Karyotypes of Species of *Sesbania* Scop. (Fabaceae)

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The legumes are among the largest families in the angiosperms, with 650 genera and 18000 species (Polhill 1981). They were used in several cytotaxonomic studies (Senn 1938, Turner and Fearing 1959, Bandel 1974, Goldblatt 1981a) to establish the phylogenetic relationships in the family. Chromosome number is the main character in cytotaxonomic studies. However, in spite of their importance, karyotypes were presented for a low number of species, specially in those with economic uses.

The genus *Sesbania* belongs to tribe Robinieae and comprises 32 species in Africa, 10 in Australia, about 10–11 in tropical Asia and 8 in New World (Monteiro 1984). Chromosome counts are available for about half of the species, but karyotypic information is restricted to few of them. There is no karyotypic data for American species. The present paper deals with somatic karyotypes of five species of *Sesbania* that have been evaluated for pasture uses.

Materials and methods

The seeds were provided by the “Instituto de Zootecnia” (IZ, Nova Odessa, state of São Paulo, southeastern Brasil). The species studied, their origin and the number of introduction in IZ are indicated in Table 1. Voucher specimens are deposited in the herbarium of that institution.

Root tips from germinating seeds were pretreated for 3 hr in a saturated solution of para-dichlorobenzene at 16–18°C, fixed in 3:1 absolute alcohol: acetic acid and stored in freezer. Permanent slides were obtained by modified Giemsa technique (Guerra 1983). Mean descriptive values for the karyotypes were estimated from information obtained in ten cells of each species. The procedure of Levan *et al.* (1964) was followed for classification of chromosome morphology. The TCL (sum of all chromosome length) and TF% (sum of short-arm length/total chromosome length) were also calculated.

Results and discussion

The chromosome number of the five species studied was $2n=12$ (Table 2). This result agrees with previous reports (Bolkhovskikh *et al.* 1969, Moore 1973, 1974, 1977, Goldblatt 1981b, 1984, 1985, 1988, Goldblatt and Johnson 1991). Eventually, polyploidy may be found in diploid species, like *S. sesban* (Joshua and Bhatia 1989). *S. sericea* is the only tetraploid species in the genus (Pawar and Kulkarni 1955, Frahm-Leliveld 1953, 1957).

The basic chromosome number of *Sesbania* is $x=6$. Considering the chromosome numbers more frequently found in tribe Robinieae ($x=10$ and $x=11$), Goldblatt (1981a) suggested that *Sesbania* may be originated by aneuploidy. The derived aneuploidy of *Sesbania*

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Table 1. Species of *Sesbania* used in karyotype studies

Species	Introduction	Origin
<i>Sesbania exasperata</i> H.B.K.	NO 1017	Campinas, SP, Brasil
<i>Sesbania punicea</i> (Cav.) Benth.	NO 1077	Moji-Guaçu, SP, Brasil
<i>Sesbania sesban</i> (L.) Merr.*	NO 934	São Paulo, SP, Brasil
<i>Sesbania tetraptera</i> Hochst.*	NO 1660	Moçambique
<i>Sesbania virgata</i> (Cav.) Pers.	NO 1289	Miranda, MS, Brasil

* Introduced in Brasil.

Table 2. Chromosome numbers (2n), karyotype formulae, total chromosome length (TCL) and TF% index of species of *Sesbania*

Species	Subgenus	2n	Karyotype formulae	TCL	TF%
<i>S. punicea</i>	<i>Daubentonia</i>	12	1Cm + 1Dsm + 3Em + 1Em*	36.38	0.40
<i>S. virgata</i>	<i>Daubentonia</i>	12	1Bm + 1Csm + 1Dm + 2Em + 1Esm*	40.40	0.39
<i>S. exasperata</i>	<i>Sesbania</i>	12	1Bm + 1Cm + 3Dm + 1Dm*	46.14	0.42
<i>S. sesban</i>	<i>Sesbania</i>	12	1Bm + 2Dm + 1Dm* + 2Em	43.44	0.44
<i>S. tetraptera</i>	<i>Pterosesbania</i>	12	1Am + 1Bm* + 2Cm + 1Dm + 1Dsm*	54.64	0.40

Chromosome length, in μm : A=6–7, B=5–6, C=4–5, D=3–4, E=2–3. Centromeric position: m-metacentric, sm-submetacentric. *=satellite.

is correlated with its specialised position in Robinieae (Goldblatt 1981a).

The karyotype characteristics of the species studied are given in Table 2 and Figs. 1 and 2. The chromosome lengths varied from 2.12 to 6.99 μm , and the majority of chromosomes were metacentric.

The karyotypic information here presented is inedit for three species, *S. punicea*, *S. exasperata* and *S. tetraptera*. Some details of chromosome morphology for *S. virgata* and *S. sesban* were given by other authors.

Castronovo (1945) classified chromosomes of *S. virgata* according to their length. The range of variation in chromosome length (3 to 5 μm) was a little different from the observed in the present study (2 to 6 μm , Table 2).

Fig. 1. Mitotic metaphases in species of *Sesbania*: 1. *S. exasperata*, 2. *S. sesban*, 3. *S. tetraptera* and 4. *S. virgata*. Bar=10 μm .

Fig. 2. Ideograms of species of *Sesbania*.

Differences more pronounced may be observed comparing the literature and the results here obtained for *S. sesban*. The differences include chromosome morphology and the position and number of satellites. Lubis *et al.* (1981) pointed out submetacentric chromosomes and two chromosome pairs satellited. In the present study all chromosomes had median centromeres and there is only a pair satellited. It is remarkable that those authors used other nomenclature than Levan *et al.* (1964) for chromosome morphology.

Table 2 shows correlation between karyotypes and the taxonomic arrangement at subgenus level. The African species *S. tetraptera* (subgenus *Pterosesbania*) has the biggest chromosomes (TCL = 56.64 μ m) and is the only to present two chromosome pairs satellited.

In subgenus *Daubentonia*, represented by *S. punicea* and *S. virgata*, the chromosomes were shorter (TCL = 36.38 and 40.40 μ m, respectively) and more submetacentrics (TF% = 0.40 and 0.39, respectively) than in the other two subgenera (Table 2).

The TF% index was bigger in subgenus *Sesbania* (*S. sesban* = 0.44 and *S. exasperata* = 0.42). This indicates a great proportion of metacentric chromosomes in this subgenus. These two species have a more symmetric karyotype, and this is accepted as a primitive condition (Stebbins 1971).

The results of TF% (Table 2) agree with the evolutionary relationships presented by Monteiro (1984) for genus *Sesbania*. Considering morphological characteristics and phyto-geography relationships, this author pointed out that the other subgenera arose from subgenus

Sesbania independently. The karyotypic analysis of other species can contribute for the knowledge of evolutionary relationships in *Sesbania*.

Summary

The karyotypes of five species of *Sesbania* were studied. All species had $2n = 12$ and there was agreement with $x = 6$ for the genus. The majority of chromosomes were metacentric and their length varied from 2.12 to 6.99 μm . Karyotype information is presented for the first time for three species. There are correlations between karyotypes and taxonomic arrangement at subgenus level. Some phylogenetic relationships were discussed. Comparisons of TF% index agreed with the proposals presented in literature.

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