The alien fraction of the flora of Bukhara oasis

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Abstract: As a result of the study of the flora of Bukhara oasis (Republic of Uzbekistan) alien plants have been discovered and taxonomic content has been formed. Alien plants of Bukhara oasis include 29 families, 116 species which belong to 94 genera.

Zusammenfassung: Nach der Erforschung der Flora des Gebiets Buchara wurden die adventiven Arten definiert und die taxonomische Klassifikation entwickelt. Die adventiven Pflanzen haben sich im Gebiet Buchara 29 Familien, 116 Arten gebildet, die zu 94 Gattungen gehören.

Keywords: Bukhara oasis, Uzbekistan, alien plants, taxonomy.

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INTRODUCTION

The first research on the flora of Central Asia, including Uzbekistan dates back to the beginning of XIX century. Most of the herbarium samples which were collected as a result of the research, have been made during the 100 years and are kept in Tashkent (TASH), St. Petersburg (LE) and in Moscow (MW). On the basis of the collected data fundamental works such as "Flora of Uzbekistan" (1941-1962), "Conspectus florae Asiae Mediae" (1968-1993), "Vegetable cover of Uzbekistan" (1971-1984) have been published. The studies which have been done were mainly devoted to the inventory of the flora. However, the study of the fraction of alien plants has not been carried out so far. Therefore, there is very little information about such species in Central Asia as well as in Uzbekistan at present. In the last few 20-30 years very few studies have been carried out on alien plants of the flora (MAKHKAMOV 2009, LAZKOV et al. 2011).

Nowadays research in the flora Bukhara Oasis on species which came from abroad has began. Such studies are being carried out in the natural and anthropogenic spheres of the oasis. Alien plants and their coming, spheres of extension, areas and the impact on the natural plant layer are being studied.

MATERIALS AND METHODS

Bukhara Oasis is located at the western bank of the river Zarafshan and is included in south-west Kyzylkum. Total area of the oasis is 2870 km^2. It is bordered on the desert Kyzylkum from the north and north west, from the west on Korakul plato, from the south Urtachul from south east and east on Oftobachi, Kuyimozor (216 m) and Kiziltepa (NUROV, 1981). Administratively it is included in the Bukhara region of the Republic of Uzbekistan (Fig. 1).

According to botanical – geographical regionalization of Uzbekistan Bukhara Oasis is a part of Kyzylkum district of the Turan province (TOJIBAEV et al. 2012).

Research material – alien plants of the flora of Bukhara Oasis. To form a list of alien plants specimens of Central Herbarium of Uzbekistan (TASH), herbarium materials collected by the author and "Flora of Uzbekistan" (1941-1962), "Conspectus florae Asiae Mediae" (1968-1993) have been used. Scientific names of species have been given according to www.ipni.org, authors of species according to R.K. BRUMMIT, C.E. POWELL (1992), synonyms of species www.theplantlist.org. Life forms have been introduced according to C. RAUNKIER classification (1934). Sources of "Flora of Uzbekistan" (1941-1962), "Conspectus florae Asiae Mediae" (1968-1993) and

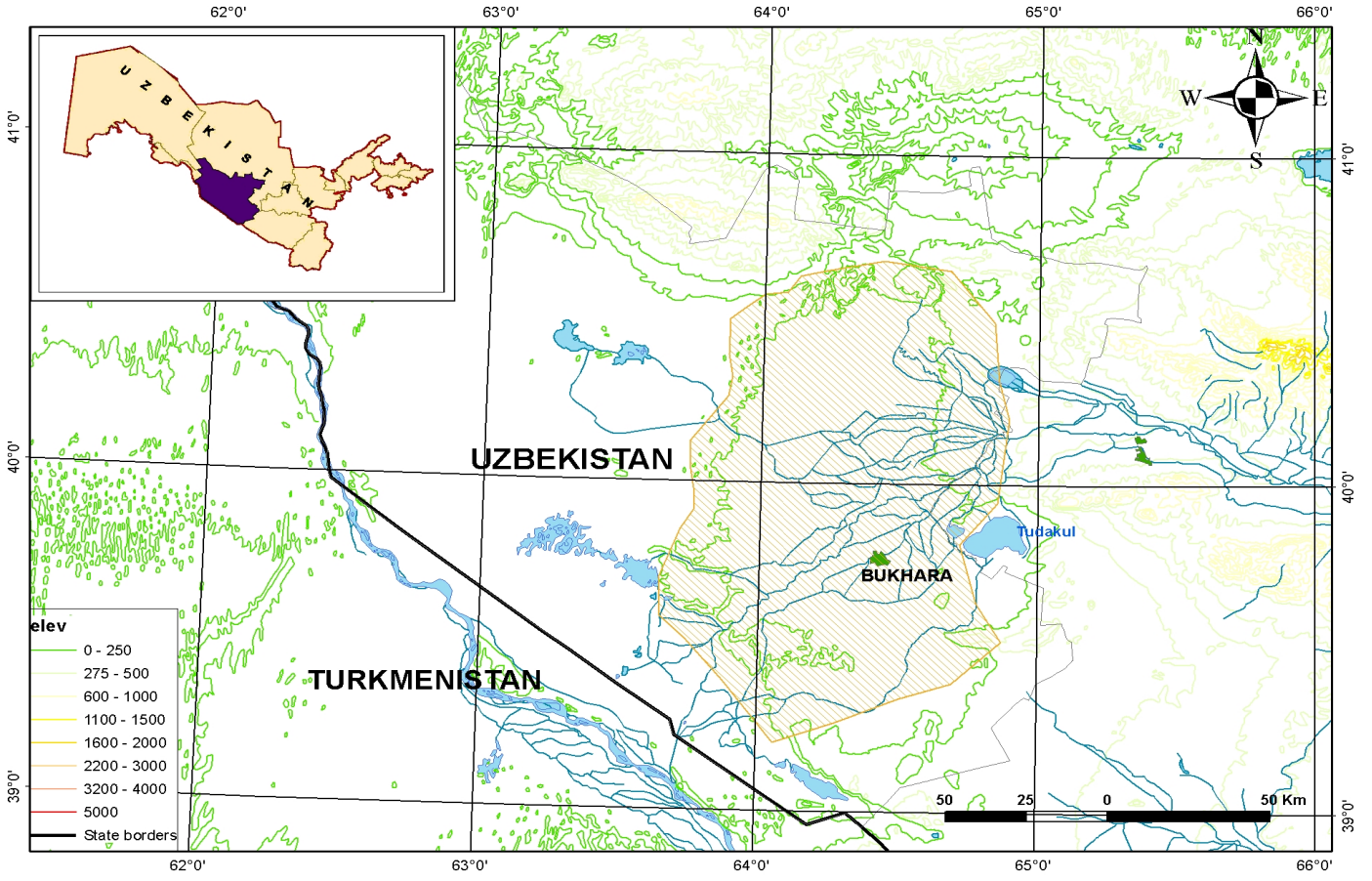


Fig. 1: Map of research area.

"Flora of USSR" (1934-1964) have been used. Furthermore, while studying the origin of the alien plants various literature (MAYOROV et al. 2012, VINOGRADOVA et al. 2010, 2011, CHANDRA 2012, AISTOVA, 2009) and web site http://efloras.org have been used to identify geographical extension of alien plants.

Most part of the Bukhara Oasis occupies agricultural zones with fruit gardens, cotton and wheat fields and others. There are some native landscapes (Fig. 2).

In the table there given abbreviation of some words: Phanerophytes – Ph, Hemicryptophytes – H, Cryptophytes – C, Therophytes – Th, along roadside –AR, along irrigation ditch – AI, plantation – P, along railway - AL, ruderal – R, sand soil –SS, flower garden – FG, aquatic – A.

RESULTS

As the result of the research 63 families, 476 species of 294 genera of the natural flora of the oasis have been identified (non published). The fraction of alien plants comprises 116 species from 29 families and 94 genera. 25 of the families mentioned above comprising 95 species in 77 genera belong to Magnoliopsida, whereas 4 families with 21 species in 17 genera are considered Liliopsida. Introduced species for Bukhara Oasis have not been given.

Comparison of the fraction of alien species with the overall flora shows a high degree of alien species in this region (Fig. 3). Alien plants comprise 46% of all families, 32% of all genera and 24% of all species, respectively.

During the process of research taxonomic content of alien plants of the flora of the oasis has been formed (Tab. 1).

Geographical origin of alien plants of Bukhara Oasis is various. A large number of them belong to Eurasia (93 species). From other territories – North America 7 species (*Equisetum ramosissimum, Amaranthus albus, Amaranthus retroflexus, Xanthium strumarium, Datura stramonium, Typha angustifolia,*

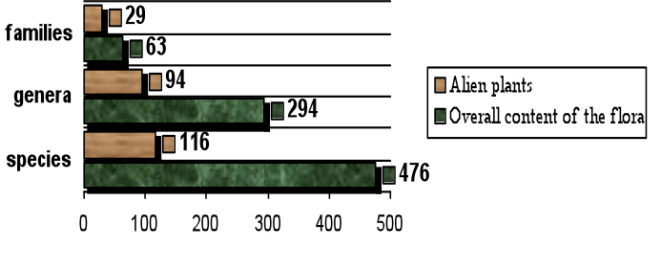


Fig. 3: Overall content and taxonomic analysis of alien plants of the flora of the oasis.

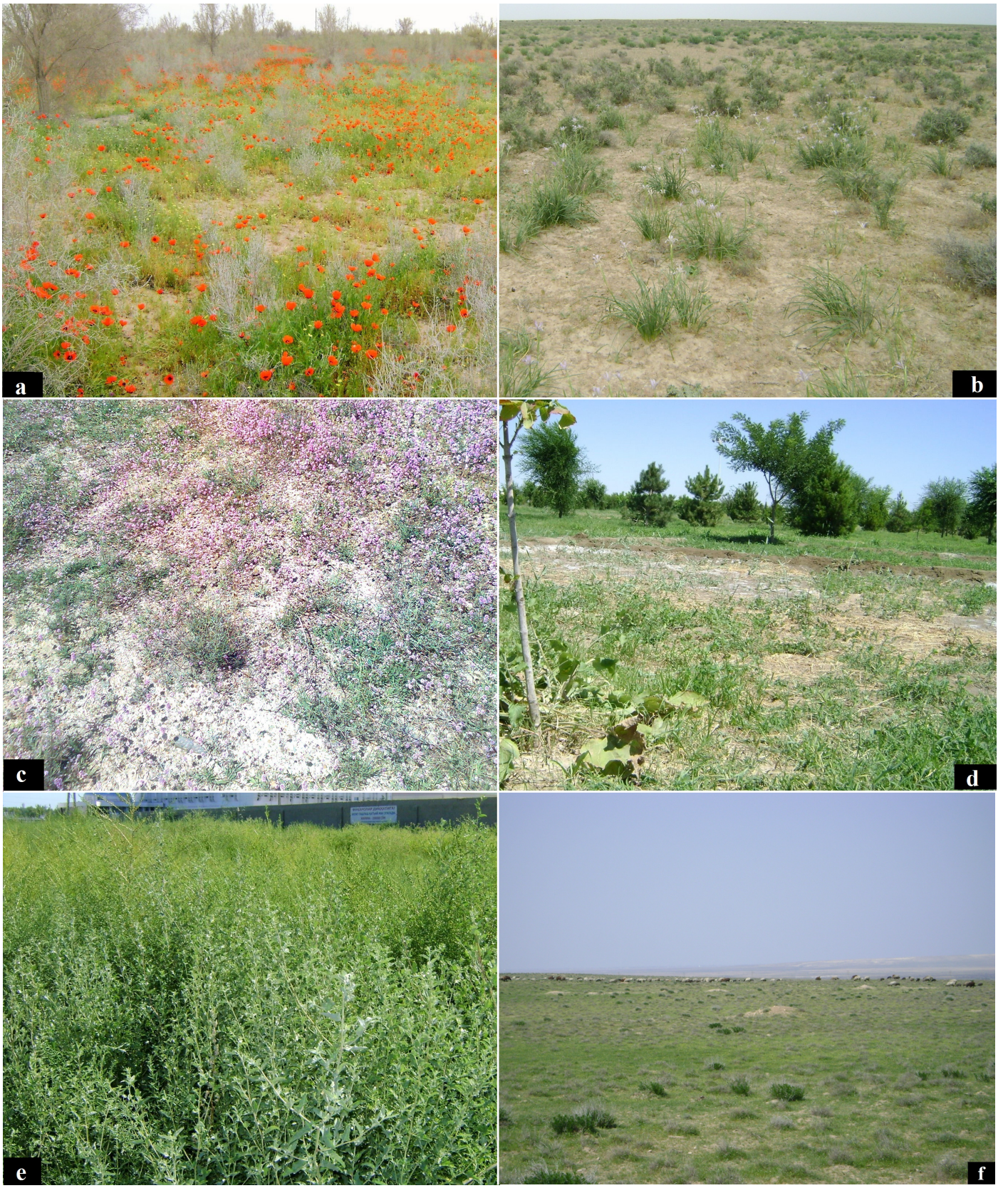


Fig. 2: Types of landscapes of the Bukhara Oasis. **a**) Sandy places with spring vegetation (*Roemeria refracta* (STEV.) DC., *Haloxylon persicum* BUNGE). **b**) *Iris* steppe (*Iris sogdiana* BUNGE). **c**) Salinity places (*Psylliostachys anceps* (REGEL) ROSHKOVA). **d**) Cultural zones (*Sophora japonica* L., *Aesculus hippocastanum* L.). **e**) Ruderal zones (*Atriplex tatarica* L., *Suaeda arcuata* BUNGE). **f**) Artemisia steppe (*Artemisia turanica* KRASCH., *Convolvulus hamadae* (VVED.) PETROV).

Tab. 1. Check-list of alien plant species of Bukhara Oasis.

Family	Species	Geographic origin	Life Form	Habitat
Equisetaceae	*Equisetum ramosissimum* DESF.	North America	C	AR, AI
Ranunculaceae	*Ranunculus arvensis* L.	Eurasia, Europe, Mediterranean	Th	P
Portulaceae	*Portulaca oleracea* L.	South America	Th	P
Caryophyllaceae	*Spergularia salina* (L.) JAUB. et C. PRESL	Eurasia, Europe, Sout-West Asia	Th	AI
Amaranthaceae	*Amaranthus albus* L.	North America	Th	AL
	Amaranthus blitum L.	Mediterranean	Th	P
	Amaranthus retroflexus L.	North America	Th	P
Chenopodiaceae	*Atriplex tatarica* L.	Eurasia	Th	R
	Atriplex hastata L.	Eurasia	Th	R
	Bassia hyssopifolia (PALL.) KUNTZE	Eurasia	Th	R
	Chenopodium album L.	Europe	Th	P
	Dysphania botrys (L.) MOSYAKIN & CLEMANTS	Mediterranean	Th	R
Primulaceae	*Anagallis arvensis* L.	Europe	Th	AI
Brassicaceae	*Brassica elongata* EHRH.	Eurasia	Th	P
	Camelina microcarpa ANDRZ. ex DC.	Eurasia	Th	P
	Chorispora tenella (PALL.) DC.	Eurasia	Th	P
	Goldbachia sabulosa (KAR. et KIR.) D.A. GERMAN ET AL-SHEHBAZ	Asia	Th	SS
	Descurainia sophia (L.) WEBB ex PRANTL	North Africa, Eurasia	Th	P, R
	Eruca sativa MILL.	Mediterranean	Th	P
	Euclidium syriacum (L.) W.T. AITON	S Eurasia	Th	P
	Hornungia procumbens (L.) HAYEK	S Europe, Asia	Th	P
	Lepidium chalepense L.	North America, S America	H	AR, P
	Lepidium latifolium L.	Southern Eurasia	H	AR
	Lepidium perfoliatum L.	Southern Eurasia	Th	P
	Lepedium ruderale L.	Europe	Th	R
	Meniocus linifolius (STEPH. ex WILLD.) DC.	Eurasia	Th	SS
	Rorippa sylvestris (L.) BESS.	Europe	Th	FG
	Sinapis arvensis L.	Mediterranean	Th	P
	Sisymbrium altissimum L.	Mediterranean	Th	P
	Sisymbrium loeselii L.	Eurasia	Th	R, AR
	Strigosella africana (L.) BOTSCH.	Mediterranean	Th	P, R
Malvaceae	*Abutilon theophrastii* MEDIK.	Southern Asia	Th	P
	Althaea officinalis L.	Eurasia	H	AR
	Malva mauritina L.	Mediterranean	H	AR
	Hibiscus trionum L.	Mediterranean	Th	P
Urticaceae	*Urtica dioica* L.	N Africa, N America, Eurasia	Th	AI, P
Rosaceae	*Duchesnea indica* (ANDREEWS) FOCKE.	Sout-East Asia	H	AR, FG
	Potentilla supina L.	Europe	H	AI
	Rosa canina L.	Eurasia	Ph	AR
Fabaceae	*Halimodendron halodendron* (PALL.) VOSS	Eurasia	Ph	AI
	Medicago lupulina L.	Eurasia	Th	P, AR
	Meliliotus albus Medik.	Eurasia	Th	AI, AR
	Meliliotus officinalis (L.) PALL.	Eurasia	Th	AI, AR
	Trifolium pratense L.	Eurasia	H	FG
	Trifolium repens L.	Eurasia	H	FG
	Vicia villosa Roth	Eurasia	Th	P
	Vicia hyrcanica FISCH. et C.A. MEY.	Eurasia	Th	P
	Vexibia alopecuroides (L.) YAKOVLEV	Eurasia	H	AI, AR
Oxalidaceae	*Oxalis corniculata* L.	Europe	Th	FG
Zygophyllaceae	*Tribulus terrestris* L.	Eurasia	Th	P, AR
Elaeagnaceae	*Elaeagnus angustifolia* L.	Eurasia	Ph	AI
Apiaceae	*Apium nodiflorum* (L.) LAG.	Europe	C	A
	Daucus carota L.	Eurasia	Th	P
	Turgenia latifolia (L.) Hoffm.	Southern Eurasia	Th	P
Asteraceae	*Arctium leiospermum* JUZ. et YE.V. SERG.	Eurasia	Th	P
	Artemisia annua L.	Easthern Asia	Th	P, AR
	Bidens tripartita L.	Eurasia	Th	AI
	Carthamus oxyacanthus M. BIEB.	Asia	Th	AR, P
	Centaurea iberica TREV. ex SPRENG.	Eurasia	H	AI
	Centaurea solstitialis L.	Mediterranean	H	AL

Tab. 1. (continued)

Family	Species	Geographic origin	Life Form	Habitat
Asteraceae	*Cichorium intybus* L.	Eurasia	H	P
	Cnicus benedictus L.	Eurasia	Th	P
	Erigeron canadensis L.	South America	Th	R, P
	Galinsoga parviflora CAV.	South America	Th	P
	Erigeron bonariensis L.	South America	Th	P, R
	Handelia trichophylla (SCHRENK) HEIMERL	Asia	H	AR
	Lactuca tatarica (L.) C.A. MEY.	Eurasia	H	P
	Lactuca serriola L.	Europe, W Asia, N Africa	Th	P
	Lactuca altaica FISCH. et C.A. MEY.	Eurasia	Th	P
	Inula britannica L.	Eurasia	H	AI, R
	Sonchus asper (L.) HILL	Mediterranean	Th	P
	Sonchus oleraceus L.	Mediterranean	Th	P
	Symphyotrichum graminifolium (Spreng.) G.L.Nesom	South America	Th	P, R
	Taraxacum bicorne DAHLST.	Eurasia	H	P
	Tripolium pannonicum (JACQ.) DOBROCZ.	Eurasia	Th	AR
	Xanthium albinum (WIDDER)	South America	Th	P, AI
	Xanthium spinosum L.	South America	Th	P
	Xanthium strumarium L.	North America	Th	P
Rubiaceae	*Galium tricornutum* DANDY	Southern Europe, N Africa, Asia	Th	P
Solanaceae	*Datura stramonium* L.	North America	Th	P
	Solanum nigrum L.	Eurasia	Th	P
Convolvulaceae	*Convolvulus arvensis* L.	Europe	H	P, AR
Boraginaceae	*Arnebia transcaspica* POPOV	Caspian Sea, Turkmenistan	Th	SS
	Asperugo procumbens L.	Europe	Th	P
	Lithospermum officinale L.	Eurasia	H	AI
	Lycopus europaeus L.	Eurasia	Th	AI
Scrophulariaceae	*Dodartia orientalis* L.	Easthern Europe, Asia	H	AR, P
	Phelipanche aegyptiaca (PERS.) POMEL	Eurasia	H	P
	Veronica anagalloides GUSS.	Europe	H	A
	Veronica persica Poir.	Asia Minor	Th	P
	Veronica polita Fries	Europe	Th	R, P
Plantaginaceae	*Plantago major* L.	Eurasia	H	P, AI
Verbenaceae	*Verbena officinalis* L.	Europe	H	AI
Lamiaceae	*Lamium amplexicaule* L.	Eurasia	Th	P
Juncaceae	*Juncus gerardii* Loisel.	Eurasia	H	AI
Cyperaceae	*Cyperus iria* L.	Africa	H	AI
	Cyperus rotundus L.	Eurasia, Africa	H	P
	Scirpus mucronatus L.	Eurasia, Africa	H	A
Poaceae	*Agropyron repens* (L.) P. BEAUV.	Eurasia	H	AI
	Aegilops cylindrica HOST	Eurasia	Th	P
	Arundo donax L.	Mediterranean	H	AI
	Avena fatua L.	Eurasia, North Africa	Th	P
	Bromus tectorum L.	Mediterranean, Europe, SW Asia	Th	P, SS
	Bromus oxyodon SCHRENK	Asia	Th	P
	Cynodon dactylon (L.) PERS.	Eurasia, Africa,	H	P
	Digitaria sanguinalis (L.) SCOP.	Europe, Caucasus, Asia	Th	P
	Echinochloa crus-galli (L.) P. BEAUV.	Southern Asia	Th	P, AI
	Eremopyrum triticeum (GAERTN.) NEVSKI	Easthern Europe, Asia	Th	SS
	Hordeum murinum L.	Southern Europe, N Africa, Asia	Th	AI, AR
	Lolium temulentum L.	Europe, Asia Minor	Th	P
	Secale sylvestre Host	Eurasia	Th	AR
	Setaria viridis (L.) P. BEAUV.	Eurasia	Th	P, R
	Setaria verticillata (L.) P. BEAUV.	Europe	Th	P
	Stipagrostis plumose MUNRO ex T.ANDERSON	Mediterranean, Asia Minor	H	SS
Typhaceae	*Typha laxmannii* LEPECH.	Eurasia	C	A
	Typha angustifolia L.	North America	C	A
29	**116**			

Tab. 2. Analysis of the largest plant families of the flora of Bukhara Oasis.

Families	Total number of species	Number of species					
		Fraction of native flora		%	Fraction of alien flora		%
		Number of species	Place №№		Number of species	Place №№	
Asteraceae	70	46	2	66	24	1	34
Chenopodiaceae	58	54	1	93	4	6	7
Brassicaceae	43	25	4	58	18	2	42
Poaceae	40	24	5	60	16	3	40
Fabaceae	40	31	3	77,5	9	4	22,5
Polygonaceae	19	19	6	100	0	-	0
Scrophulariaceae	9	4	7	44	5	5	56

Lepidium chalepense), 8 species (*Portulaca oleracea, Erigeron canadensis, Galinsoga parviflora, Erigeron bonariensis, Symphyotrichum graminifolium, Xanthium albinum, Xanthium spinosum, Echinochloa crus-galli*) from South America, 8 species (*Descurainia sophia, Urtica dioica, Galium tricornutum, Hordeum murinum, Cynodon dactylon, Cyperus rotundus, C. iria, Scirpus mucronatus*) have come from Africa. Species from Australia have not been found (Fig. 4). Species originated to Eurasia have come from Europe, from different regions of Asia and from neighborhood territories of the Mediterranean.

When analyzed according to families of alien plants 6 families have been dominant (Fig. 5).

It is evident that in Bukhara Oasis species which come from outside are found mostly in Asteraceae (24 species or 21%). This case can also be met in the flora of alien plants of the Earth. For instance, 14,5 % in south – east Ukraine (OSTAPKO et al. 2009), 13% for Moscow region (MAYOROV et al. 2012) and 16 % in Himalayan Region of Indian (CHANDRA 2012). After Asteraceae, from 1 up to 3 species are met in the families of Brassicaceae (18 species), Poaceae (16), Fabaceae (9), Chenopodiaceae and Scrophulariaceae (5). 67% of alien plants of Bukhara Oasis are in the portion of leading polymorphous families.

When local and alien fractions of the families of the flora of the Bukhara Oasis had been compared the following results were found (Tab. 2).

The condition of leading families of local and alien plant fractions of the flora of Bukhara Oasis is various. The number of alien plants in Scrophulariaceae family is more than native species. Alien plants are not typical for family Polygonaceae. In the flora of the oasis members of Chenopodiaceae are basically formed of native species (54 species). This case shows the connection of the origin of this family in this area. During the research process coming of alien plants is dynamically high in the natural flora of the oasis especially in Asteraceae, Brassicaceae and Poaceae. In the leading families of the flora of Bukhara Oasis the number of alien plants is high. This process is still going on.

During the studies it was defined that the natural flora of Bukhara Oasis comprises 476 species, 24,3% of which (116 species) are alien plants. This determines that the role of alien plants in the formation of the flora of the oasis is substantial. It has been found that most alien plants are members of the native flora of Europe and of other Asian countries.

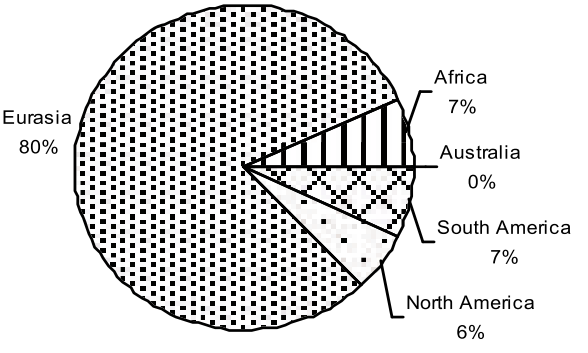


Fig. 4: Origin of alien plant species of Bukhara Oasis.

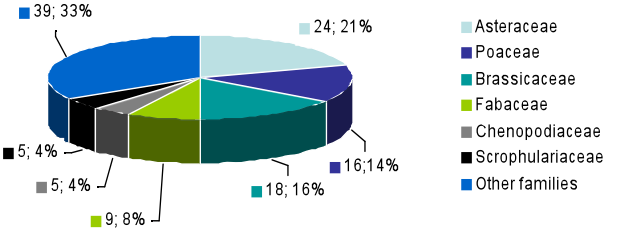


Fig. 5: Polymorphous families of the flora of Bukhara Oasis

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