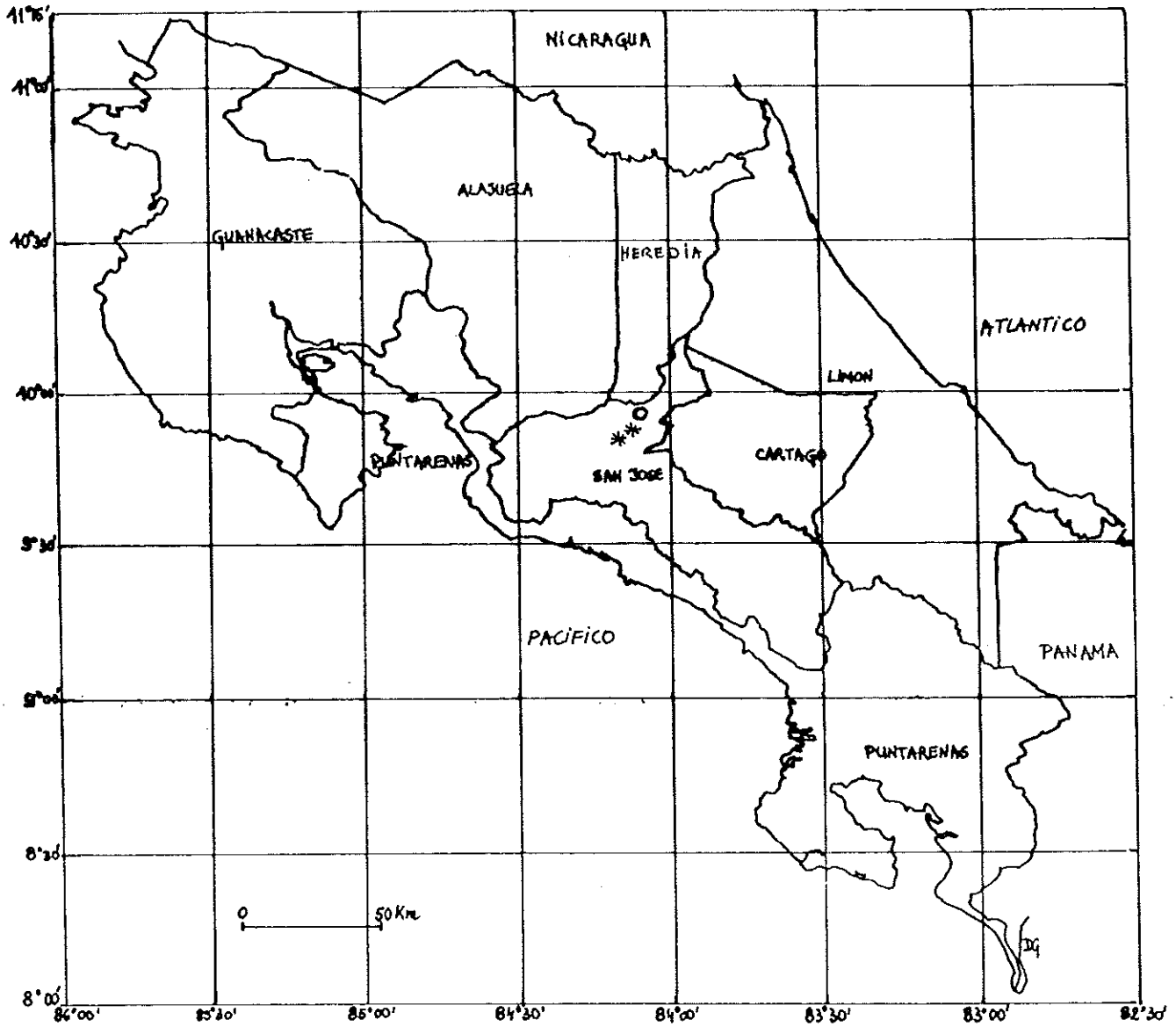
Burkart and Brücher (1953) described a wild form of P. vulgaris, present in Morazan, Honduras: P. aborigineus var hondurensis. The wild bean was known to be present in Guatemala (McBryde, 1945; Gentry, 1969) where explorations were carried out (Debouck, 1986a). According to Delgado (1985), there could be one herbarium record for Nicaragua. There were no records of wild P. vulgaris found in Costa Rica in the literature.

The possibility of finding the wild bean in Costa Rica was open, however, thanks to a personal communication. In 1986, Prof. H. Brücher wrote to Dr. P.L. Gepts that he found the wild bean in "Cerro Volcan, Depto. Santa Cruz". But no herbarium specimen was found in the two Herbariums visited in San Jose.

Two populations (# 2097 and 2111) were found during this trip (see map # 5). They are truly wild: weight of 100 seeds = 4.9 g, seeds roundish, shinny, grey-mottled. They were maturing when visited, climbing on thickets, and were found in zones of difficult access to cattle (e.g. Piedra de Aserri) and of low agronomic value: premontane humid forest on superficial rocky soils, cliffs, etc. Altitudes were: 1750 m (# 2097) and 1650 m (# 2111). The amount of rainfall in those places would be around 2000 mm/year (Atlas climatológico, 1985), with a dry season from December to March.

Both populations were encountered at pod maturity ready to harvest. Although much of the leaves had already fallen off, it was possible to observe problems of rust, bruchids, mexican bean beetle, thrips

Map 5. Distribution of wild P. vulgaris in Costa Rica



* = collections made in 1987

and on some seedlings from early germination, powdery midlew.

In both places, we were able to find a kind of escaped material, # 2098 and 2115, respectively, climbing a few meters apart from the places where the wild beans were found. Apparently, they were not planted by human intervention, but grew freely on the thickets in the bush. Both had brown speckled greyish seeds, larger than the ones of the true wild form (length: 10 and 6 mm, respectively), somewhat heavier (weight 100 seeds aprox. 18 g). The seed of these escaped materials were frequently ill-formed, the testa with a shrivelled aspect, indicating some problem of seed filling, the reason of which is unknown to us. The pods were wider than in the case of the wild form (11 and 8 mm, respectively) and purple striped. Leaves were already completely dried so that pathological observations were uneasy; anthracnosis has been seen.

It would be interesting to include these two forms in electrophoretic studies in order to know whether they originate from the respective populations of wild bean or not. It should be noted that in both cases P. striatus and/or a P. polyanthus-like material was present.

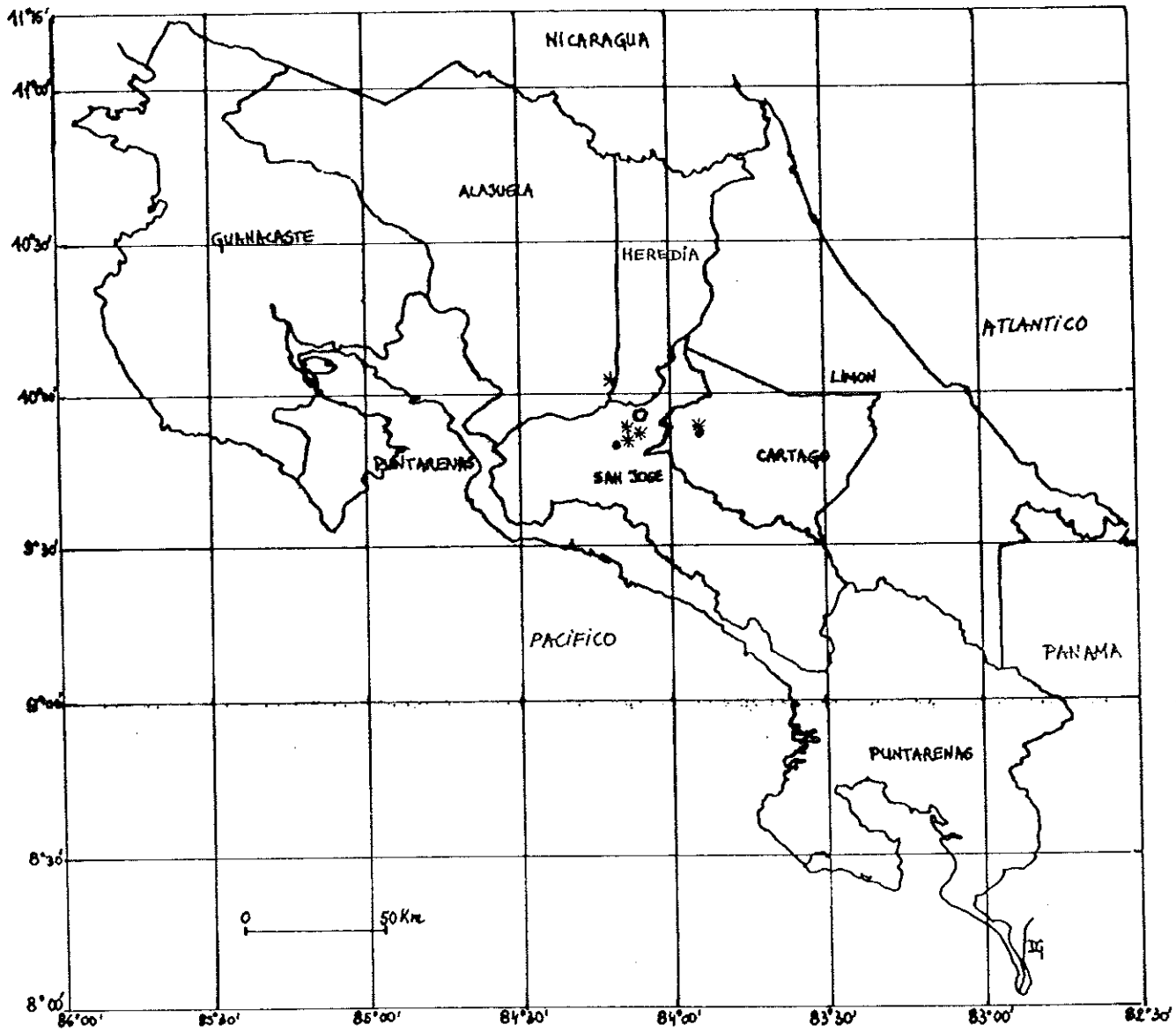
Phaseolus xanthotrichus Piper

Very little is known about the distribution of this species apparently found only in the central and southern parts of the Mesoamerican center.

Mexico: 2 herbarium specimens mentioned by Delgado (1985) for Chiapas.
Guatemala: the type from Santa Rosa and 5 germplasm collections (Debouck, 1986a)
Costa Rica: 2 herbarium specimens, one from San Jose and the other from Cartago (Biolley # 8999).

During this exploration, we were able to add 5 germplasm collections (see map # 6), extending the known distribution in the Meseta Central.

MAP 6. . Distribution of P. xanthotrichus in Costa Rica



● = herbarium samples

* = collections made in 1987

All populations were found in the humid premontane forest with an altitude range of 1550 - 1700 m.a.s.l. It is a small climber, starting from fleshy, tuberous roots, growing on grasses and thickets in semi-shady underwoods and old clearings of the forest.

The material was at pod filling stage reaching maturity so that seed for germplasm was already picked up for all populations. Problems of antracnosis, pod weevil, mexican bean beetle, trips were observed.

Phaseolus sp.

In the Parque Nacional Chirripo, we found what could be a new Phaseolus species (see data in annex), as judging from its caducous primary bracts and its large broad stipules, with its leaves already completely dried and fallen off. All its seeds were destroyed by Apion. It should be flowering in October and producing seeds in early December. In the case it is confirmed it is a new species, it would mean that the list of species for Costa Rica is not definitive yet. Obviously, more material should be looked for in next explorations.

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List of materials of Phaseolus found in Costa Rica in January, 1987.

2090	P. xanthotrichus	83°55'W	9°53'N	1550m
2091	P. oligospermus	83°55'W	9°53'N	1550m
2092	P. lunatus (wild)	83°55'W	9°53'N	1550m
2093	P. striatus	83°53'W	9°54'N	1650m
2094	P. lunatus (wild)	84°06'W	9°51'N	1420m
2095	P. striatus	84°06'N	9°51'W	1470m
2096	P. xanthotrichus	84°06'W	9°51'N	1700m
2097	P. vulgaris (wild)	84°07'W	9°49'N	1750m
2098	P. vulgaris (escaped)	84°07'W	9°49'N	1750m
2099	P. lunatus (wild)	84°07'W	9°48'N	1450m
2100	P. lunatus (wild)	84°07'W	9°53'N	1520m
2101	P. xanthotrichus	84°07'W	9°52'N	1620m
2102	P. striatus	84°07'W	9°52'N	1620m
2103	P. lunatus (wild)	84°12'W	10°01'N	930m
2104	P. lunatus (wild)	84°14'W	10°07'N	1390m
2105	P. xanthotrichus	84°14'W	10°08'N	1550m
2106	P. lunatus (wild)	84°23'W	10°07'N	1170m
2107	P. leptostachyus	84°26'W	10°09'N	1350m
2108	P. lunatus (wild)	84°07'W	9°46'N	1080m
2109	P. leptostachyus	84°07'W	9°45'N	1210m
2110	P. tuerkheimii	84°07'W	9°46'N	1800m
2111	P. vulgaris (wild)	84°07'W	9°52'N	1560m
2112	P. xanthotrichus	84°07'W	9°52'N	1560m
2113	P. lunatus (wild)	84°07'W	9°52'N	1560m
2114	híbrido natural	84°07'W	9°52'N	1560m
2115	P. vulgaris (escaped)	84°07'W	9°52'N	1560m
2116	P. striatus	84°07'W	9°52'N	1590m
2117	P. lunatus (wild)	84°00'W	9°55'N	1320m
2118	P. striatus	83°58'W	9°53'N	1600m
2119	P. striatus	83°57'W	9°57'N	1750m
2120	P. lunatus (wild)	83°57'W	9°49'N	1470m
2121	P. polyanthus (escaped)	83°58'W	9°41'N	2000m
2122	P. striatus	83°57'W	9°40'N	1660m

2123	P. lunatus (wild)	83°56'W	9°40'N	1800m
2123	P. lunatus (wild)	83°40'W	9°26'N	970m
2125	P. tuerckheimii	83°40'W	9°31'N	1550m
2126	P. striatus	83°40'W	9°26'N	1550m
2127	P. lunatus (wild)	83°57'W	9°27'N	1160m
2128	P. striatus	83°37'W	9°30'W	1690m
2129	P. tuerckheimii	83°37'W	9°31'N	1820m
2130	P. sp.	83°37'W	9°31'N	1890m
2131	P. tuerckheimii	83°42'W	9°28'N	2020m
2132	P. striatus	83°51'W	9°34'N	1990m
2133	P. tuerckheimii	83°51'W	9°34'N	1920m
2134	P. tuerckheimii	83°52'W	9°34'N	2500m
2135	P. striatus	83°55'W	9°37'N	2080m

Trabajo de Recolección de Germoplasma de *Phaseolus*
patrocinado por el Consejo Internacional de Recursos Fitogenéticos

Misión colaborativa entre el Centro Internacional de Agricultura Tropical (Cali, Colombia) y la Estacion Experimental Fabio Baudrit de la Universidad de Costa Rica.

HERBARIO

Nombre científico: Phaseolus
Determinavit: _____ Fecha: _____
Nombre vulgar: desconocido
País/Estado/Municipio/Localidad: COSTA RICA, SAN JOSE, San Isidro El General, 5 Km N de Herradura, orillas del Rio Blanco, al pie de la Fila Ojo de Agua.
Longitud: 83 ° 37 ' W Latitud: 9 ° 31 ' N Altitud: 1890 m

Fecha de Recolección: 13/I/1987

Observaciones: zona del bosque humedo de montaña con epifitas. En barrancos y peñas cara E. En matorrales con Compuestas. Soleado a mi soleado. Suelo franco organico pedregoso derivado de roca ignea pendiente. Escaso. Bejuco trepando poco guias de aprox. 1 m de largo. Ya en madurez seca, ya hubo dispersion de semillas. Con # 2129 y 2128.
Colectores: D.G.Debouck, R.Araya Villalobos, R.A.Ocampo y W.G.Gonzalez U.
Nº: 2130 Se colectaron semillas bajo el Nº: _____

2131

Trabajo de Recolección de Germoplasma de *Phaseolus*
patrocinado por el Consejo Internacional de Recursos Fitogenéticos

Misión colaborativa entre el Centro Internacional de Agricultura Tropical (Cali, Colombia) y la Estacion Experimental Fabio Baudrit de la Universidad de Costa Rica.

HERBARIO

Nombre científico: Phaseolus tuerckheimii Donnell-Smith
Determinavit: D.G. Debouck Fecha: 1/III/1987
Nombre vulgar: frijol de monte
País/Estado/Municipio/Localidad: COSTA RICA, SAN JOSE, San Isidro El General, Km 113 de carr. interamericana.
Longitud: 83 ° 42 ' W Latitud: 9 ° 28 ' N Altitud: 2020 m

Fecha de Recolección: 14/I/1987

Observaciones: Bosque humedo de montaña con Alnus, helechos y numerosas epifitas poco perturbado. Mi soleado. Lugar humedo neblinas. Suelo franco pardo organico. Abundantes en lugares protegidos. En fin de floracion (flor lila intenso ; algunas plantas de la poblacion con flor blanco puro) - vainas verdes. Trepadora 3 m de alto sobre Dahlias.
Colectores: D.G.Debouck, R.Araya Villalobos, R.A.Ocampo y W.G.Gonzalez U.
Nº: 2131 Se colectaron semillas bajo el Nº: 2131