

ACHENE DIMORPHISM IN *BIDENS PILOSA* L. (ASTERACEAE) AS DETERMINED BY GERMINATION TEST

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ABSTRACT

The germination of achenes of *Bidens pilosa* L. was analyzed during the life span of the mother plant. Decrease in the range of achene size was monitored until the senescence of the mother plant when the shortest achenes were harvested. The analysis of the germination percentage confirmed the presence of two distinct classes, formerly defined as short and long ones. Because length can not be used for the separation of those classes, the morphological characteristics of the tegument, specially of the ornament must be used for separation of the achenes with verrucose tegument (formerly named as short achenes) and achenes without ornament of the tegument (formerly named as long achenes). The achenes with verrucose tegument presented dormancy and light sensitivity, and the achenes without ornament of the tegument presented no dormancy and no light sensitivity for the germination process.

Key words: *Bidens pilosa*, seed dimorphism, phytochrome, seed germination

INTRODUCTION

Bidens pilosa is a widelyspread weed responsible for decrease in the yield of several crops (FORSYTH & BROWN, 1982). The presence of dimorphic achenes in *Bidens pilosa* has been described by several authors (FORSYTH & BROWN, 1982; SANTRA *et al.*, 1981). FENNER (1980), however, described the presence of polymorphic achenes, and CORKIDI *et al.* (1991) described about heteromorphic achenes in *B. odorata*.

FORSYTH and BROWN (1982), working with short and long achenes observed that short achenes presented dormancy and long ones germinated under light and darkness indicating no phytochrome control of the process. VALIO *et al.* (1972) observed that light of different wavelength had no effect on achene germination and proposed that phytochrome was not involved in the process, but FENNER (1980) observed that the canopy filtered light induced photosensitivity for germination in *B. pilosa*. AMARAL and TAKAKI (1993) working with achenes of *B. pilosa* harvested in different places observed that the light sensitivity was present in different batches but short achenes always presented light sensitivity. In the present work we described the dimorphism of achenes in *B. pilosa* by germination tests.

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MATERIAL AND METHODS

Achenes of *B. pilosa* were harvested from plants during their life-span (120, 130, 150, 187 and 237 days). The achenes were measured with the aid of millimetered rule and eye piece.

Thirty achenes, on two layers of water moistened filter paper, in each of four 90 mm Petri dishes were used for germination test. The dishes were placed under continuous fluorescent light and under darkness by wrapping them with two layers of aluminum foil as described previously (AMARAL & TAKAKI, 1993). Red light was obtained by filtering the fluorescent white light with two layers of red cellophane paper, and far-red light with the aid of two layers each of red and blue cellophane paper under incandescent bulb. The dark germinated achenes were counted under dim green safe light (KENDRICK & FRANKLAND, 1969).

The germination percentage data were transformed in $\arcsin \sqrt{x}$ for analysis of variance (SNEDECOR, 1962). The distributions of achene sizes harvested in different periods were analysed and the least significant difference (LSD) determined at 5% level of probability.

RESULTS AND DISCUSSION

We observed that the distributions of achene sizes during the life span of *B. pilosa* decreased from first achenes harvested where the range of size were 5-12 mm to 3-10mm at achenes harvested in the senescent mother plants, i.e., after 237 days (Figure 1). The achenes were separated in two classes long and short ones by morphological characteristics (Figure 2). It was observed that achene considered as short presented verrucose ornament of the tegument, while achene considered as long presented no ornament. The LSD of mean achene sizes indicated significative difference among harvests (Table 1). This meant that the short achenes (5 mm long) of the first harvest was of the same size that the long achenes (5 mm long) while short achenes were 3 mm long in the last harvest.

Table 1. Mean achene sizes at different harvests

Harvest (days)	N	Mean size
120	620	8,51 A
130	620	7,67 B
150	620	6,44 C,D
187	620	6,62 C
237	620	6,10 D

N=number of measured achenes

LSD=0,24

Means with the same letter are not significantly different.

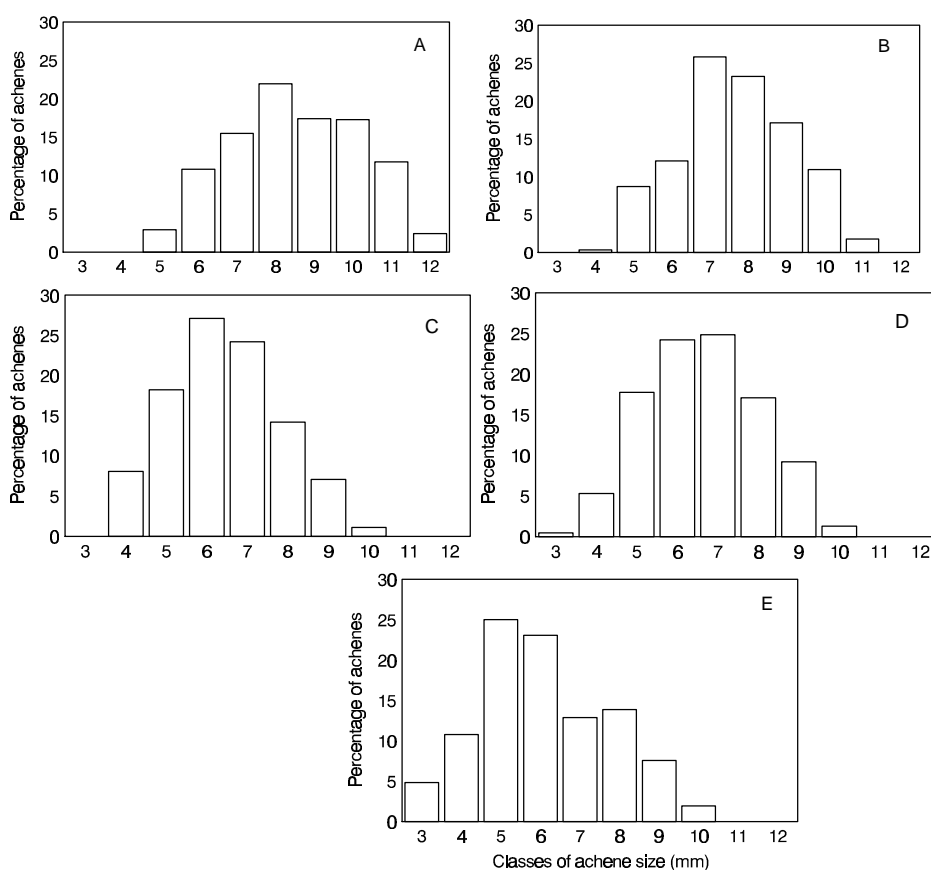


Figure 1. Distribution of achene sizes harvested in different ages of mother plant. A) 120 days; B) 130 days; C) 150 days; D) 187 days and E) 237 days.

The presence of polymorphic achenes has been reported by KOLLER and ROTH (1964) in *Gymnarrhenna micrantha*, by WULFF (1985) in *Hyptis suaveolens* and by

VENERABLE and LEVIN (1985) in *Heterotheca latifolia*.

Germination test indicated that the achenes harvested after 120 days and ranging from 6 to 12 mm (achene without ornament) presented the same pattern of germination with no light sensitivity while 5 mm achenes (with ornament of the tegument) presented low germination and light sensitivity (table 2).

Tabela 2. Germination percentage of achenes of different sizes of *Bidens pilosa* harvested from 120 day-old plants and 150 days, under continuous white light and darkness.

Achene length (mm)	120 day-old harvest		150 day-old harvest	
	light	dark	light	dark
4	-	-	18.6 b	6.6 c
5	38.2 b	7.5 c	96.6 a	97.5 a
6	97.5 a	97.5 a	96.6 a	98.3 a
7	98.3 a	98.3 a	100 a	97.5 a
8	98.3 a	98.3 a	97.5 a	97.5 a
9	96.6 a	97 a	98.3 a	98.3 a
10	100 a	100 a	100 a	98 a
11	100 a	100 a	-	-
12	100 a	100 a	-	-

means with the same letter are not significantly different

- achene not found in the indicated size

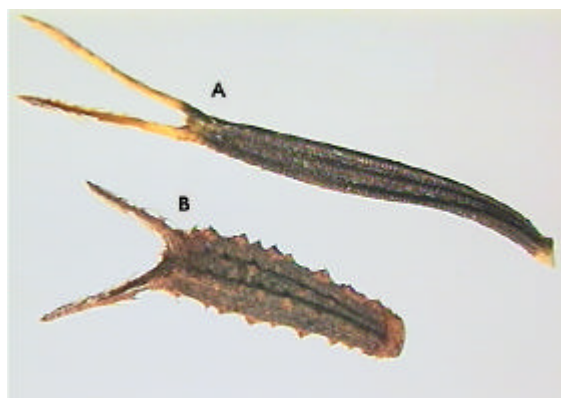


Figure 2. A. Achenes with ornament of the tegument (formerly named as long achene) and B. achene with verrucose ornament of the tegument (formerly named as short achene) of *Bidens pilosa*.

Achenes harvested from 150 days old plants presented the same pattern of germination. Short achenes now with 4 mm long presented dormancy and light sensitivity while long achenes (5-10 mm) presented no light sensitivity (Table 2). Due to the decrease in

the range of achene size, the length could not be used to separate the two classes of achenes from a population of plants and morphological characteristics presented in the Figure 2 must be used for the separation of those classes.

FELIPPE (1990), working with *B. gardneri* observed the same pattern of dimorphism with dormant short achenes. CORKIDI *et.al.* (1991), working with achenes of *B. odorata* reported the presence of three classes for size distribution and proposed that phytochrome controlled germination in short and long achenes but not in achenes of intermediate size.

AMARAL and TAKAKI (1993) proposed that the germination of achenes of *B. pilosa* was controlled by phytochrome and the proportion of pre-existing Pfr (active form of phytochrome) was responsible for the germination in darkness.

The incubation of achenes under red and far-red light indicated that the germination of achenes without tegument ornament (formerly named as long achenes) were not controlled by phytochrome, however, achenes with verrucose ornament of the tegument (formerly named as short achenes) highest percentage germination was obtained under white and red lights, indicating phytochrome control (Figura 3). The achenes with verrucose ornament presented dormancy with the maximum percentage germination of 50% and the achenes without ornament of the tegument presented no dormancy.

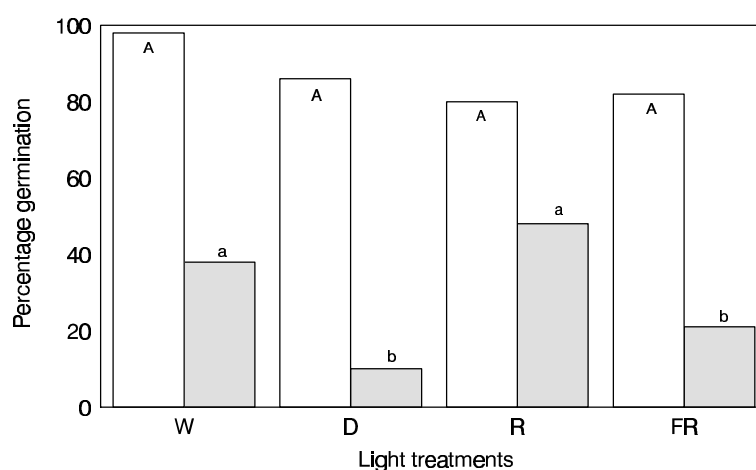


Figure 3. Effect of different light qualities on the germination of achenes without tegument ornament () and achenes with verrucose ornament of the tegument (::) of *B. pilosa* incubated at 25°C. The achenes were separated by morphological characteristics of the tegument ornament. W= white light, D= darkness, R=red light and FR= far-red light.

A,B- means with the same letter are not significantly different

a,b- means with the same letter are not significantly different

Our results indicated that the achenes of *B. pilosa* were dimorphic, confirming FORSYTH and BROWN (1982) findings, although FENNER (1980) reported the presence of polymorphic achenes with the presence of an intermediate class, we suggest that the achenes must be separated only by morphological characteristics.

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