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Variability in the indument of *Phaseolus vulgaris* var. *aborigineus* (Fabaceae)

Variabilidad en el indumento de *Phaseolus vulgaris* var. *aborigineus* (Fabaceae)

Fabiana S. Ojeda
María T. Amela García
Patricia S. Hoc

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Nota científica

SUMMARY

The indument of *Phaseolus vulgaris* L. var. *aborigineus* (Burkart) Baudet, a native bean from Argentina, potential source for improvement of cultivated varieties, was compared between different genetic lines. Seeds collected from wild, weedy forms and presumptive hybrid individuals in two distant latitudes were sown in two sites of Buenos Aires University Campus (field and greenhouse). Two type of trichomes were found, which differenciate in length and shape. The pubescence density was significantly different between wild specimens from different latitudes and between culture sites for plants of a same procedence. This character could be involved in physical defences of these plants.

Keywords

leguminosae • wild beans • physical defenses

RESUMEN

El indumento de *Phaseolus vulgaris* L. var. *aborigineus* (Burkart) Baudet, un poroto nativo de la Argentina, potencial fuente para mejoramiento de variedades cultivadas, se comparó entre diferentes líneas genéticas. Semillas de individuos silvestres, tipos maleza y presuntos híbridos colectadas en dos latitudes distantes fueron sembradas en dos sitios del campus de la Universidad de Buenos Aires (campo e invernáculo). Se encontraron dos tipos de tricomas que se diferencian en longitud y forma. La densidad de la pubescencia fue significativamente distinta entre especímenes silvestres de distintas latitudes y entre sitios de cultivo para plantas de la misma procedencia; este carácter podría estar relacionado con las defensas físicas de estas plantas.

Palabras clave

leguminosae • porotos silvestres • defensas físicas

PRHIDEB-CONICET/Dpto. de Biodiversidad y Biología Experimental. Facultad de Ciencias Exactas y Naturales. Universidad de Buenos Aires. Pabellón II, 4to Piso, lab. 75. Intendente Güiraldes 2160. Ciudad Universitaria. C.A.B.A. Argentina. C1428EGA. fabianaojeda@bg.fcen.uba.ar

INTRODUCTION

Cultivars and wild forms of *P. vulgaris* are important multipurpose crops, specially in the Neotropics where the species is native (4, 13, 14). The wild varieties (3, 4, 6) and the cultures of the commercial varieties and primitive races (1, 9) extend from northern Mexico to central Argentina, mainly along the Andes. *P. vulgaris* L. var. *aborigineus* (Burkart) Baudet, which easily hybridizes with the commercial forms, gives rise to fertile lines (1).

P. vulgaris var. *aborigineus* distributes from northwestern to central Argentina. The plants are scandent, with long internodes and the leaves covered with short hairs. Flowering begins late in summer and lasts until autumn. A large quantity of legumes are produced, easily dehiscent in dry climate.

The compatibility and the gene flow between the native variety and the cultivated ones originated wild-weedy-crops in areas of simpatry (16). In lowlands forests of Argentina, plants of presumptive hybrid origin between the wild variety and the commercial "red kidney" one were found; when self-pollination was induced, these plants tended to exhibit mainly the traits of the wild progenitor (6, 7). These complexes are under research to find out characters that should reduce production losses due to abiotic or biotic factors (10, 11, 12).

A successful culture of *P. vulgaris* var. *aborigineus* from seeds belonging to Salta and Córdoba was performed in Buenos Aires (6); the plants underwent the same phenological changes as in their natural habitats and set fruits.

The following hypothesis were tested:

H_1) Plants of *P. vulgaris* var. *aborigineus* from different procedences differ in the physical traits of their vegetative parts.

H_2) The wild, "weedy" and presumptive hybrid of *P. vulgaris* var. *aborigineus* from a same procedence differ in the physical traits in their vegetative parts.

MATERIALS AND METHODS

Seeds of *P. vulgaris* L. var. *aborigineus* were collected from the following specimens from Salta (wild: Hoc 346, 283, weedy: Hoc 359 and presumptive hybrid: Hoc 357) and Córdoba (wild: Drewes 615, 620, 659, 680, 661, 671), Argentina; subsamples are kept at the Banco de Germoplasma EEA-INTA-Cerrillos, Salta.

To compare procedences, during October and November 2005, 56 seeds (31 from Córdoba and 25 from Salta) were mechanically scarified with a cut in the integument, sown on filter paper in Petri dishes and kept at ambient temperature and natural photoperiod; 50 seedlings emerged (27 from Córdoba and 23 from Salta), but one of each procedence died. During October and November 2006, 84 seeds (34 from Córdoba and 50 from Salta) were sown; 5 seedlings from Salta and 9 from

Córdoba died due to fungal infections or susceptibility to transplant. For both seasons, each seedling was placed in a ¼ l pot with a mixture of soil: perlite 3:1; when they reached 15 cm height, they were transplanted to the field.

To compare culture site effect, 50 seeds from Salta were sown each season, half of the seedlings were transplanted to the field and half to a greenhouse.

The cultures were carried out at Facultad de Ciencias Exactas y Naturales of Buenos Aires University. Field: a place of 16 x 10 m partially shadowed by some trees was selected, holes 50 cm wide were performed, distributed in 6 files separated 1 m from each other, and filled with a mix of soil; perlite 3:1. Greenhouse: 10 l pots, previously filled with the same mixture were located 50 cm from each other in a partially shaded sector. Three canes were placed in each hole and pot to let the developing plant climb. Observations were performed since October to March 2005-2006 and 2006-2007.

The average meteorological conditions were as follows: Photoperiod, 7.1 LUX; Maximun temperature, 22.16°C; Minimun temperature, 14.4°C; Precipitation, 901.4 mm (2005-2006) and: Photoperiod, 7LUX; Maximun temperature, 21.63°C; Minimun temperature, 14.4°C; Precipitation, 1072.25 mm (2006-2007).

During both seasons and in both sites a leaf of each plant was collected and dried between paper sheets at the end of each culture season, and the middle leaflet was observed with a stereomicroscope. To estimate the indument density, trichomes were counted within a 0.25 mm² on both leaf surfaces.

To study the leaves surface with scanning electron microscopy, pieces were mounted in dishes metallized with gold-palladium and observed and photographed with a Zeiss Supra 40 Scanning Electron Microscope.

Pubescence data was analyzed using the Man Whitney (U) tests for two samples included in the STATISTICA 5.1 program (15).

Meteorological conditions were supplied by the Meteorological National Service.

RESULTS

Plant phenology

The reproductive period began in March; in 2006, the plants from Córdoba started flowering on March 19th, while those from Salta started on March 23rd. In 2007, only plants from Córdoba bloomed, since March 18th. Fructification did not take place in 2006 and began on March 28th in 2007 for both procedences.

Leaf pubescence

Plants from both procedences had two kinds of hairs: straight and long vs. uncinate and short (figure, page 306).

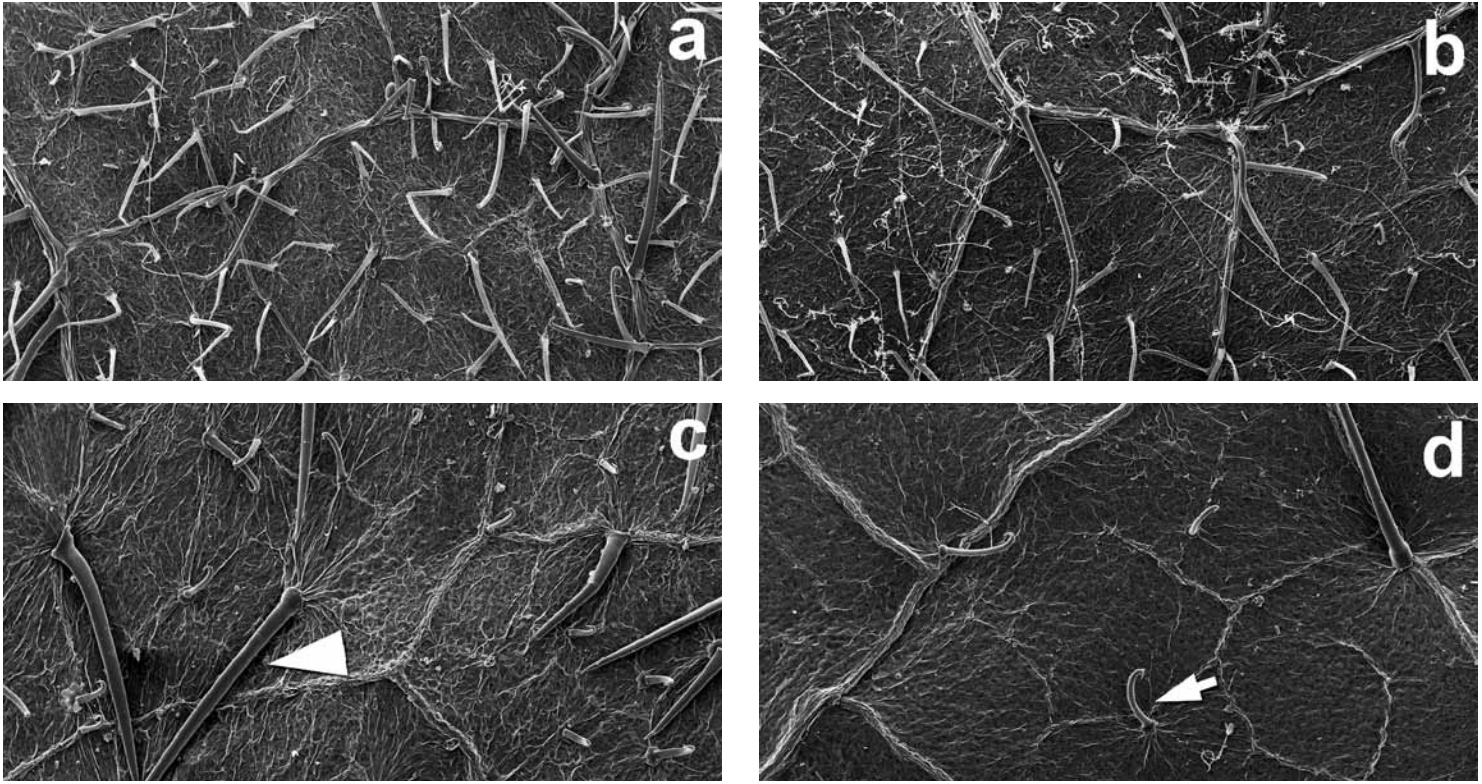

Figure. Foliar pubescence of specimens of *P. vulgaris* var *aborigineus* from different localities photographed with scanning electronic microscope (SEM). a-b, abaxial surface; c-d, adaxial surface; a and c, Córdoba; b and d, Salta; straight and long hair (arrow head); uncinate and short hairs (arrow). Scale bars = 10 µm.

Figura. Pubescencia foliar de los especímenes de *P. vulgaris* var *aborigineus* de las diferentes localidades, fotografiadas con microscopio electrónico de barrido (MEB). a-b, superficie abaxial, c-d, superficie adaxial; a y c, Córdoba; b y d, Salta; pelos rectos y largos (cabeza de flecha); pelos uncinados y cortos (flecha). Escala = 10 µm.

The former distributed beside or on the veins; the latter covered the blade and were more abundant, so they were employed to analyze the pubescence density. Plants from both procedences exhibited major density on the abaxial surface (figure, page 306; table).

Table. Leaf trichomes density (average and standard deviation) per 0.25 mm^2.
Tabla. Densidad de pelos en las hojas (media y desvío estándar) por 0,25 mm^2.

Procedence/site	Forms	Abaxial surface	Adaxial surface	N
[a] **Salta/field**	**wild + presumptive hybrid + weedy**	**186 ± 74**	[a2, b2] **51 ± 34**	**9**
	wild	[d] 232 ± 68	[e] 47 ± 2	2
	presumptive hybrid	[d] 207 ± 107	[e] 62 ± 64	3
	weedy	[d] 148 ± 40	[e] 44 ± 14	4
[b] **Salta/greenhouse**	**wild + presumptive hybrid + weedy**	[b1] **267 ± 95**	[b2] **74 ± 31**	**19**
	wild	[f] 301 ± 118	[g] 95 ± 35	8
	presumptive hybrid	[f] 292 ± 71	[g] 67 ± 13	3
	weedy	[f] 223 ± 66	[g] 56 ± 18	8
[c] **Córdoba/field**	wild	[c1] 307 ± 51	[c2] 102 ± 44	**13**

Values with different letters differed significantly ($p < 0.01$); [a1], U = 41; [a2], 36.5; [b1], U = 12; [b2], U = 12.
Los valores con letras diferentes difieren significativamente ($p < 0,01$); [a1], U = 41; [a2], 36,5; [b1], U = 12; [b2], U = 12.

For each leaf surface, the pubescence was significantly different between procedences (abaxial, U = 12; $p \leq 0.01$; adaxial, U = 12, $p \leq 0,01$) and between sites for plants from Salta (abaxial, U = 41, $p \leq 0.01$; adaxial, U = 36.5, $p \leq 0,01$). On the contrary, for any leaf surface, the pubescence did not differ significantly between entities cultured from Salta, neither in the field (abaxial, H = 1.61, $p \geq 0.01$; adaxial, H = 0.61, ≥ 0.01) nor in the greenhouse (abaxial, H = 5.34, $p \geq 0.01$; adaxial, H = 3.03, $p \geq 0.01$).

DISCUSSION

Plant phenology

Plant development was affected by strong winds and storms; the last ones flooded the plantation and several plants died during the vegetative period. In 2007, few plants reached flowering, perhaps ought to the adverse meteorological conditions. Due to the photoperiod sensibility, when germplasm of a population is sown in other latitude, blooming, and consequently, fruiting, may be anticipated or delayed (1). The first blossoms appear in the middle of February in Córdoba (Drewes, pers. com.) and at the beginning of March in Salta (5), so the reproductive stages of both procedences cultured in Buenos Aires experienced a delay, but overlapped somewhat.

Leaf pubescence

The trichome density of the wild forms from both procedences and for a given procedence in different culture sites differed significantly. Variations in leaf trichome density may determine the resistance or susceptibility to pests, for example between lines of *P. vulgaris* (8). In soy, more grasshoppers fed on specimens without trichomes than on hairy ones (Singh *et al*., 1971 cited in 2).

Future studies

The damage of the arthropods in the crop are necessary to analyze if the pubescence acts as a physical barrier in *P. vulgaris* var. *aborigineus*, which will be dealt in a coming paper.

CONCLUSIONS

The indument density varied significantly between wild specimens from different latitudes and between culture sites for plants of a same procedence. The indument density might constitute a mechanical obstacle against the herbivores.

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