ANNUAL INCREASE IN BULB´S SIZE IN *Tigridia huajuapanensis* Molseed ex Cruden

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SUMMARY

Capsules were collected in the region of Valsequillo, Puebla in 1992 and stored under ordinary room conditions till sowing. Seeds from ten capsules, each from a different plant, were sown June 6, 1995 separately. The seedlings were replanted to plastic bags filled with volcanic sandy soil. The objective of this study was to determine the annual increase in bulb mass. The fresh mass was registered annually during the plant dormancy. In the first year the size of bulbs varied from 28 to 415 mg, in the second year from 254 to 5,001 mg, the third year from 400 to 10,800 mg. The increments were: the second year from 2.1 to 151 mg, the third year from 1.06 to 52.2 mg. Some bulbs remained dormant, which resulted in a reduction of their mass. The rest period lasted four months, approximately. The bulbs entered into flowering the fourth year from sowing the seeds.

KEY WORDS: Flowering, shooting, dormancy, ornamental plant.

INCREMENTO ANUAL EN TAMAÑO DE BULBOS DE *Tigridia huajuapanensis* Molseed ex Cruden

RESUMEN

Cápsulas de tigridia fueron colectadas en el área de Valsequillo, Pue. en 1992. Semillas de 10 cápsulas, cada una de diferente planta, se sembraron por separado el 30 de junio de 1995. Las plántulas se transplantaron en bolsas de plástico con tierra volcánica. El objetivo principal de este ensayo fue determinar el incremento anual en masa de bulbos. El peso fresco se determinó siempre en la etapa de reposo profundo de bulbos. En el primer año el peso varió de 28 a 415 mg, en el segundo de 254 a 5,001 mg y en el tercer de 400 a 10,800 mg. Los incrementos fueron en el segundo año de 2.1 a 151 mg, y en el tercer año de 1.06 a 52.2mg. Algunos bulbos no brotaron, lo cual produjo una reducción de su masa. El período de reposo profundo es de 4 meses, aproximadamente. Los bulbos entraron en la edad madura de floración en el cuarto año.

PALBRAS CLAVE: Floración, brotación, reposo, planta ornamental.

INTRODUCTION

Tigridia huajuapanensis Molseed ex Cruden (Figure 1), in comparison to *T. pavonia* Ker. Gawl., belongs to a group of tigridias of a relatively inconspicious flowers and of low stature (Molseed, 1970). This species was found to be abundant in the area of Valsequillo, state of Puebla. This plant grows in xerophytic, strongly eroded, rocky terrain. Due to these conditions of growing, flowering and bulbs characteristic (data to be reported later), it may constitute a species of interest to landscaping and to the conservancy of wild life, specially birds in disturbed land (Borys and Leszczyñska-Borys, 1998b).

Various aspects of horticultural and ecological interest were related to the annual increase in the bulbs fresh mass, a characteristic rarely studied in wild bulb's species. The annual increase in the bulbs fresh mass, the bulbs linear dimensions, influenced the flowering readiness of some species or their selections, the readiness for vegetative multiplication, the number of roots produced per bulb and the depth of rooting (Leszczyñska-Borys *et al*., 1995a, b) The bulbs size and the bulbs age were without influence upon the rest period of bulbs of *T. pavonia* Ker. Gawl. and the percentage loss in the fresh mass of bulbs (Borys, data unpublished). The losses in bulbs stands of three species of genus *Tigridia* depended upon the interaction of bird species with the size of bulbs (Borys and Leszczyñska-Borys,

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1998 b). Road landscaping and city´s landscaping should take into account this aspect in the successful establishment of bulbous species. Moreover, the reintroduction of bulbous species into the wild habitat requires planting of bulbs forming contractil roots, to secure a rapid, forced, deep establishment of bulbs. This, to make more difficult access to animals feeding, to reduce losses in the fresh mass during the dry season. A lack of information upon the size and the growth of bulbs of *T. huajuapanensis* and its probable use in breeding and/or landscaping forced us to study the annual increase in bulb size and to define the bulbs size and age, when this species is ready to flower.

Figure 1. A flower of *Tigridia huajuapanensis* Molseed ex Cruden.

MATERIAL AND METHODS

The capsules were collected from a wild habitat of plants in the area of Valsequillo, Puebla, Mexico. One capsule was harvested from each of ten plants in 1992, stored dry under ordinary room conditions in paper bags. The seeds were sown June 6, 1995 in volcanic sandy soil, each capsule forming one population of seeds, later of seedlings. The seedlings were replanted to plastic bags with a volcanic sandy soil. Plants were watered according to the need presented, including the rest period which occurred at temperature ranging from 0 to 24^{0}C. The tap water was used for watering. Once a year a fertilizer mixture (Borys and Bustamante, 1990) was applied to the soil. The fresh mass of bulbs was measured yearly during the rest period. General notes upon plants growth and flowering were taken.

RESULTS AND DISCUSSION

Growth season

In natural field conditions the growth season is limited by shallow soils (less than 30 cm of depth) and the length of rainy season (July to October; García, 1973). Growing plants from seeds in plastic bags, it was assumed, that the above factors were eliminated. Under such conditions the basal leaves and shoots started to die at the end of September and dried completely at the end of October till the end of November. The bulbs started shooting the second half of March and this process ended in July (Table 1). In general the growth season of plants grown in plastic bags, watered frequently, started to shoot earlier by three months and terminated their growth one month later as compared to those plants grown in natural habitat (when the rainy season starts in June to July). The bulbs, in spite of beeing watered entered a deep dormancy period.

Shooting of bulbs

The shooting of bulbs was dispersed in a very wide time scale (Table 1). Observations suggest that this could be due to a difference in the time of bulbs entrance into the rest period. Probably the period of rest of each bulb is constant. This aspect of bulbs development remains to be defined. It is interesting to note that the bulbs shooted in two waves of major intensity, the 13.5 and 27.5, each of this peaks were followed by lower number of bulbs shooted. As mentioned above, a bulb of larger size may divide giving two bulbs, thus two shoots. Such cases were observed for the first time in bulbs four years old.

TABLE 1. Shooting of one year old bulbs *of Tigridia huajuapanensis.*

Date (Year 1996)	Total number of bulbs	Bulb shooted (%)
May 2	13	10.16
May 6	16	12.50
May 9	30	23.44
May 13	57	44.53
May 16	71	55.47
May 20	78	60.94
May 27	100	78.13
June 10	117	91.41
July 18	128	100.00

Bulb size

The yearly mean increase in mass was highly significant (Table 2). The highest increase (11.8 fold) was noted in 1996 as compared to the year 1995. In 1997 the bulbs average mass increased only 2.4 fold. The effect of the two years old bulbs upon the bulbs size of the third year ilustrated Figure 2. There was a very high difference in mass among bulbs (Table 3). Only 24.21% of the total number of bulbs were in the class of above 5 g. This, may be due to the limited volume of disponible soil and the low column of soil. It was noted that, most of roots accumulated at the bottom of bag and the bulb could not be forced into a deeper layer and could not escape from higher temperature of the substrate.

The bulbs of *T. huajuapanensis* of minor age, one-year-old, were simple one. The third year bulbs of larger size initiated a process of dividing, giving two bulbs, enclosed in a common tunic. Thus, probably, we may get two shoots per bulb or these two bulbs may separate each other. Such reactions were noted also in *T. pavonia* (Borys *et al.,* 1998 a, b, c)

TABLE 2. Bulbs average mass (mg) of *Tigridia huajuapanensis* generated from seeds, sown in 1995.

	Year				Ratio	
	1995	**1996**	**1997**	**F value**	**1996/1995**	**1997/1996**
Mean	128.1	1412	3379	174***	11.8	2.7
Minimum	81.6	455	1914			
Maximum	177.1	2296	4354			
Number of bulbs	139.0	121			0.87	0.79

*** Significant difference at a $P \leq 0.001$

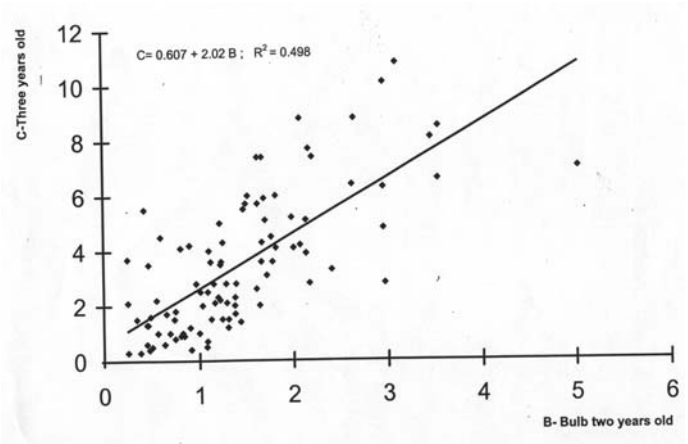

Figure 2. Mass of three years old bulb (C) of *Tigridia huajuapanensis* a function of previous year´s mass (B).

TABLE 3. Distribution of frequency of bulb weight in every year of cultivation of *Tigridia huajuapanensis*.

Year					
1995		**1996**		**1997**	
Weight (mg)	**%**	**Weight scale (g)**	**%**	**Weight scale (g)**	**%**
<30	0.72	<5	14.05	<1.0	16.84
31.60	8.63	0.5-10	20.66	1.1-2.0	17.90
61.90	15.83	1.1-1.5	26.45	2.1-3.0	16.84
91-120	20.86	1.6-2.0	20.66	3.1-4.0	11.58
121-150	20.86	2.1-2.5	87.26	4.1-5.0	12.63
151-180	16.55	2.5-3.0	5.79	5.1-6.0	9.47
181-210	6.48	3.1-3.5	2.48	6.1-7.0	4.21
211-240	4.32	3.6-4.0	0.83	7.1-8.0	4.21
241-270	1.44	4.1-4.5	0	8.1-9.0	4.21
271-300	3.60	4.6-5.0	0	9.1-10.0	0
≥301	.72	5.1>	0.83	≥10.1	2.-11

Productiveness of seeds and bulbs.

The yield of seedlings obtained from seeds was low (60%). Even lower was the number of one year bulbs harvested (Table 4). The number of bulbs harvested, with years, was falling gradually. Three factors were responsible for this phenomenon: a) bulbs which not shooted remained dormant, reduced their size and probably, low energetic reserves to respond with growth; b) the wild, small birds feeding; c) some bulbs rotted. Thus, the yield of bulbs ready to flower, as compared to the number of seeds sown, was very low (10%). It is possible, that the number of bulbs reaching the maturity stage to flower will reach in the next year 100% of bulbs.

The size of bulbs seems to influenced more the flowering ability of bulbs than their shooting maturity (Table 5). These aspects of bulb development remain to be studied in details in the near future once sufficient seeds and bulbs will be available.

The bulbs of *T. huajuapanensis* grew slowly, as compared to *T. pavonia* Ker. Gawl. and were reaching the flowering stage very late, when reproduced from seeds (Leszczyñska-Borys *et al*., 1995 b). In the case of *T. huajuapanensis* one will have to waite much more time to get the first flowers, when one year bulbs will be planted. The plants of *T. pavonia* reproduced from seeds were flowering the same year. Also, in *T. huajuapanensis* a high loss of bulbs may occurr. Thus, the costs of bulbs production in *T. huajuapanensis* will be a few times higher.

One way of maintaining a stand of *T. huajuapanensis* at high density, to secure high density stand of flowers, would

be itself-reproduction by continued generation of seeds. At least, in a mentioned natural stands of *T. huajuapanensis*, no high density presence of plants was observed. No data is available upon the seeds production and germination of this species. It was found, however, that the bulbs of this species were vulnerable to feeding by birds (Borys and Leszczyñska-Borys, 1998 b) and rodents. We may get a high yield of seedlings but the number and percent of bulbs coming to the age of flowering may be very low. These questions require some investigations.

TABLE 4. Productiveness of seeds sown of *Tigridia huajuapanensis*.

	Seeds sown	Sedlings obtained	Bulbs harvested			Bulbs which began flowering in 1998
			1995	1996	1997	
Total	250	150	139	125	95	25
Mean		30	27.8	25	21	5
Minimum		13	13	9	9	0
Maximum		46	40	33	32	11

TABLE 5. Summary of relations between bulbs planted and growth events observed of *Tigridia huajuapanensis*.

Number of planted bulbs (year 1997)		Number of bulbs	
Total	≥2.0 g	Shooted	Flowered [z]
95	64	61	24

[z]Refers to the year 1998, the first year of flowering.

CONCLUSIONS

T. huajuapanensis belongs to a small-size bulb species. The bulb size of one year old bulb produced from seeds is very small. Its growth is the most intensive in the second year and its intensity lowers in the third year. The bulbs of the fourth year are reaching its flowering maturity. The bulbs are beeing characterized by a wide scale of time of shooting and a long rest period.

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