

**Original Contribution****KARYOLOGICAL STUDY OF GENUS *BASSIA* ALL. IN BULGARIA****N. Grozeva*, S. Gospodinova**

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ABSTRACT

The karyotype morphology of four species of *Bassia* All. – *B. hirsuta* (L.) Asch., *B. laniflora* (S. G. Gmel) A. J. Scott., *B. prostrata* (L.) Beck, *B. scoparia* (L.) A. J. Scott is reported for the first time from Bulgarian populations. The karyograms and the idiograms of all studied populations were illustrated. The somatic chromosome numbers for all species were the same ($2n = 18$). The karyotypes for all of the investigated populations consist of metacentric and submetacentric chromosomes and in the two of the studied populations of *B. hirsuta* were established chromosomes with satellites.

Key words: *Bassia*, karyotype, chromosome number

INTRODUCTION

Kochia Roth and *Bassia* All. are shrubs, subshrubs or herbs with indehiscent fruits, and with embryos that are horizontally oriented in the flower and ring-like rather than spiral (1). Scott (2) on the basis of structure of the perianth proposed to submerge *Kochia* into *Bassia*. The molecular analysis of Kadereit & Freitag (3) confirmed its justification. In Bulgarian flora genus *Bassia* is represented by 4 species: *Bassia hirsuta* (L.) Asch., *Bassia laniflora* (S. G. Gmel) A. J. Scott. (= *Kochia laniflora* Borbás), *Bassia prostrata* (L.) Beck (= *Kochia prostrata* (L.) Schrad.), *Bassia scoparia* (L.) A. J. Scott (= *Kochia scoparia* (L.) Schrad.) (4-6).

B. hirsuta occurs on saline sands and clay soils along the Black Sea coast and the shores of saline lakes at the Black Sea coast, rarely on rocks facing the sea (4, 6-8). The species is protected under the Biological Diversity Act (9) and is included in the Red Book of Bulgaria under the category „Endangered“ (8). *B. laniflora* inhabits sandy terrains by the sea and along inland rivers (7). The species has been reported for the Black sea coast, Danube plain and Struma valley (4, 6).

B. prostrata grows on dry rocky, stony and sandy terrains on the sea coast as well as on

dry and sunny rocky, stony and sandy soils, mainly by the Danube river, Black sea coast and the Danube plain (4, 6-7).

B. scoparia is adventitious species (6). It is cultivated in the country, grows near villages and by roads in ruderalized areas, very often appears as crop weed (4, 7).

The present study is a part of a multi-annual research on family Chenopodiaceae within the Bulgarian flora and aims to investigate the chromosome number and karyotype morphology of taxa from *Bassia* in Bulgaria, thus to help in taking taxonomic decisions and elucidate evolutionary problems.

MATERIALS AND METHODS

Karyological analyses were carried out on 6 natural Bulgarian populations of the genus *Bassia*, referred to four species (**Table 1**). Chromosome numbers and karyotypes have been reported on lasting preparations of metaphase root apex plates of seeds germinated in laboratory conditions collected in the natural habitats of the species. The root tips were treated and squashed according to the accepted methods (10). The chromosomal type was determined after the centromere index $I = s/s+1$ (in%), according to the classification proposed by GRIF and AGAPOVA (11). The idiograms are constructed after measurements were performed on three metaphase plates from each population. The voucher specimens are kept in the herbarium of the Bulgarian Academy of Sciences (SOM).

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Table 1. Studied populations of genus *Bassia* All.

Species	Population location	2n
<i>Bassia hirsuta</i>	Northern Black Sea Coast, Varnensko lake, periodically flooded coastal alluvial, at 79 m, 43°11,09'N, 27° 50,16' E.	18*
	Southern Black Sea Coast, Atanasovsko lake, at the northern end of the lake near the road Burgas - Pomorie at 1.5 m, 42°35,14'N, 27° 36,07' E.	18*
	Southern Black Sea Coast, Pomoriysko lake, sandy terrains near Salt museum, at 1 - 2 m, 42°35,14'N, 27° 36,07' E.	18*
<i>Bassia laniflora</i>	Southern Black Sea Coast, Ahtopol town, near the coastline south of the town, at 5 m, 42°05'40" N 27°56'60" E.	18**
<i>Bassia prostrata</i>	Thracian Lowland, Rakitnitsa village, ruderal places, at 184 m, 42° 20' 36" N, 25° 31' 15" E.	18***
<i>Bassia scoparia</i>	Thracian Lowland, Tselina village, ruderal places, at 193 m, 42° 07' 14" N, 25° 27' 06" E.	18***

* – data published by Grozeva & Todorova (12), ** – data published by Grozeva (13), *** – data published by Grozeva (14)

RESULTS AND DISCUSSIONS

Bassia hirsuta

For the three studied populations of the species are established diploid chromosome number of $2n = 18$ (Table 1, Figure 1). Among the total of 9 pair chromosomes, 5 pairs are metacentric and 4 pairs are submetacentric. Two of the populations, from Varnenskoto and Atanasovskoto Lake, have satellites.

The total haploid chromosome length for the population from Varnenskoto Lake is 20.23 μ

(Figure 1A). The longest chromosome has the length of 4.05 μ and is submetacentric with satellites and the shortest one has the length of 1.6 μ and is metacentric. The length of long arm of chromosomes is between 0.84 and 2.12 μ and the length of short arm of chromosomes is between 0.51 and 1.93 μ . The karyotype formula is as $2n = 10m + 6sm + 2sm-SAT$. The ideogram of chromosomes is illustrated in Figure 1B.

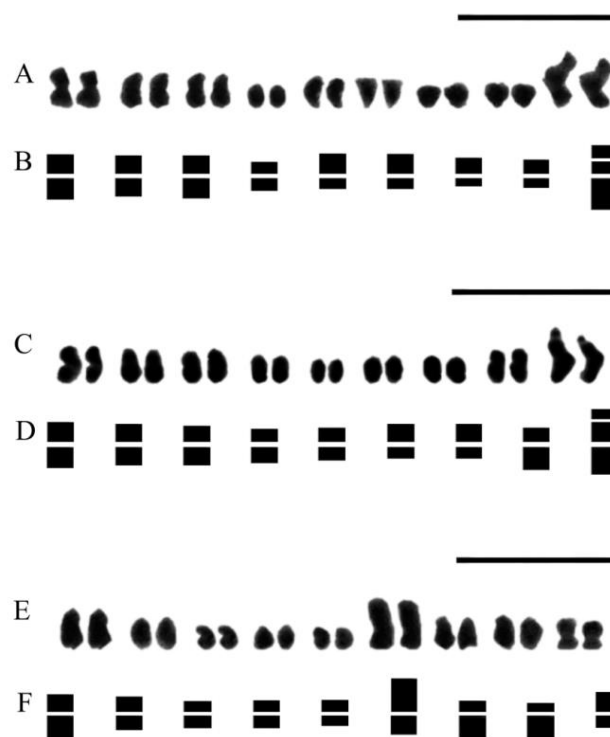


Figure 1. Karyograms and ideograms of *Bassia hirsuta* (L.) Asch. populations from: A-B Varnensko Lake; C-D Atanasovsko Lake; E-F Pomoriysko Lake.

The total haploid chromosome length for the population from Atanasovskoto Lake is 19.16 μ (**Figure 1C**). The longest chromosome has the length of 3.29 μ and is submetacentric with satellites and the shortest one has the length of 1.6 μ and is metacentric. The length of long arm of chromosomes is between 0.82 and 1.83 μ and the length of short arm of chromosomes is between 0.56 and 1.45 μ . The karyotype formula is as $2n = 10m + 6sm + 2sm-SAT$. The ideogram of chromosomes is illustrated in **Figure 1D**.

The total haploid chromosome length for the population from Pomorie Lake is 19.73 μ (**Figure 1E**). The longest chromosome has the length of 3.38 μ and is submetacentric and the shortest one has the length of 1.53 μ and is metacentric. The length of long arm of chromosomes is between 0.78 and 2.05 μ and the length of short arm of chromosomes is between 0.66 and 1.33 μ . The karyotype formula is as $2n = 10m + 8sm$. The ideogram of chromosomes is illustrated in **Figure 1F**.

The karyotype morphology of the species is reported for the first time from Bulgarian populations. The chromosome number $2n = 18$ confirms the previous results from Bulgaria –

Northern Black Sea Coast, Schablensko Lake and Southern Black Sea Coast, Poda Protected Area (12). The results obtained correspond also to the data reported by the other authors (15-18).

Bassia laniflora

For the studied population of the species is established chromosome number of $2n = 18$ (**Table 1, Figure 2A**). Among the total of 9 pair chromosomes of this population, 5 pairs are metacentric and 4 pairs are submetacentric. The total haploid chromosome length is 14.88 μ . The longest chromosome has the length of 2.37 μ and is metacentric and the shortest one has the length of 1.21 μ and is submetacentric. The length of long arm of chromosomes is between 0.68 and 1.44 μ and the length of short arm of chromosome is between 0.34 and 1.08 μ . The karyotype formula is as $2n = 10m + 8sm$. The ideogram of chromosomes is illustrated in **Figure 2B**.

The karyotype morphology of the species is reported for the first time from Bulgarian populations. The diploid chromosome number of *B. laniflora* is in accordance with earlier countings (19-21).

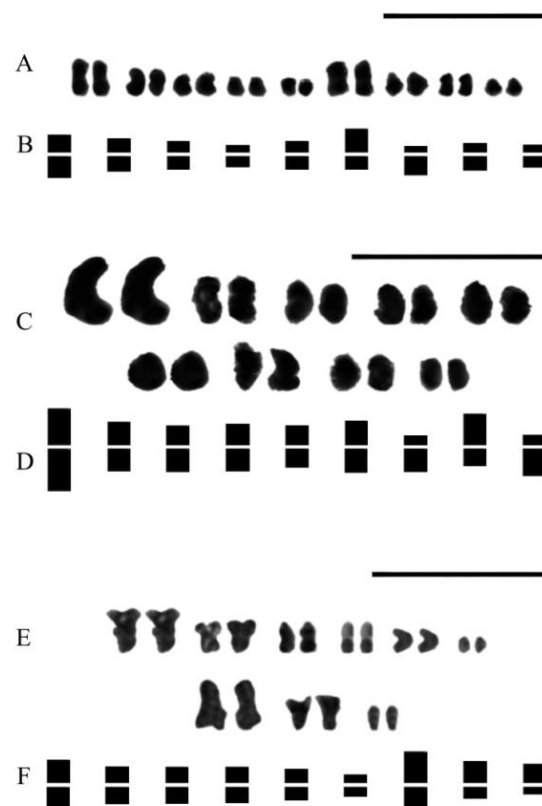


Figure 2. Karyograms and idiograms of populations of: A-B *Bassia laniflora* (S. G. Gmel) A. J. Scott. from Ahtopol town; C-D *Bassia prostrata* (L.) Beck from Rakitnitsa village; E-F *Bassia scoparia* (L.) A. J. Scott from Tselina village.

Bassia prostrata

For the studied population of the species is established diploid chromosome number of $2n = 18$ (Table 1, Figure 2C). Among the total of 9 pair chromosomes of this population, 6 pairs are metacentric and 3 pairs are submetacentric. The total haploid chromosome length is 25.43 μ . The longest chromosome has the length of 4.33 μ and is metacentric and the shortest one has the length of 2.12 μ and is submetacentric. The length of long arm of chromosomes is between 1.39 and 2.41 μ and the length of short arm of chromosome is between 0.65 and 1.92 μ . The karyotype formula is as $2n = 12m + 6sm$. The ideogram of chromosomes is illustrated in Figure 2D.

The karyotype morphology of the species is reported for the first time from Bulgarian populations. The diploid chromosome number $2n = 18$ reported here agrees with reports of Pope & McArthur (22), Javůrková-Jarolímová (23), Lomonosova & Krasnikov (24), Stepanov (25), Zakirova (26), Krasnikov (27). Some other chromosome numbers were also reported for the same species: $n = 8$ (28), $2n = 36$ (29-30) and $2n = 54$ (29).

Bassia scoparia

For the studied population of the species is established diploid chromosome number of $2n = 18$ (Table 1, Figure 2E). Among the total of 9 pair chromosomes of this population, 7 pairs are metacentric and 2 pairs are submetacentric. The total haploid chromosome length is 18.09 μ . The longest chromosome has the length of 3.09 μ and is metacentric and the shortest one has the length of 1.08 μ and is metacentric, too. The length of long arm of chromosomes is between 0.62 and 1.72 μ and the length of short arm of chromosome is between 0.37 and 1.37 μ . The karyotype formula is as $2n = 14m + 4sm$. The ideogram of chromosomes is illustrated in Figure 2F.

The karyotype morphology of the species is reported for the first time from Bulgarian populations. The chromosome number $2n = 18$ confirms the previous result from Bulgaria, Thracian Lowland, Plovdiv Botanical Garden (31). It confirms the earlier counts published from elsewhere (24, 27, 30, 32-37).

CONCLUSIONS

The chromosome numbers established from Bulgarian populations of *B. hirsuta*, *B. laniflora*, *B. prostrata* and *B. scoparia* are diploid based on basic chromosome number $x = 9$. The karyotypes for all of the investigated populations consist of metacentric and submetacentric chromosomes and in the two of

the studied populations of *B. hirsuta* were established chromosomes with satellites.

The total haploid chromosome length of the studied populations of *B. hirsuta* is between 19.16 and 20.23 μ and the chromosome length ranges from 1.53 to 4.05 μ .

The total haploid chromosome length of *B. laniflora* is 14.88 μ and the chromosome length ranges from 1.21 to 2.37 μ .

The total haploid chromosome length of *B. prostrata* is 25.43 μ and the chromosome length ranges from 2.12 to 4.33 μ .

The total haploid chromosome length of *B. scoparia* is 18.09 μ and the chromosome length ranges from 1.08 to 3.09 μ .

The karyotype morphology of fourth species from genus *Bassia* is reported for the first time from Bulgarian populations.

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