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Өсімдіктердің биологиясы және биотехнологиясы институтының

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## ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК  
РЕСПУБЛИКИ КАЗАХСТАН  
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## NEWS

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**USING OF COMPUTER PROGRAMM «BD-PLANT-KZ»  
FOR CADASTRAL REGISTRATION OF PLANTS  
OF THE NATURAL FLORA OF KAZAKHSTAN**

**Abstract.** The description of the computer “BD-PLANT-KZ” program, intended for input and storage in memory of the computer of various botanical information on plants of the natural flora of Kazakhstan is provided. 11 points of the program are a part of the Main menu: "File," "Editing," "Input," "Search," "Viewing," "Lists," "Herbarium," "Communities," "Databases," "Service," and "Reference." The program allows carrying out a quick search of data, printing, exporting to various formats, drawing up reports and lists in the set taxonomical, bioecological, decorative, and other parameters. “BD-PLANT-KZ” has undergone successful approbation in two botanical gardens of Kazakhstan (Altai and Mangyshlak). Now floristic the database of the program includes information on natural flora for 882 taxons from 4 departments, 6 classes, 12 subclasses, 26 suborders, 59 orders, 10 suborders, 80 families, and 300 genes. The approbation of the program has allowed making the summary characteristic of the natural flora of Western Kazakhstan on the example of the Mangystau, Atyrau, Aktyubinsk, and West Kazakhstan regions. Lists of taxons are determined by geographical points and floristic areas, geographical novelties are revealed.

**Keywords:** computer program, «BD-PLANT-KZ», cadastral, registration of plants, Data Base.

**Introduction.** The creation of the information databases (DB) containing a large number of accounts and variables, related to the inventory of plants, in particular, pays significant attention to the development of the instrument of formation of a DB or, in other words—the special computer program adapted with modern operating systems, graphics, and text editors. Storage and processing of botanical data are widely applied in the countries of the near and far abroad. However, such works were not carried out in Kazakhstan earlier.

In 2011-2012, RGP "Mangyshlak Experimental Botanical Garden" of CS of MES RK, within the implementation of the "Development of Scientific and Methodical and Information Database for Creation of the Inventory of Plants of the Republic of Kazakhstan" project, developed the special computer program BD-PLANT-KZ with the electron shells, allowing to enter the data on the taxonomical structure of the higher vascular plants with the description of their morphology, ecology, economic and biological properties, geographical coordinates, herbarium samples, vegetable communities, raw stocks, geographical and floristic areas, with an illustration photos and maps of areas into the databases.

The work aimed to assess a possibility of application of the made computer program for conducting an accounting of plants of the natural flora of Kazakhstan.

**Materials and methods of research.** The elaboration on the work required four program languages: Microsoft Visual FoxPro 9 SP2, Visual Basic For Applications 7.0, HTML 4.0, and JavaScript API 2.1.

The simplification of the input of the taxonomic units involved the use of the database, created from the list of R.K. families. Brummitt [1]. The phylogenetic system A is the basis for systematization. L. Takhtadzhyan [2, 3].

The description of vegetable communities in BD-PLANT-KZ engaged the scheme used by I. N. Safonova [4] at the geo botanical inspection of the deserts of Mangyshlak: vegetation type, a group of for-

mations, formations, associations. The volume of information on each database record is 25-30 Kbytes without drawings and the map and 150-200 – without the latter.

The Install Shield 2012 Premier Edition SP1 program was applied to the formation of an adjusting compact disk and the uniform distributive Setup.exe file.

Effective work of BD-PLANT-KZ is possible in case of the implementation of the following system requirements to computers: Microsoft Windows XP SP 2-3, Vista SP 1-2 operating system or 7, 8 and 10 (32-bit or 64-bit), existence of Microsoft Office 2007, 2010 or 2016, is also more modern than Adobe Reader 7 or more of the late version, Internet Explorer 9; Processor: Intel Pentium 4 or above; RAM of 512 MB or more, but 2048 is recommended; free disk memory - 700 MB; minimum resolution of the monitor - not less than 1024x768. The maximum use of opportunities for hardware acceleration involves the graphic video cards, compatible DirectX with the built-in video memory not less than 128 MB.

**Results and discussions.** Main Menu (MM) with 11 points reflects the structure of the program: "File," "Edit," "Input," "Search," "View," "Lists," "Herbarium," "Communities," "Databases," "Service," and "Reference" (figure 1).

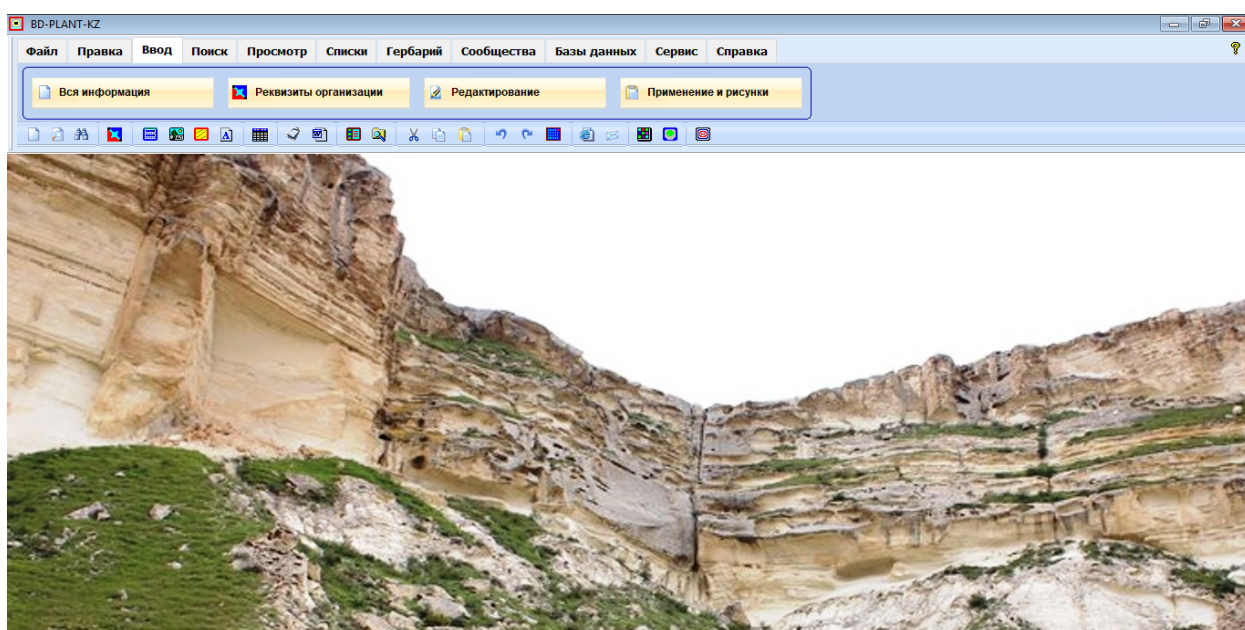


Figure 1 – Main Window of Program

The point of MM includes a standard set of sub points: "To open...," "My computer," "Press," "Filer," "Search of files," "Server," "Internet," "Mail," and "Exit" also aim for creating new and working with already available files, printings information, contacting with the server and Internet resources, sending electronic messages, and exiting the program. The point "Edit" is necessary for editing active text fields of forms of input, view of information, search and replace the words and expressions, control of font, the color of letters, and a background. "Input" point activates filling forms of a database with new and already edited information. It includes three sub points—"All information," "Requisites of the organization," "Edit," and "Apply and draw."

The Search point allows to look for plants in a database in the following options: according to the identification number; the Latin name of a taxon, the Russian name, the national name, on family, on floristic and geographical areas, and by any word or a fragment of a word from Latin, Russian, and national names. "Advanced search" integrates all above-mentioned ways. "View" is used for work with already entered information with its further printing and export in external editors and programs in various formats - doc, docx, RTF, TXT, PDF, XML, etc.

Applying "Lists" makes possible to form the most various reports on plants on taxonomical, morphological, and other characteristics.

Three commands such as "Input and View" "Reports," and "Export" of point "Herbarium" of MM realize a possibility of full work with information on Herbarium Fund of the Botanical Establishment.

"Communities" include only one sub point "Input and View" necessary for work with populations of plants.

Point of the Main Menu of Database is intended for implementation of the following commands: "Copy," "Restore," "Export," "Import," "Re-indexation," "Index Repair," and "Information on Database."

A system push-button menu for a fast call of the most often used forms of input, viewing, printing information, etc. is located below MM.

After BD-PLANT-KZ installation, the first start of the program makes mandatory the requisites of the botanical establishment with the help of the sub point "MM\input\Requisites of the organization." The input of information to a certain organization demands to bind all taxons.

All plant data are divided between the forms of input and viewing into 11 groups (pages): Taxonomy, Names, Areas, Card, Morphology, Ecology, Application, In Addition, Herbarium, Drawings, and Text. All MM pages and buttons of the fast choice of the standard or already available in DB information for the purpose of an expeditious input (figure 2) are provided.

Figure 2 – Page "Taxonomy" of forms "Input" and "View"

Forms "Input" and "View" of plant data differ only functionally and according to the lower push-button menu of teams. The push-button menu on a form of "Input" includes 5 points: "Save" adds new record after all plant data is entered to Database; "Copy" serves for copying from Database of already entered data on a taxon for further editing and preservation that facilitates input of information; "Check" is necessary for searching for a plant in Database to exclude duplication; "Reset" removes all information from a form of "Input;" "Exit" closes it. A form "View" has 11 command buttons which perform various functions of work with earlier entered data, 4 of them that are placed at the left appear the parts Database navigation. Page Taxonomy provides all entered and checked systematic characteristic of a plant.

The program enters "Names" of plants automatically, adding the name of a look, a form, etc. through a gap to a sort. For authors, certain fields are provided. The fields of the section "Habitats" have included old and new names of floristic areas, administrative and geographical regions in the explored territory, the general distribution, etc. Page "Map" can display the places of occurrence of plants.

Page "Morphology" provides the description of morphological features of taxons (figure 3) on the following indicators: growth form, vital form on A. Raunkiyer, classification by frequency of bearing fruit, pollination type, terms of blossoming and dusting, coloring of flowers, fruits and leaves, characteristic of a morphological structure.

Page "Ecology" displays such ecological features as a natural area, habitats, the phyto security status, an endemicity, an aboriginality, classification in relation to light, water, fertility and salinity of the soil, etc.

Figure 3 – Page "Morphology" of a form "Input and View"

Section "Application" collects economic and biological value as well as the reproductive ability of plants. Page "Additionally" has references and data on the organization-user. Section "Herbarium" is made for input and view of places and geographical coordinates of selection of herbarium samples (up to three). Page "Drawings" can fit up to 6 files of a plant's images with their names (figure 4). Page "Text" aims for input and storage of big text information on a taxon (including the data from the files).

Figure 4 – Page "Drawings" of a form "Input and View"



BD-PLANT-KZ pays significant attention to the quick search of taxons. The special form allows filtering taxons on institutions, families, and childbirth or choosing a particular plant (figure 5).

BD-PLANT-KZ assists in exporting information on plants to 9 formats (txt, doc, docx, XLS, XLSX, RTF, PDF, TIF, XML) for the subsequent editing in external text and graphic editors. The call of a form of export (figure 6) is carried out through "MM\View\WinWord." Completion of the broadcast of data in the chosen format allows opening the created file in the corresponding editor. The example of export to Microsoft Word (figure 7).

Access to a form of the list of taxonomical units is carried out by Button "Systematization" in Point "View" of MM (figure 8). The choice of any unit of systematization in the right text field evokes a list of the taxons, which are its part. It is possible to obtain information not only about the taxonomy of the organization but also about Database in general.

Figure 5 – "Advanced Search" Form

Figure 6 – "Export of Information to WinWord and Other Formats" Form

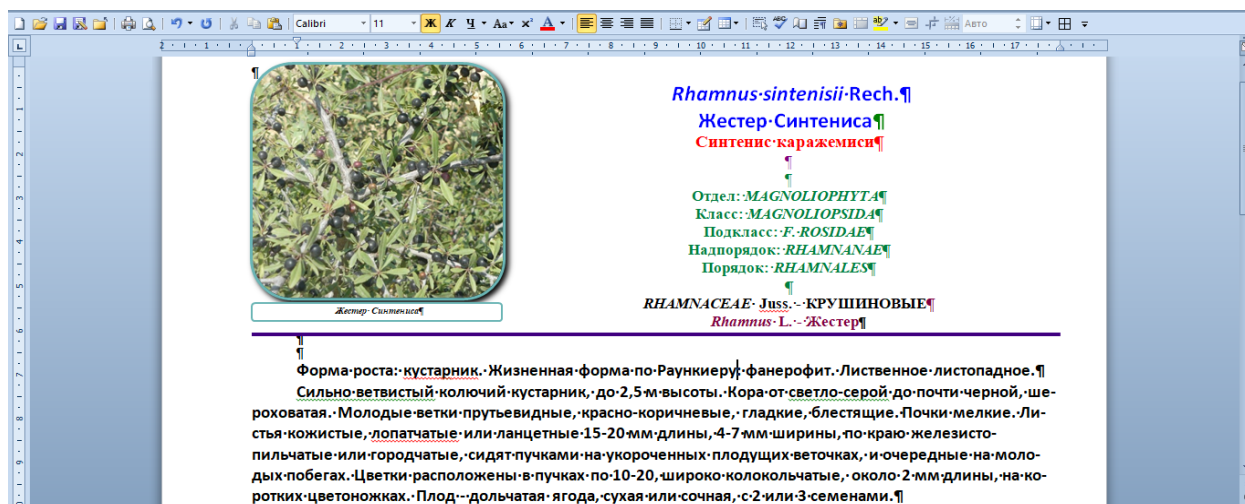


Figure 7 – An example of information export to pdf – a format

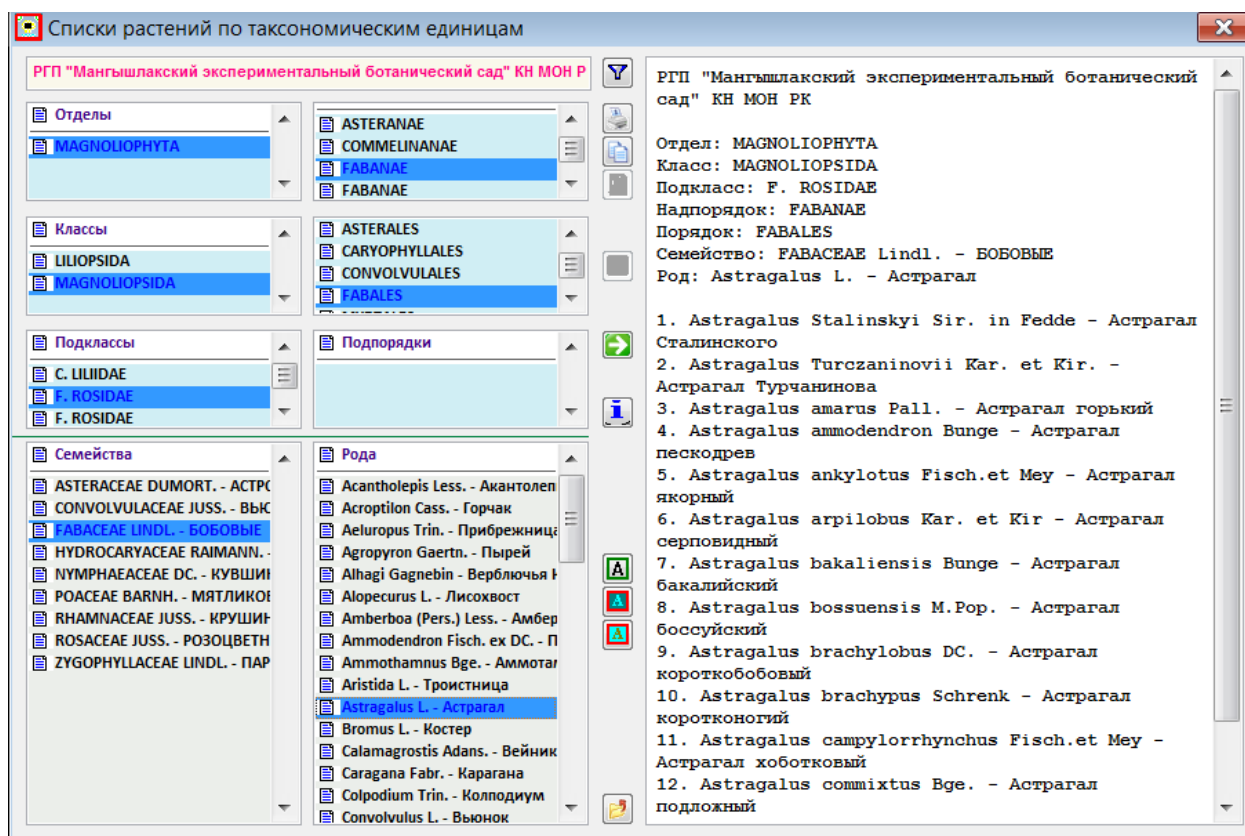


Figure 8 – Form of the list of taxonomic units

The program has provided the formation of the most various lists of plants according to taxonomic, morphological, and other characteristics.

The more detailed task of parameters of drawing up lists is possible when using a form with the similar name which is started by the commands "Choice..." from Point "List of..." of MM. The formation of Lists in Excel provides the use of Form, represented in figure 9.

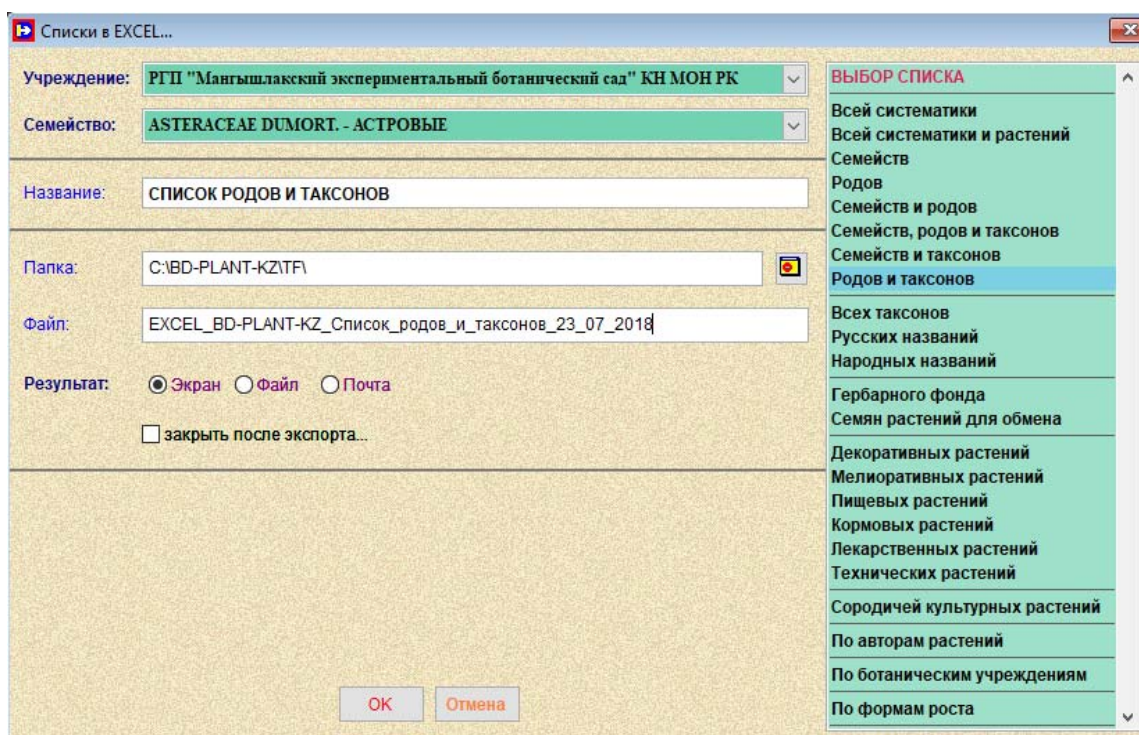


Figure 9 – "Lists in Excel..." Form

Main Menu\Herbarium command is applied to work with Herbarium fund. At the same time, a special form, including all lists of plants of the botanical establishment by default will appear on the screen. The lower Push-button menu makes possible to execute a search for the necessary taxon, to see and print out all list and also to edit it regarding inclusion or an exception of a plant of herbarium fund. If herbarium samples are available, the button "Samples," with the help of which the form intended directly for editing information is activated. The command "Edit" makes Database fields available for editing. The current record of Herbarium can be copied and removed. "Reports" and "Export" modes provide two options for a herbarium sample data withdraw: "All information" and "Labels."

For plants' communities, BD-PLANT-KZ provides a form "Input" and "View," including 5 pages (groups) of information: "Location," "Communities," "Tier," "In addition," and "Drawings" (figure 10).

Database fields characterizing an administrative and geographical location of population, coordinate, a natural zone and conditions of dwelling are concentrated on Page "Location." The group of variables of "Community" is devoted to geo botanical units.

Many of them can be chosen or created from the lists revealing the corresponding buttons. The correct connection of dominant in the name of association can be executed automatically by a combination of installation or removal of a tick to the left of the words "Other Sinusion", "Identical Value" and "Characteristic Look."

Drawing up Latin names of communities involves the first position for the name of an edifikator, whereas Russian names – on the contrary [4]. The signs such as a hyphen "-", and a plus "+" connect taxons of various synusia in the population in case plants have identical value and belong to one synusia, they are listed by a comma. Types, characteristic of the community requires the use of square brackets "[...]" to surround their names.

The page of "Tier" includes not only the general list of the plants which are a part of the population but also their level accessory with the indication of a protective covering, abundance by Drudae, occurrences, and heights. The group additionally has geo botanical districts, areas, and sub districts, the existence of raw stocks, the note of a text format of the size, unlimited on length, botanical establishment, position, degree, and full name of the performer. Drawings (page No. 5) are necessary for working with a graphic material on communities which can be looked through in three modes: "Clip," "Isometry," and "Stretched."

Figure 10 – Page "Community" of a form "Input" and "View" of information

Thus, regarding the structure, three main databases are a part of the program: 1) floristic, 2) herbarium and 3) geo botanical, consisting, respectively, of 211, 60, and 131 fields of numerical, symbolical, and logical types in the total length - 10,602, 2,703, and 8,161 symbols.

The commands of the point GM of a database have the following functional meaning:

- 1) Copying – the creation of the insurance copy of all databases, settings of the program and files of images in case of loss of information;
- 2) Restoration – a complete recovery of a DB and settings;
- 3) Export – the creation of the copy of a floristic, herbarium, and geo botanical DB for transfer on another personal computer (PC) or in another botanical establishment;
- 4) Import – an addition of records on plants, herbarium fund, and communities from another personal computer;
- 5) Re-indexing – updating the DB indexes and their packing;
- 6) Repair of indexes – the creation of new indexes instead of spoiled in the course of work if that happens;
- 7) "Information" – obtaining data on the content of a DB.

Using the first two sub points makes copying of a DB on other personal computers also possible. The folder, created in the Export mode, can be archived and sent at once to another botanical establishment by e-mail or via the server on purpose formation of a united DB according to the inventory of plants of the natural flora of Kazakhstan.

By present, the fullest taxonomical, geographical, ecological, biological, and graphic information for 882 taxons from 4 departments, 6 classes, 12 subclasses, 26 sub orders, 59 orders, 10 suborders, 80 families and 300 gena have been entered into the *floristic* database. More than a half (66.0%) of taxons (582) with the data, available in a DB, relates to the representatives of 7 families (table 1), from which the most numerous are the 4th: *Asteraceae* Dumort. (124), *Chenopodiaceae* Vent. (152), *Fabaceae* Lindl. (111) и *Poaceae* Barnh. (138). Among patrimonial complexes in the database considerably prevail gena *Artemisia* L. (53 - 6.0%), *Astragalus* L. (80 - 9.1%), *Elymus* L. (34 - 3.9%) и *Salsola* L. (20 - 2.3%). In a natural area of the dwelling, plants grow in 37 floristic regions of Kazakhstan. All territory of the republic has 96 gena of plants. The greatest number of taxons is dated for the following floristic areas: «3. Tobolsk and Ishim (101), "4. the Ural" (33), "5. Aktyubinsk" (45), "6. Turgai" 63), "16. Mangystau" (40) and "30. Altai" (119). At present, DB has 976 graphic files (drawings, images, and maps).

Table 1 – The most representative families and gena of plants of floristic database

Family	Taxons	%	Gena	Taxons	%
<i>Asteraceae</i> Dumort. - Астровые	124	14.1	<i>Artemisia</i> L. - Полынь	53	6.0
<i>Brassicaceae</i> Burnett – Капустные	26	2.9	<i>Astragalus</i> L. – Астрагал	80	9.1
<i>Chenopodiaceae</i> Vent. – Маревые	152	17.2	<i>Atriplex</i> L. – Лебеда	15	1.7
<i>Fabaceae</i> Lindl. – Бобовые	111	12.6	<i>Chenopodium</i> L. – Марь	16	1.8
<i>Lamiaceae</i> Lindl. – Яснотковые	14	1.6	<i>Elymus</i> L. – Волоснец	34	3.9
<i>Poaceae</i> Barnh. – Bluegrass	138	15.6	<i>Salsola</i> L. – Solyanka	20	2.3
<i>Scrophulariaceae</i> Juss. - Figwort family	17	1.9	<i>Suaeda</i> Forsk. – Suaeda	14	1.6
Total	582	66.0	Total	232	26.3

The *herbarium* database of BD-PLANT-KZ program contains data recording for 765 samples of 281 species and forms of plants of natural flora from 53 families and 162 gena collected in 74 habitats of 320 geographical regions (areas) of 14 administrative regions of 4 areas of Kazakhstan now. Beyneusk, Karakiyansk, Mangystau, both Tupkaragansk, Mangystau, Zhylyoysk, Kzylkogins, and Atyrau regions collected and turned into herbariums 99, 150, 170, 65, 53, 126 samples respectively (table 2). The following floristic areas dominate regarding the number of the herbarium data entered into a database "16. Mangystau" (381 - 49.8%), "17. Northern Ustyurt" (96 - 12.5%) and "4. Ural" (256 - 33.5%). Gerbarny samples of the database are illustrated by 465 their photos.

Table 2 – Distribution of gerbarny samples of the database on the administrative and floristic regions of Kazakhstan

Administrative region (area)	Taxons	%	Floristic area	Taxons	%
Beyneusk (Mangystau)	99	12.9	5. Aktyubinsk	23	3.0
Bokeyordinsky (West Kazakhstan)	1	0.1	15. Bozasha	6	0.8
Zhylyoysk (Atyrau)	53	6.9	13a. Bukeevsk	1	0.1
Indersky (Atyrau)	39	5.1	16. Mangystau	381	49.8
Isataysky (Atyrau)	20	2.6	13. Pricaspian	1	0.1
Karakiyansky (Mangystau)	150	19.6	17. Northern Ustyurt	96	12.5
Kzylkoginsky (Atyrau)	126	16.5	6. Turgai	1	0.1
Makatsky (Atyrau)	14	1.8	4. Ural	256	33.5
Mangystau (Mangystau)	170	22.2			
Makhambetsky (Atyrau)	22	2.9			
Mugalzharsky (Aktyubinsk)	1	0.1			
Munaylinsky (Mangystau)	4	0.5			
Tupkaragansky (Mangystau)	65	8.5			
Hobdinsky (Aktyubinsk)	1	0.1			
Total	765	100.0	Total	765	100.0

**Conclusion.** The computer program has undergone successful approbation in two botanical gardens of Kazakhstan (Altai and Mangyshlaksy) and has shown high reliability and efficiency of work with floristic and herbarium information on plants of the natural flora of Kazakhstan. Lists of taxons on the systematic accessory, ecological and biological properties, geographical points, floristic areas, etc. revealed the geographical novelties of plants.

BD-PLANT-KZ is registered in Committee on intellectual property rights of the Ministry of Justice of the Republic of Kazakhstan (the certificate on the state registration of the rights for the subject of copyright No. 1408 of December 25, 2012, IS 0009258).

Introduction of the program in the practice of the cadastral registration has considerably simplified creation information databases, has allowed to carry out quickly search of taxons and, in general, has expanded possibilities of work with information on plants and their communities.

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### **ҚАЗАҚСТАННЫҢ ТАБИҒИ ФЛОРАСЫНЫҢ ӨСІМДІКТЕРІН КАДАСТРЛІК ЕСЕПКЕ АЛУ ҮШІН «BD-PLANT-KZ» КОМПЬЮТЕРЛІК БАҒДАРЛАМАСЫН ҚОЛДАНУ**

**Аннотация.** «Қазақстанның табиғи флорасының өсімдіктерінің ботаникалық алуан түрлігі жөнінде ақпаратты компьютер жадына енгізу және сақтау үшін арналған BD-PLANT-KZ» компьютерлік бағдарламасының сипаттамасы берілген. Бағдарламаның негізгі құрылымының құрамы 11 мәтіннен тұрады: «Файл», «Өңдеу», «Енгізу», «Іздеу», «Қарау», «Тізім», «Кеппе шөп», «Қауымдастық», «Деректер базасы», «Сервис» және «Анықтама». Бағдарлама деректерді жылдам іздеуге, басып шығаруға, әртүрлі форматта экспорттауға, берілген таксономикалық, биоэкологиялық, сәндік және басқа параметрлер бойынша тізімдер мен есептерді жасауға мүмкіндік береді. «BD-PLANT-KZ» Қазақстанның екі ботаникалық бақтарында (Алтай және Маңғыстау) сынақтан сәтті өтті. Қазіргі уақытта бағдарламаның флористикалық деректер базасында табиғи флораның 4 бөлімдер, 6 класс, 12 класс асты, 26 қатарүсті, 59 қатар, 10 қатар асты, 80 тұқымдастан және 300 туыстан тұратын 882 таксон үшін ақпарат енгізілген. Бағдарламаның сынағы Батыс Қазақстанның мысалға Маңғыстау, Атырау Ақтөбе және Батыс Қазақстан облыстарының табиғи флорасының жиынтық сипаттамасын құрастыруға мүмкіндік берді. Географиялық нүктелер мен флористикалық аудандар бойынша таксондар мен географиялық жаңа тізімдер анықталды.

**Түйін сөздер:** компьютерлік бағдарлама, BD-PLANT-KZ, кадастр, өсімдік есебі, деректер базасы.

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### **ИСПОЛЬЗОВАНИЕ КОМПЬЮТЕРНОЙ ПРОГРАММЫ «BD-PLANT-KZ» ДЛЯ КАДАСТРОВОГО УЧЕТА РАСТЕНИЙ ПРИРОДНОЙ ФЛОРЫ КАЗАХСТАНА**

**Аннотация:** Приводится описание компьютерной программы «BD-PLANT-KZ», предназначенная для ввода и хранение в памяти компьютера разнообразной ботанической информации о растениях природной флоры Казахстана. В состав Главного меню входят 11 пунктов программы: «Файл», «Правка», «Ввод», «Поиск», «Просмотр», «Списки», «Гербарий», «Сообщества», «Базы данных», «Сервис» и «Справка». Программа позволяет осуществлять оперативный поиск данных, вывод на печать, экспорт в различные форматы, составление отчетов и списков по заданным таксономическим, биоэкологическим, декоративным и иным параметрам. «BD-PLANT-KZ» прошла успешную апробацию в двух ботанических садах Казахстана (Алтайский и Мангышлакский). В настоящее время флористическая база данных программы включает информацию по природной флоре для 882 таксонов из 4 отделов, 6 классов, 12 подклассов, 26 надпорядков, 59 порядков, 10 подпорядков, 80 семейств и 300 родов. Апробация программы позволила составить сводную характеристику природной флоры Западного Казахстана на примере Мангистауской, Атырауской, Актюбинской и Западно-Казахстанской областей. Определены списки таксонов по географическим точкам и флористическим районам, выявлены географические новинки.

**Ключевые слова:** компьютерная программа, «BD-PLANT-KZ», кадастр, учет растений, базы данных.

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