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SEXUALITY AND APOMIXIS IN *TARAXACUM* WIGG. SPECIES OF FLORA OF KAZAKHSTAN

Keywords: sexuality, apomixis, *Taraxacum*.

Abstract. *Taraxacum* Wigg. is one of the a very large genus. It is widespread in temperate regions of both northern and southern hemispheres. The basic chromosome number in *Taraxacum* is eight (x=8) and the genus reveals considerable variation of chromosome number, from 2n=2x=16 to 2n=12x=96. Although a total of approximately 73 species occur in Kazakhstan. Among of this species, native to Kazakhstan, mode of reproduction is described in 36 species. In Kazakhstan it is dominated by triploid (2n=3x=24) and tetraploid (2n=4x=32) species. Sexuality is linked to diploid Taraxacum, whereas polyploid species usually reproduce asexually via apomixes.

Тірек сөздер: жыныстық көбею, апомиксис, *Taraxacum*.

Ключевые слова: половое размножение, апомиксис, *Taraxacum*.

Introduction. *Taraxacum* Wigg. is one of the a very large genus. It is widespread in temperate regions of both northern and southern hemispheres [1]. Members of the genus grow in wide range of habitats and display a considerable diversification in morphological features [2]. Basic chromosome number in the genus is x = 8 and the genus reveals considerable variation of chromosome number, from 2n=2x=16 to 2n=12x=96 [3].

Taraxacum has been widely studied as a model for analysis of breeding systems in which ploidy level is a good indicator of the mode of reproduction [4, 5]. The genus contains both sexual and apomictic species. Sexuality is linked to diploid *Taraxacum*, whereas polyploid species usually reproduce asexually via apomixes [6]. In *Taraxacum*, apomixis involves meiotic diplospory, parthenogenesis and autonomous endosperm development [7].

The modes of reproduction of Kazakh species of Taraxacum. Today, Kazakhstan *Taraxacum* assemblages include 73 species and consist of mixed sexual (diploid) and asexual (polyploid) plants. Among of this species, native to Kazakhstan, mode of reproduction is described in 36 species (Table 1).

Large number of dandelions in Kazakhstan are polyploids, growing mainly on mountain grasslands, riverside terraces and meadows, at altitudes from 600 m up to 4500 m.

Table 1 – The distribution of sexual and apomictic *Taraxacum* in flora of Kazakhstan

Species	Ploidy	Habitat	Mode of reproduction
1	2	3	4
T. album Kirschner & Štěpánek	2n=24	Riverside terraces, 2800-2980 m.	Apomixis
T. altaicum Schischkin	2n = 24, 32	Forest meadows, 2000-2500 m.	Apomixis
T. androssovii Schischkin	2n=24	Meadows, pastures, 1300-2300 m.	Apomixis
T. bessarabicum (Hornemann) Handel-Mazzetti	2n=16	Wet saline meadows and pastures, 400-2000 m.	Sexual
T. bicorne Dahlstedt	2n=24	Subsaline pastures, grasslands, 600-1800 m.	Sexual
T. brevicorniculatum Koroleva	2n = 16, 24, 32	Riverside terraces, meadows, pastures, usually on subsaline soils, 1500-2000 m.	Apomixis/Sexual
T. brevirostre Handel-Mazzetti	2n=24	Subalpine grasslands, 3300 m.	Apomixis
T. compactum Schischkin	2n = 24	Desert grasslands, forest meadows, 700-1700 m.	Apomixis
T. dealbatum Handel-Mazzetti	2n = 32	Riverside terraces, fields, roadsides, 600-3200 m.	Apomixis
T. dissectum (Ledeb.) Ledeb.	2n = 24	High mountain pastures, 1400-3160 m.	Apomixis
T. ecornutum Kovalevskaja	2n = 16	Low mountain grasslands, fields, roadsides, 700 m.	Sexual
T.erythrospermum Andrzejowski ex Besser	2n = 16, 24, 32	Grassy mountain slopes, forest meadows, desert grasslands, riverside terraces, 0-1500 m.	Apomixis/Sexual
T. fedtschenkoi Handel-Mazzetti	2n = 24	Stony slope, 1500 m.	Apomixis
T. glabrum Candolle	2n = 24, 32	Alpine and subalpine grasslands, 2300-4200 m.	Apomixis
T. goloskokovii Schischkin		Riverside terraces, along alpine streams 3000-3700 m.	Apomixis
T. kok-saghyz Rodin.	2n=16	Riverside terraces, meadows, subsaline pastures, 1600-2000 m.	Sexual
T. leucanthum (Ledeb.) Ledeb.	2n=32	Alkaline waterside meadows, alkaline steppe slopes, wastelands in inhabited places, 2500-6000 m.	Apomixis
T. lilacinum Schischkin	2n = 24	Alpine meadows, grasslands, 3000-3800 m.	Apomixis
T. luridum G. E. Haglund	2n = 24	Subsaline meadows, along streams, 2800–3000 m.	Apomixis
T. microspermum Schischkin.	2n=24	Salt marsh meadows, pebbles, 700-2000 m.	Apomixis
T. minutilobum Popov ex Kovalevskaja	2n = 24	Riverside terraces, 3000-3700 m.	Apomixis
T. monochlamydeum Handel-Mazzetti	2n = 24	Salt marsh meadows, deserts, fields, roadsides, 1200-2000 m.	Apomixis
T. montanum (C.A. Mey) DC.	2n=40	Rocky slopes, moist areas, 1250-2800 m.	Apomixis
T. multiscaposum Schischkin	2n=16	Ruderal sites, pastures, along roads and paths, grasslands; 1200-2000 m	Sexual
T. niveum Kirschner et Štěpánek	2n=32	Wet saline meadows, along rivers, 1200 m.	Apomixis
T. officinale F. H. Wiggers	2n = 22, 24, 26, 27, 32, 40, 44, 48	Grasslands, fields, roadsides, 700-2200 m.	Apomixis/Sexual
T. pingue Schischkin	2n = 24, 32	Alpine deserts, grasslands, 2800-3000 m.	Apomixis

Table 1–

1	2	3	4
T. pseudoatratum Orazova	2n = 18, 24	Alpine and subalpine grasslands, probably above 3000 m.	Apomixis
T. pseudoleucanthum Soest	2n = 24	Pastures along rivers, mountain slopes, 3500–3800 m.	Apomixis
			Table 1
T. scariosum (Tausch) Kirschner & Štěpánek	2n = 24	Dry steppe and substeppe, roadsides, dry pastures, 900-3000 m.	Apomixis
T. serotinum (Waldst. Et Kit) Poir.	2n=16	Arid areas, steppe, field 400-2400 m.	Sexual
T. sinicum Kitagawa	2n = 24	Subsaline pastures, temporarily wet grasslands, substeppe depressions, 600-2000 m.	Apomixis
T. stenolobum Stscheglejew	2n = 24, 32	Riverside terraces, mountain slopes, 700 m.	Apomixis
T. subglaciale Schischkin	2n = 24	Alpine and subalpine deserts, 3500-4500 m.	Apomixis
T. sumneviczii Schischkin	2n = 24	Riverside terraces, forest meadows, 2200-2600 m.	Apomixis
T. tianschanicum Pavlov	2n = 28	Mountain grasslands, desert grasslands, forest margins, fields, 900-2500 m	Apomixis

Most of them apomictically reproducing species (*T. brevirostre, T. dissectum, T. fedtschenkoi, T. album, T. sinicum, T. butkovii, T. luridum, T. pseudoleucanthum, T. leucanthum, T. dealbatum, T. niveum, T. scariosum, T. minutilobum, T. monochlamydeum, T. goloskokovii, T. pseudoatratum, T. subglaciale, T. lilacinum, T. pingue, T. sumneviczii, T. microspermum, T. androssovii*) are triploid (2n=3x=24). The other *Taraxacum* species apomictically reproducing such T. *stenolobum, T. glabrum, T. altaicum* are tetraploid (2n=4x=32), *T. montanum* is pentaploid (2n=5x=40) and *T. tianschanicum* is aneuploid (2n=28).

Sexual *Taraxacum* species *T. serotinum, T. ecornutum, T. kok-saghyz, T. multiscaposum, T. bessarabicum* are diploid (2n=2x=16). However, sexual species *T. bicorne* is triploid (2n=3x=24). But in all cases they are obligate sexuals and are normally highly self-incompatible.

Mixed populations of sexual and apomictic dandelions are rather common in Kazakhstan. Mimixed sexual-asexual species *T. brevicorniculatum, T. erythrospermum, T. officinale* have both ways of reproduction. Sexual plants are diploid (2n=2x=16) and are fully outcrossing due to a sporophytic self-incompatibility system. Asexual plants are triploid (2n=3x =24) or tetraploid (2n=4x=32) and produce seeds through apomixes.

Widespread apomictic species *Taraxacum* in different climatic and geographical regions of Kazakhstan indicates their high adaptive capacity are defined as genotypic structure apomictic (high ploidy, hybridogeneous nature) and lability of seed reproduction. This allows you to implement and apomixis amphimixis switch from one type to another reproductions , leveraging the benefits of adaptation as apomixis and amphimixis . All this allows apomictic species of the genus *Taraxacum* compete successfully with other types of local ecosystems and , as a result, occupy wide ranges .

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Резюме

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ҚАЗАҚСТАН ФЛОРАСЫНДАЄЫ *TARAXACUM* WIGG. ТҐРЛЕРІНІS ЖЫНЫСТЫҚ ЖӘНЕ АПОМИКСТІ КҒБЕЮІ

Taraxacum туысы *Asteraceae* тҰқымдасындаєы бірден-бір ґлкен туыс. Туыс ґкілдері солтґстік жјне остґстік жарты шардаєы қосыржай белдеулерде кезінен таралєан. Туыстаєы хромосоманыs негізгі саны сегіз (x=8). Бақбақтардыs ішінде диплоидтармен қатар(2n=2x=16), полиплоидтар да кездеседі (2n= 24тен 96 дейін). Қазақстанда бақбақтардыs 76 тґрі кездеседі, солардыs 36 тґрінis кґбеюі сипатталєан. Бақбақтар 2 ґдіспен кґбейеді: жынысты (амфимиксис) жјне жыныссызтҰқыммен (апомиксис). Диплоидты тґрлер амфимиктер, ал полиплоидты тґрлер – апомиктер болып табылады. Қазақстандық тґрлер ішінде триплоидты (2n=3x=24) жјне тетраплоидты (2n = 4x = 32) тґрлер басымырақ кездеседі.

Резюме

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ПОЛОВОЕ И АПОМИКТИЧНОЕ РАЗМНОЖЕНИЕ У ВИДОВ *TARAXACUM* WIGG. ВО ФЛОРЕ КАЗАХСТАНА

Род *Taraxacum* один из крупнейших в семействе *Asteraceae*. Представители рода широко распространены в умеренных широтах в северном и южном полушариях. Основное число хромосом в роде восемь (x=8). Среди одуванчиков встречаются как диплоидные (2n=2x=16), так и полиплоидные (2n= от 24 до 96). В Казахстане произрастает 76 видов одуванчиков, из которых у 36 видов описан способ размножения.

Одуванчики размножаются 2 способами: половым (амфимиксис) и бесполосеменным (апомиксис). Дипло-+идные виды являются амфимиктами, а полиплоидные виды – апомиктами. Среди казахстанских видов преобладают триплоидные (2n=3x=24) и тетраплоидные (2n = 4x = 32) виды.