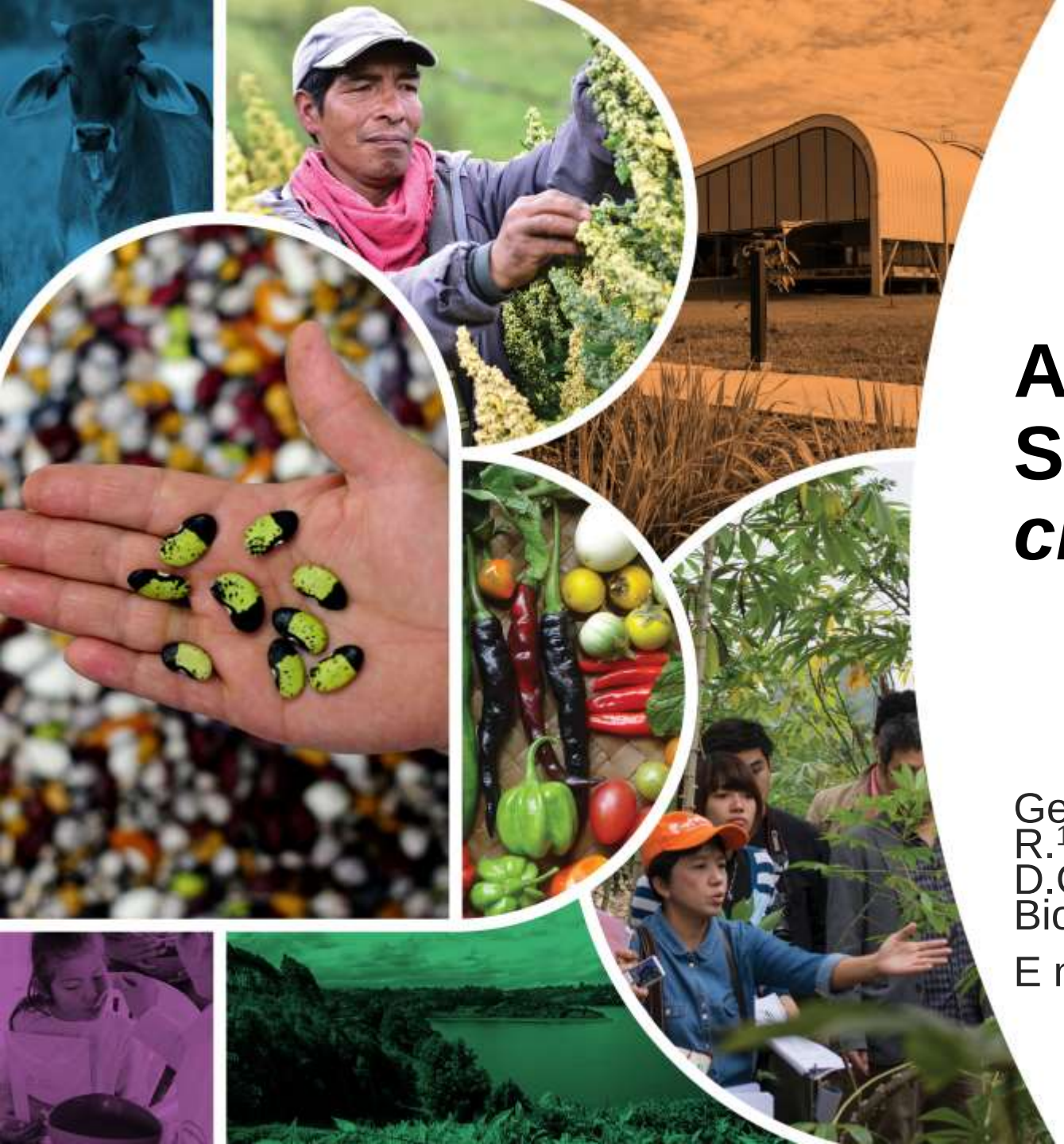

# AUMENTO EXITOSO DE SEMILLAS DE Phaseolus *chiapasanus* Piper

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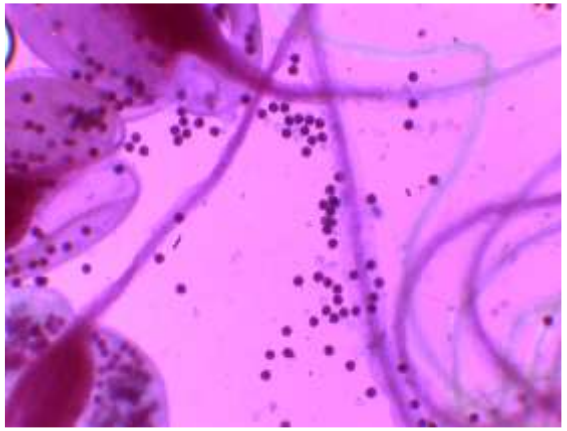
# Introducción

*Phaseolus* chiapasanus es un frijol silvestre propio, posee las flores más grandes del género (30x35 mm), vainas grandes (120x20 mm) y semillas discoides (diámetro 12 mm, 27.6 g/ 100 semillas). Aunque se describió originalmente de Chiapas en México, también se encuentra en Oaxaca y Veracruz. Hasta ahora no existen registros para el oeste de Guatemala. Es una liana alta de hasta 10 m de altura, que trepa en un bosque húmedo de transición tropical montano bajo. Es interesante tener algunas accesiones en los bancos de germoplasma (existen cuatro accesiones en el banco de germoplasma de la Alianza Bioversity Internacional y CIAT) para conocer mejor su potencial.





*P. chiapasanus* fue colectado en bosques mesófilos de montaña en Veracruz, Oaxaca y Chiapas, entre los 600 y 1500 msnm en el territorio mexicano (Hernández-Delgado et al., 2015), durante los años de 1991 y 1992. Durante estas colectas se obtuvieron tres (3) muestras de la especie Phaseolus chiapasanus en el estado de Oaxaca en un rango altitudinal 900 a 1400 msnm en la Sierra Madre del Sur con temperaturas promedio de 24°C humedades relativas mayores al 60% (Morrone.,2017).

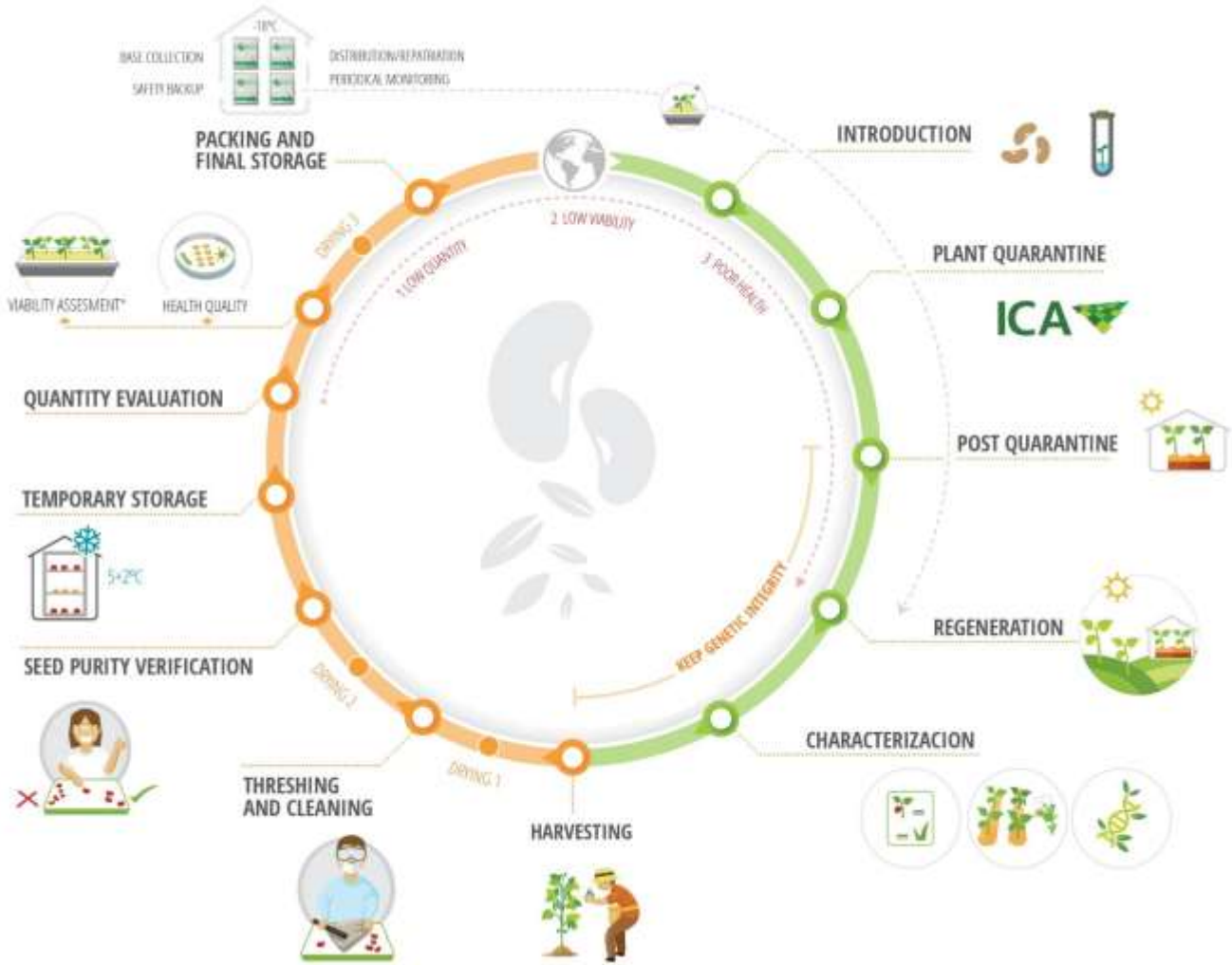


En este estudio nos enfocamos sobre *Phaseolus chiapasanus* Piper identificado como G40794 en el **Banco de Germoplasma de la Alianza Bioversity International y CIAT, Palmira, que conserva a la fecha la colección de fríjol (*Phaseolus*) más grande y diversa del mundo con 37.934 accesiones de 47 especies.**


# Banco germoplasma en Palmira

SEED CONSERVATION - **GRP**

# OPERATIONS FOR BEANS AND TROPICAL FORAGES



# *Phaseolus chiapasanus* Piper G40794 – Oaxaca, Mexico

- Mean temperature 25.7 °C (15 °C- 34 °C), mean relative humidity 59.8% (36.6%- 90.9%)
- 30 plants were established in a furrow
- After 2 years (750 days) it has produced 1,640 seeds
- The root system supports establishment of the climbing aerial part, and it also helps the plant, when rains resume, to compete with other understory forest bushes and vines

# Objetivo

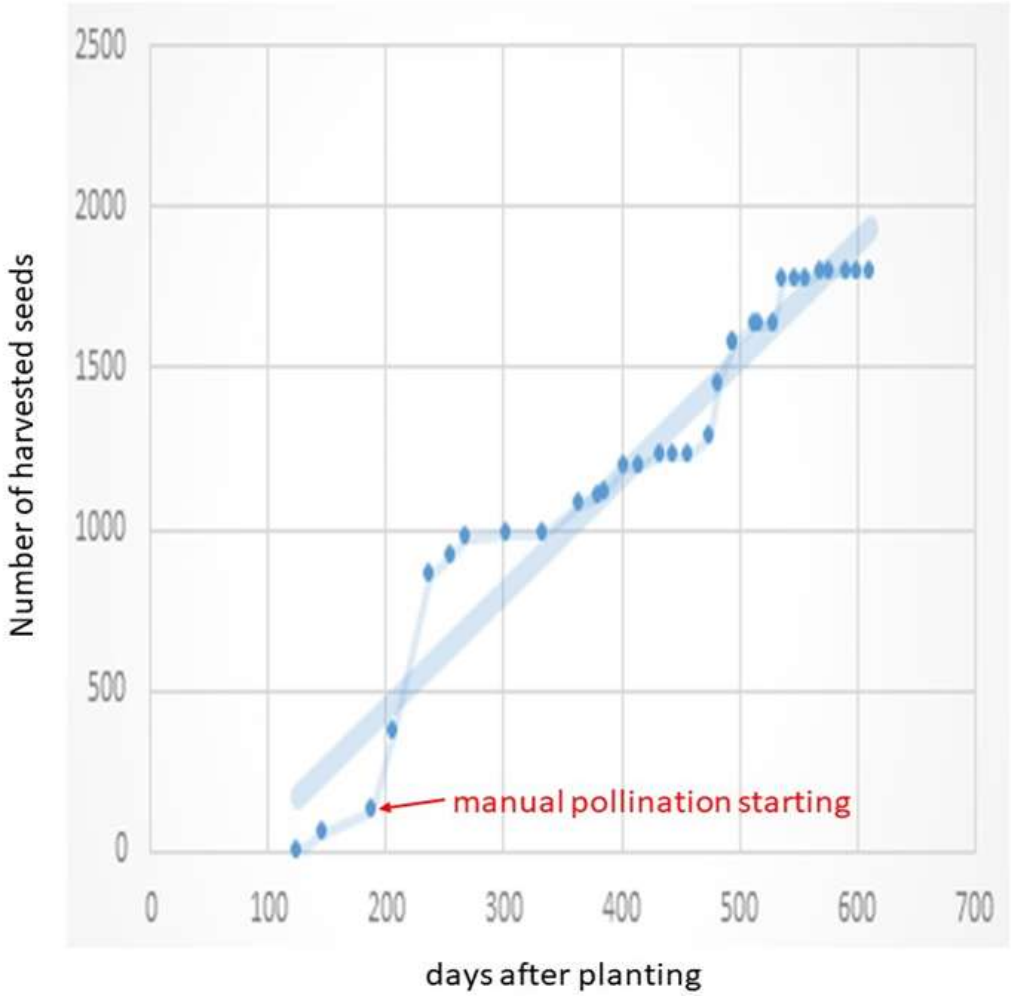
Desarrollar y evaluar una metodología optimizada de regeneración de germoplasma para *Phaseolus chiapasanus* Piper.

# Métodos

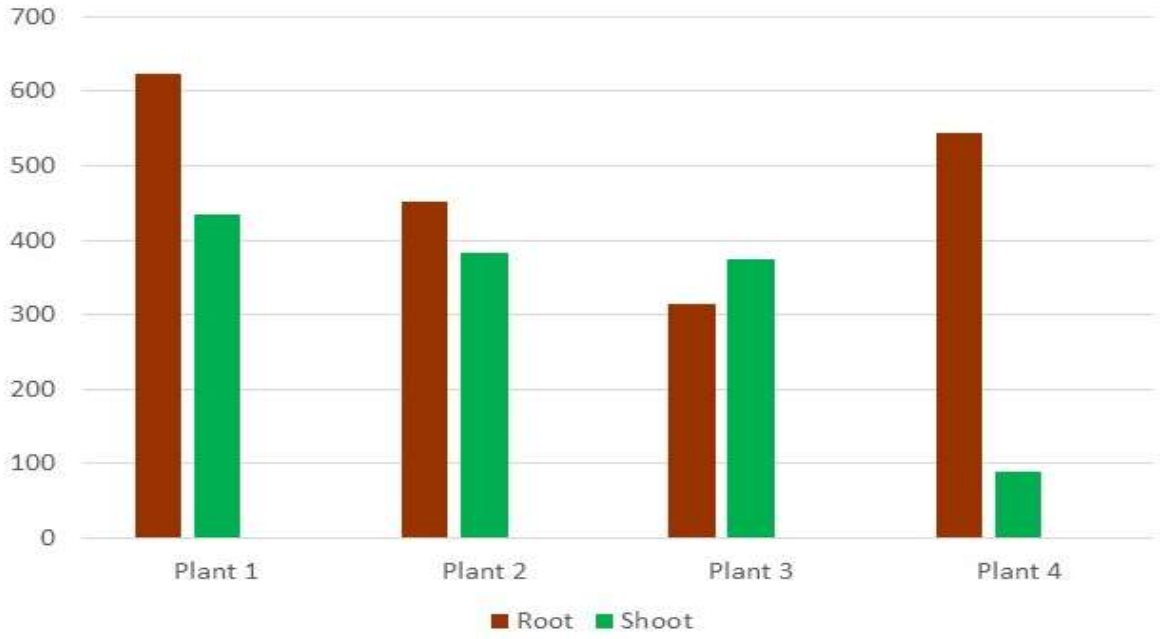
Dada la ecología original (la accesión G40794 fue recolectada en Oaxaca, México, en la comarca de Santiago Xanica a 1.400 msnm) el material fue plantado en la estación de Tenerife (Colombia, Valle del Cauca, Cerrito; lat. N 03°41′30″, long. W 76°04′23″, elevación 2.160 msnm). La siembra se realizó en casa de malla cerrada con techo de plástico y paredes de malla anti áfidos. La temperatura media fue de 25,7ºC (15,1ºC-34ºC), y la humedad relativa media del aire de 59,8% (36,6%-90,9%). Se establecieron un total de 30 plantas en fila.

# Resultados

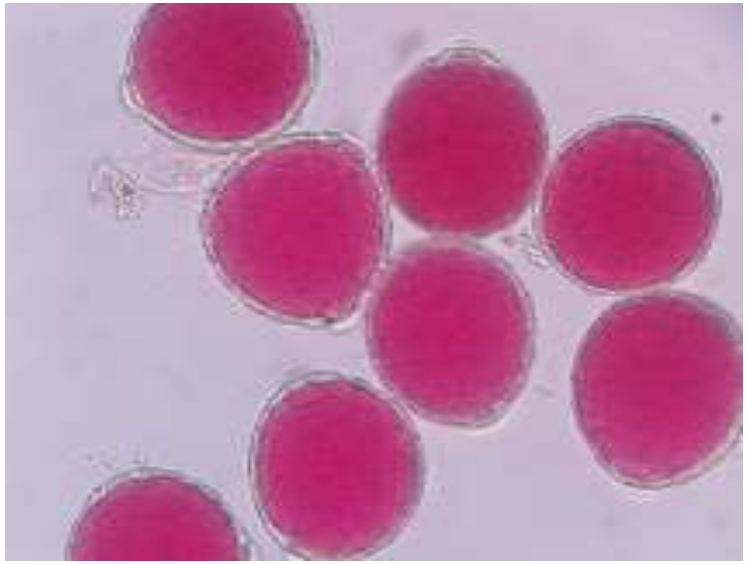
Después de 750 días ha producido 1.614 semillas. La floración (con viabilidad del polen del 95,6%) se inició a los 121 días de la siembra y fue continua. El desarrollo de la vaina desde la antesis hasta la madurez duró 64 días. La polinización manual aumentó significativamente el número de semillas.

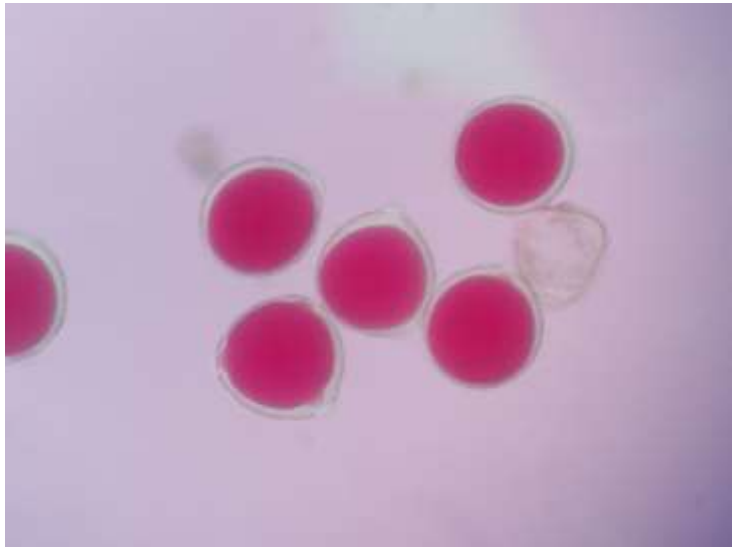

Number of harvested seeds
2500
2000
1500
1000
500
0
0
100
200
300
400
500
600
700
manual pollination starting
days after planting

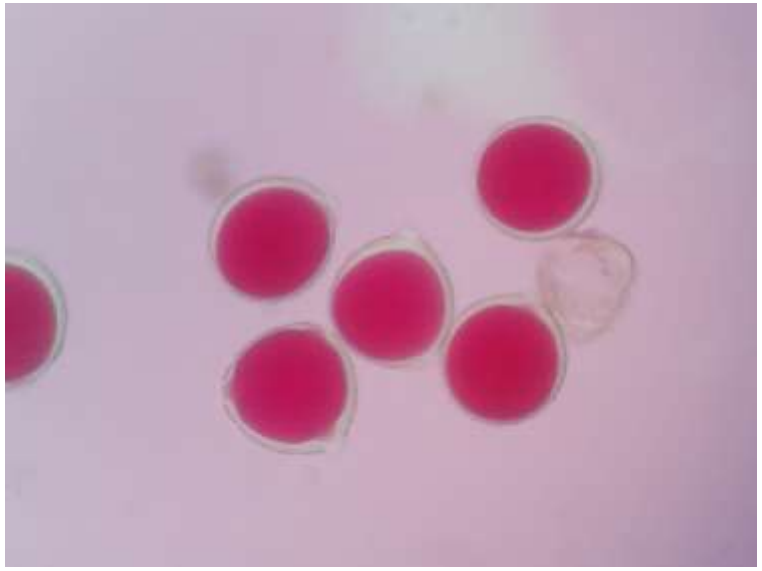
El sistema radicular constiye una parte importante de la biomasa total, lo que indica una estrategia reproductiva de doble propósito. El sistema radicular tuberoso ayuda al establecimiento de la parte aérea trepadora cuando se reanudan las lluvias por lo tanto ayuda a la especie a competir con otros arbustos y lianas en el sotobosque del bosque.




# P. chiapasanus G40794







Debido a su hábito plurianual, tendrá varios eventos de dispersión de semillas relativamente grandes, contribuyendo ambos a la supervivencia de unos pocos individuos en la progenie.

La apertura de las flores coincidió con la salida del sol, por eso la polinización se realizo entre las 5:30 y 9:00 de la mañana, la caída del polen y la receptividad del estigma deben coincidir con la apertura de la flor por eso se realiza en flores recién abiertas.

El período entre la polinización y fecundación fue de aproximadamente 4 horas.

# CONCLUSIONES

En condiciones de altitud y equinocciales es posible producir suficiente semilla de calidad de una especie forestal como P. chiapasanus.

Proporcionando más altura a las plantas, podría ser posible obtener una mayor biomasa y eventualmente un mayor número de semillas.

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16 October 2020

# Successful seed increase of *Phaseolus chiapasanus* Piper

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*Phaseolus chiapasanus* is a wild bean of its own: it has the largest flowers in the genus (30x35 mm), big pods (120x20 mm) and discoid seeds (diam. 12 mm, 27.6 g/ 100 seeds), and upon drying all vegetative and reproductive plant parts turn black (Freytag & Debouck 2002). Its tricolporate pollen is unique, showing some affinity with the genus *Sigmoidotropis* (Piper) A. Delgado (Delgado-Salinas et al. 1982). It also has affinities with the sections *Brevilegumen* Freytag and *Xanthotricha* A. Delgado (Delgado-Salinas et al. 2006), but its unique morphology justifies a separate section *Chiapasana* A. Delgado (1985). As most species of the genus, its karyotype is 2n= 2x= 22 (Mercado-Rua´ro & Delgado-Salinas 1996). Although originally described from Chiapas in Mexico (Piper 1921), it also occurs in Oaxaca and Veracruz (Debouck 2014). So far no records exist for western Guatemala. It is a tall liana up to 10 m high, climbing in a humid lower montane tropical transition forest, where deforestation is high because of coffee plantations. It is thus interesting to have a few accessions in genebanks (four accessions exist in CIAT genebank) in order to know more about its potential. To that end it is important to develop regeneration capacity, of which some details are reported hereafter.

Given the original ecology (accession G40794 was collected in Oaxaca, Mexico, in the county of Santiago Xanica at 1,400 masl) the material was planted in the station of Tenerife (Colombia, Valle del Cauca, Cerrito; lat. N 03°41'30", long. W 76°04'23", elev. 2,160 masl). Planting was done in closed mesh-house with plastic roof and anti-aphids mesh walls. Mean temperature was 25.7°C (15.1°C-34°C), and mean air relative humidity 59.6% (36.6%-90.9%). A total of 30 plants were established in a row (Figure 1). After 2 years and 20 days or a total of 750 days it has produced 1,614 seeds (approved for viability (84%) and health, according to the standards of CIAT genebank; Gereda et al. 2018) (Figure 2). Flowering (with pollen viability of 95.6%) started 121 days after planting and was continuous while peaking three times in a year. The development of the pod from anthesis to maturity lasted 64 days. Hand pollination significantly increased the seed set (Figures 2 and 3).

Figure 1 – Row of *P. chiapasanus* plants established in a mesh-house in Tenerife; left scale 1 m high.

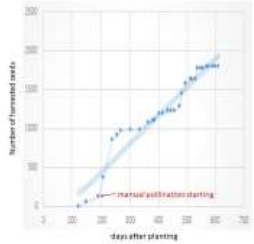


Figure 2. Evolution of seed production over time.

The root system was a significant part of the total biomass (Figure 4), indicating a reproductive strategy of dual purpose. The tuberous root system helps to the establishment of the climbing aerial part when rains resume, and thus helps the species to compete with other bushes and vines in the understory of the forest. Because of its pluriannual habit, it will have several seed dispersal events of relatively large seeds, both contributing to the survival of a few individuals in the progenies.

Concluding, in altitude and equinoctial conditions it is possible to produce enough quality seed of a forest species such as *P. chiapasanus*. Providing more height to the plants, it could be possible to obtain a higher biomass and eventually a higher number of seeds. We were able to keep *P. chiapasanus* plants for months in a growth chamber in Palmira but without flowering because of frequent clipping of the shoots.

Figure 3. Features of the biological cycle of *P. chiapasanus* (G40794) in Tenerife station; clockwise from upper left: close-up of flower one day after anthesis with lilac color of petals fading and a black spot at the sinus of the standard upper margin; exposure of stigma by pressing the left wing; bringing pollen on the stigma with help of pencil point; tuberous root systems and lower stems of three plants in the row.

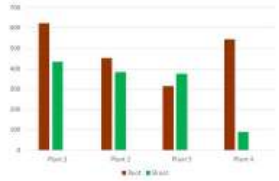

Figure 4. Biomass produced in g (fresh weight) between the underground and aerial parts of four plants of *P. chiapasanus* sown in Tenerife 1,056 days after planting.

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