UDC 582.736.3:[581.522.4+581.95](477.4:292.485)

O.P. BONDARCHUK, D.B. RAKHMETOV

M.M. Gryshko National Botanical Garden, National Academy of Sciences of Ukraine
Ukraine, Kyiv 01014, Timiryazevska str., 1

EVALUATION OF THE INTRODUCTION EFFECTIVENESS OF PLANTS OF *ASTRAGALUS* SPP. IN CONDITIONS OF RIGHT-BANK OF FOREST-STEPPE OF UKRAINE

Objective *— to evaluate of successful introduction of plants of species of the Astragalus L. genus in conditions of Right-Bank of Forest-Steppe of Ukraine.*

Material and methods. *The subject of the study were perennial plants of Astragalus species: A. galegiformis L., A. cicer L., A. falcatus Lam., A. glycyphyllos L., A. ponticus Pall., A. monspessulanus L., A. onobrychis L., A. sulcatus L., A. canadensis L., A. dasyanthus Pall. Investigations of biomorphological and ontomorphogenetical peculiarities of plants were conducted on introduction plots of the Department of Cultural Flora of M.M. Gryshko National Botanical Garden of the NAS of Ukraine in compliance with generally accepted techniques. Processing result was performed by analysis of variance and statistical estimation of the data using Microsoft Excel (2010) program.*

Results. *The established age states ontomorphogenesis species of Astragalus genus and seasonal rhythms of plants development. Marked morphological characteristics for comparison mobilized species of plant. According to the success of the plant introduction among the species of the Astragalus genus — A. ponticus, A. monspessulanus was recognized as promising and A. galegiformis, A. cicer, A. falcatus, A. glycyphyllos — especially promising.*

Conclusions. *On the basis of biological and morphological features and the availability of economically valuable traits selected promising forms and varietals samples of medicinal, fodder and energy use. Further introduction into agriculture of the species plants of this genus will allow not only preserving natural places of growth and considerably expand the raw material base of modern crops of the Leguminosae (Fabaceae) family.*

Key words: species of the *Astragalus* L. genus, ontomorphogenesis, introduction effectiveness, Right-Bank of Forest-Steppe of Ukraine.

One of the most effective ways to preserve biodiversity is the plant introduction [16, 17]. Introduction to plant culture of the *Astragalus* L. genus species in Ukraine also has a significant scientific significance and is mainly due to the so-called «protective introduction». More than 40 % of the species diversity of the Ukrainian natural flora strawberries requires conservation measures, therefore actively explored and multiplied under the conditions of introduction for further repatriation in the natural conditions of their growth [14]. This is primarily due to their valuable medicinal properties, individual representatives of *Astragalus*, as a result of which the natural places of their growth have undergone an intensive anthropogenic load [11].

The *Astragalus* genus was studied in the IV-III century BC as a valuable medicinal herbal remedy. Now in world flora includes about 2500 species, in the flora of Ukraine is growing 60 [13]. Huge amounts of genus and plasticity of plants to environmental conditions, cause great interest among modern scientists [1, 8—10, 18, 22]. Natural places of growth of *Astragalus* on the territory of Ukraine undergo a large anthropogenic load, which is due to the number of their valuable practical properties [7, 8]. In China, some *Astragalus* is used in organic farming as an alternative to chemical fertilizers [24]. On the territory of United States, some representatives of this genus are studied as highly productive plants for provision needs of fodder production [9, 10]. Analyzing the results of studies by British scientists, one can assume that these plants can be used to form stable pastures [18]. But most scholars of the world focuses on the study of chemical composition and nutritive value of *Astragalus* for use in the medical industry [1, 22].

The mobilization of the gene pool of rare and uncommon beneficial plant species and the creation of high-yielding varieties, hybrids and forms on their basis emphasizes the relevance of the comprehensive study and introduction into the broader culture of representatives of the *Astragalus* genus in Ukraine, as it will meet the needs of production, as a consequence, to reduce the harvesting of raw materials in natural growth areas. It is worth noting that in the department of cultural flora of M.M. Gryshko National Botanical Garden of the NAS of Ukraine has been working on the introduction of *Astragalus* for decades [16, 19]. As a result of our comprehensive research on the introduction of representatives of this genus, a number of results have been obtained emphasizing the prospects for the further introduction of high-yield species, forms and varieties in agriculture [17].

Objective — to evaluate of successful introduction of plants of species of the *Astragalus* L. genus in conditions of Right-Bank of Forest-Steppe of Ukraine.

Material and methods

The research was conducted on experimental sites of the department of cultural flora of the M.M. Grishko National Botanical Garden of the NAS of Ukraine, located in Right-Bank of Forest-Steppe of Ukraine.

Soils of experimental areas — grey forest pine forest. The depth of the arable layer is 20—22 cm. The content of humus in the soil — 3.26 %, pH — 6.7, nitrogen content — 98 mg/kg, phosphorus — 373 mg/kg and potassium — 66 mg/kg of soil.

Seeding rate of seeds at a widely-row sowing of 10 kg/ha. The depth sowed of the seeds is 1.5 cm, which is optimal for Astragalus on the soils of the investigated zone.

The names of plants are given as in «Vascular plants of Ukraine a nomenclatural checklist» by S.L. Mosyakin, M. Fedoronchuk [13], and the APG III system (2009). Describing the aboveground and underground organs of the plant we used [26, 27].

Phenological observations were carried out by registration of development phases at intervals of 3—5 days using the method of I.N. Beydeman [3], G.M. Zaitsev [25] and «Methodology of Phenological Observations in the Botanical Gardens of the USSR» [12]. The beginning of the phase was determined in the presence of a sign in 10 % of plants, the full phase — in the presence of 75 %. Photo illustrations are made using the Canon EOS 400D digital camera.

The evaluation of the success of the introduction was made according to the method of V.N. Bylov & & R.A. Karpisonova (1978). In assessing the signs of the basis are three-point scale V. Berezkina (Table 1) [2].

Table 1. **Scale for assessment of the success of introduction of perennial herbaceous plants**

Evidence	Mark		
	3	2	1
Generative development	Abundant fruiting and annual	Fruiting is not each year	Fruiting is absent
Resistance to drought and frost	Plants do not fall particularly	Shoots and plants die off in a particularly difficult period	Each year a significant extinction shoots and individuals
Resistance to lodging and shattering	Almost absent	No mass	Mass
Defeat by diseases and pests	Not damaging	No mass damaging	Each year mass damaging
Pretentious to the fertility of soils	Unpretentious	Medium pretentious	Very pretentious

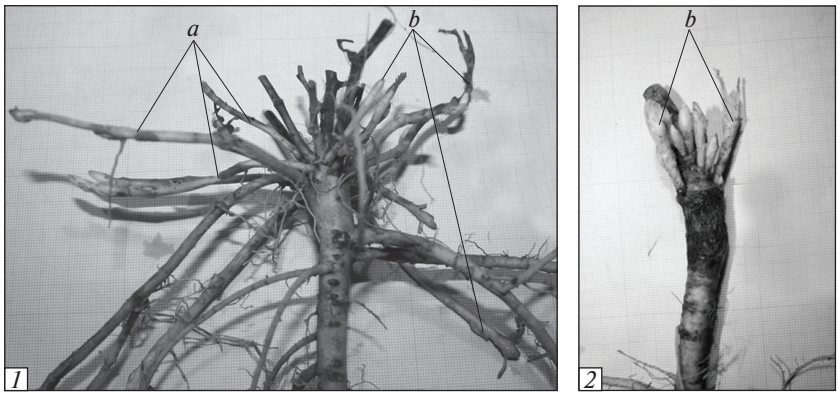

Fig. 1. Formation of rhizomes in plants species of the *Astragalus* genus: *1 — A. cicer*; *2 — A. galegiformis*; *a* — plagiotropic shoots; *b* — kidney renewal

The processing of the obtained research results was carried out using methods of dispersion analysis and statistical estimation of average data using the program Microsoft Excel (2010).

Results and discussion

It should be noted that the basis of our work is based on the research results of a number of scientists and their own data, which are covered in the articles [4—6, 17, 19]. As a result of biology-morphological studies, it was determined that plants of the species *Astragalus* genus are herbaceous perennials with non-parietaphystoid leaves, horseradish hemicryptophytes. A comparative analysis of underground organs allowed the isolation of 2 groups of plants: vegetatively mobile — *A. cicer*, the renal buds are located on plagiotic shoots, which allows the formation of a rhizome with a large number of clones, not mobile — all other investigated representatives whose buds restoration are located around the root cervix of the root (Fig. 1).

All representatives have a high hardness of seeds of about 98 %. The seed shell is impermeable to moisture and nutrients, which allows for a long time to prevent germination. The permeability of water in the seed naturally is carried out through a seed claw (Fig. 2), not natural due to scratching.

It was found that the introduced plant species of the *Astragalus* genus in conditions of culture have four age periods and 10 developmental states: seeds, sprouts, juvenile, immature, virginal, generative, subsenile and senile. The duration of ontogeny — about 25 years (Fig. 3).

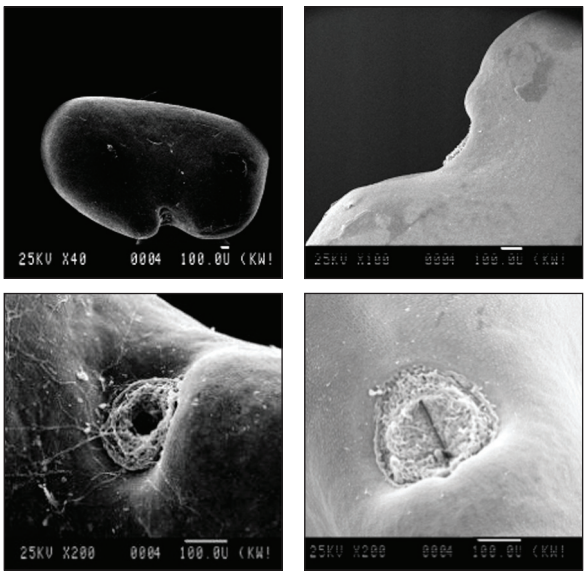

Fig. 2. Morphological features of the surface of the seed species of the *Astragalus* genus: *1 — A. sulcatus*; *2 — A. canadensis*

The rhythm of seasonal growth and development of plants, the duration of phenological phases is one of the important indicators of the success of the process of their introduction. It was established that the duration of the vegetation period of all investigated species of the first year of life in the conditions of the Right-Bank of Forest-Steppe of Ukraine varies within 190—210 days; in subsequent

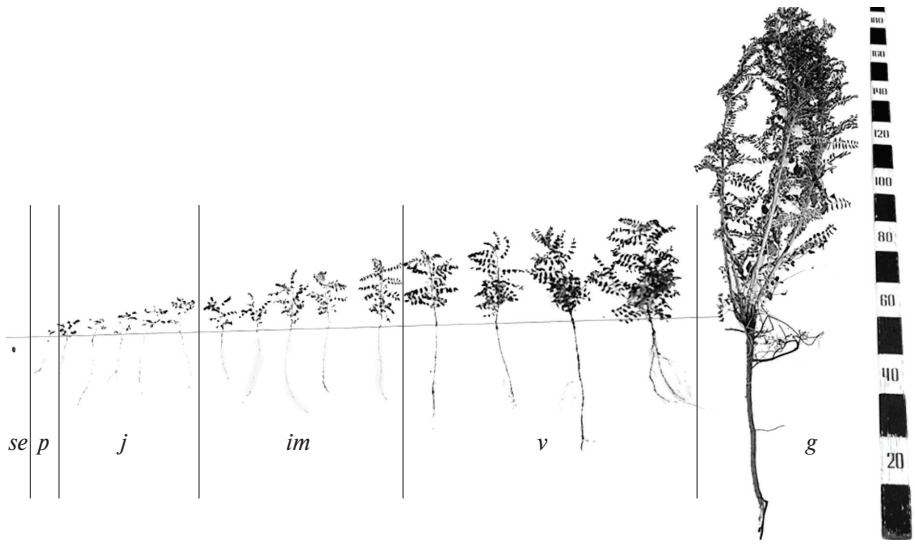

Fig. 3. Age states of *A. galegiformis* L. in conditions of introduction into the Right-Bank of Forest-Steppe of Ukraine: *se* — seed; *p* — sprouts; *j* — juvenile; *im* — immature; *v* — virginal; *g* — generative

years — 200—230 days; from the sowing of plants species of the *Astragalus* genus to the occurrence of stairs passes 14—23 days. In the generative period, plants of the first year of vegetation do not enter and vegetate until the transition of the average daily temperature of negative values. The duration of the development phases depended on weather conditions. Delay of germination to 14—23 days was observed at low soil moisture. Decrease in temperature also caused the slowdown of plant development.

In subsequent years, the plant's growth began on average, 22—29 days before the emergence of stairs. The budding phase began at 48—55 days after the start of the vegetation. The flowering phase came in 24—30 days, and the fruiting, respectively, after 19—24 days one after another.

It was found that plants of species of the genus *Astragalus* exhibit repairing properties in particular A. cicer after alienation of above-ground phytomass during budding, there is a re-flowering and fruiting. Rigorous flowering is noted in vegetatively

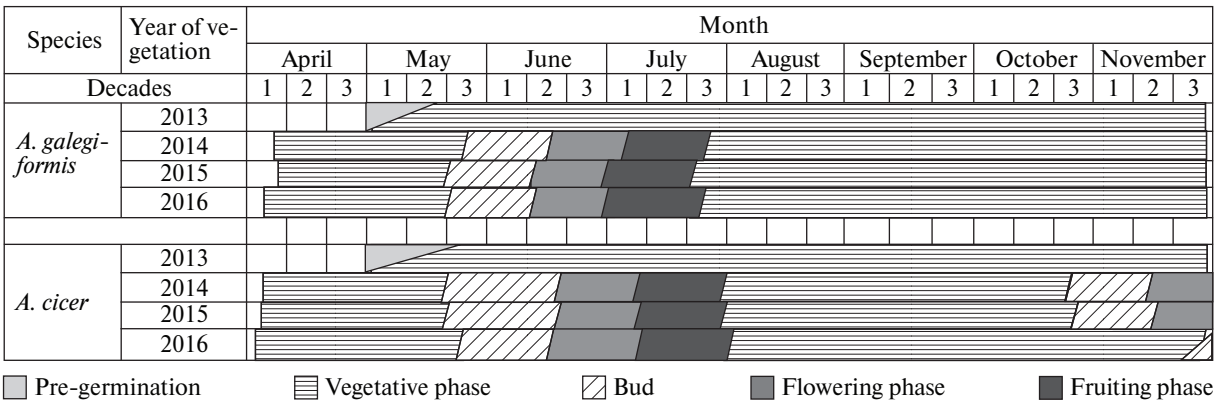

Fig. 4. The phenological spectrum of seasonal growth and development of *Astragalus* plants depending on species (2013—2016)

Table 2. **The evaluation of the introduction effectiveness of *Astragalus* L. species in conditions of Right-Bank of Forest-Steppe of Ukraine (according to the method of V.N. Bylov & R.A. Karpisonova, 1978)**

Species	Mark					General assessment of vitality	The effectiveness of the introduction
	Reproduction		General condition	Resistance to diseases, pests	Condition after wintering		
	Seed	Vegetative					
A. galegiformis	3	2	3	3	3	14	EP
A. cicer	3	3	3	3	3	15	EP
A. falcatus	2	2	3	3	3	13	EP
A. glycyphyllos	3	3	3	2	3	14	EP
A. ponticus	2	2	2	2	2	10	P
A. monspessulanus	3	1	2	3	2	11	P
A. onobrychis	2	1	2	2	1	8	UP
A. sulcatus	1	1	2	2	1	7	UP
A. canadensis	1	2	1	2	1	7	UP
A. dasyanthus	2	1	2	2	1	8	UP

N o t e: EP — especially promising; P — promising; UP — unpromising.

mobile plants (*A. cicer*). In the plants of the remaining investigated species, re-flowering was not observed. When alienation of the above-ground part of plants in the first group of plants after the fruiting phase are able to blossom for the second time in the growing season but do not pass into the fruiting phase. In other plants, under such conditions, no re-flowering was observed (Fig. 4).

According to the success of the plant introduction (Table 2) among the species of the *Astragalus* genus, 2 was recognized as promising and 4 (*A. galegiformis*, *A. cicer*, *A. falcatus*, *A. glycyphyllos*) — especially promising.

The most pronounced difference from the others on such features as the productivity of above-ground biomass, yield of seeds, content in the raw materials of structural and functional and biologically active compounds, resistance to adverse environmental factors characterized by form *A. galegiformis*. Based on the results of the evaluation, selection of standard forms for further breeding studies was carried out.

Conclusions

Therefore, as a result of ontomorfogenetical peculiarities plant of species of *Astragalus* L. genus representatives in conditions of introduction of M.M. Gryshko National Botanical Garden of the NAS of Ukraine which is located in the Right-Bank of Forest-Steppe of Ukraine the established age states ontomorphogenesis species of *Astragalus* L. genus and seasonal rhythms of plants development. Marked morphological characteristics for comparison mobilized species of plant and provided assessment of the success of plant introduction in culture. On the basis of biological and morphological features and the availability of economically valuable traits selected promising forms and varietals samples of medicinal, fodder and energy use. Further introduction into agriculture of the species plants of this genus will allow not only preserving natural places of growth and considerably expand the raw material base of modern crops of the *Leguminosae* (*Fabaceae*) family.

REFERENCES

1. *Arslan, M. and Yanmaz, R.* (2010), Use of ornamental vegetables, medicinal and aromatic plants in urban landscape design. Acta Horticulturae 881, pp. 207—211. https://doi.org/10.17660/ActaHortic.2010.881.26
2. *Berezkina, V.* (2007), Otsinka uspishnosti introdukcii vydiv *Sedum* L. [Evaluation of the introductions of *Sedum* L. species]. Visnyk Kyivs. nac. un-tu imeni Tarasa Shevchenka [Visnyk of Taras Shevchenko National University of Kyiv], N 11, pp. 4—6.
3. *Beydeman, I.N.* (1974), Metodika izucheniya fenologii rasteniy i rastitelnykh soobshchestv [Method of studying the plants and plant communities]. Novosibirsk: Nauka, 155 p.

4. *Bondarchuk, O.P. and Rakhmetov, D.B.* (2016), Ontomorfohenez roslyn vydiv rodu *Astragalus* L. za introduktsiyi v Pravoberezhnomu Lisostepu Ukrayiny. [Ontomorphogenesis of plant of the genus *Astragalus* L. in conditions of introduction in the Right-Bank of Forest-Steppe of Ukraine]. Introdukciya roslyn [Plant Introduction], N 2, pp. 45—51.
5. *Bondarchuk, O.P. and Rakhmetov, D.B.* (2017), Morfoloho-biolohichni osoblyvosti nasinnia roslyn vydiv rodu *Astragalus* L. (*Fabaceae*) introdukovanykh v Natsionalnomu botanichnomu sadu im. M.M. Hryshka NAN Ukrainy [Morphologo-biological features of seed *Astragalus* spp. (*Fabaceae*) introducted in the M.M. Gryshko National Botanical Garden of the NAS of Ukraine]. Molodyi vchenyi [Young Scientist], vol. 43, N 3, pp. 10—13.
6. *Bondarchuk, O.P. and Rakhmetov, D.B.* (2017), Produktyvnist roslyn vydiv rodu *Astragalus* L. v umovah introdukcii v Pravoberezhnomu Lisostepu Ukrayiny [Productivity of plants of the genus *Astragalus* L. species in conditions of introduction into Right-Bank of Forest-Steppe of Ukraine]. Introdukciya roslyn [Plant Introduction], N 4, pp. 11—19.
7. *Bondarchuk, O.P., Rakhmetov, D.B. and Fishchenko V.V.* (2017), Perspektyvy vyroshchuvannya roslyn vydiv rodu *Astragalus* L. dlya rozshyrennya potencialu syrovynnoyi bazy v dopovnennya tradycijnym kulturam [Prospects for growing plants of species of the *Astragalus* L. genus to increase the potential of the raw material base in addition to traditional crops], Vseukrayinska naukovo-praktychna konferenciya "Aktualni pytannya suchasnyh tehnologij vyroshchuvannya silskogospodarskyh kultur v umovah zmin klimatu", [National Scientific Conference "Aspects of modern technologies of growing crops in a changing climate"]. Kamyanets-Podilsky, pp. 58—60.
8. *Bondarchuk, O., Rakhmetov, D., Vergun, O. and Fishchenko, V.* (2017), Screening of secondary metabolites of *Astragalus* species during primary introduction trials into Right-Bank of Forest-Steppe of Ukraine. Stress factors & secondary metabolites, pp. 20.
9. *Kishor, B., Johnson, D.A., Jones, T.A. et al.* (2008), Physiological and Morphological Characterization of Basalt Milkvetch (Astragalus filipes): Basis for Plant Improvement. Rangeland Ecology & Management, vol. 61, N 4, pp. 444—455. https://doi.org/10.2111/08-011.1
10. *Lumpkin, T.A., Konovsky, J.C., Larson, K.J., and McClary D.C.* (1993), Potential new specialty crops from Asia: Azuki bean, edamame soybean, and astragalus. In: J. Janick and J.E. Simon (eds.), New crops. New York: Wiley, pp. 45—51.
11. *Lysiuk, R., Darmohray, R.Ye, Rakhmetov, D.B. and Bondarchuk, O.P.* (2015), Current trends and prospects for application of *Astragalus* spp., Agrobiodiversity for improving nutrition, health and life quality. Nitra, Slovakia, pp. 442—444.
12. *Metodika* fenologicheskikh nablyudeniy v botanicheskikh sadakh SSSR (1987), Metodiki introduktsionnykh issledovaniy v Kazakhstane. [The method of observation in the botanical gardens of the USSR]. Alma-Ata: Nauka, 136 p.
13. *Mosykin, S.L. and Fedoronchuk, M.M.* (1999), Vascular plants of Ukraine. A nomenclatural check list, Kiev. 346 p.
14. *Peregrim, Yu.S.* (2014), Introduktsiya ridkisnih i znikayuchih vidiv rodu *Astragalus* L. (*Fabaceae*) prirodnoi flori Ukraini: uspihi ta perspektivi [Introduction of rare and endangered of the species *Astragalus* L. genus (*Fabaceae*) of Ukraine natural flora: successes and perspectives]. Scientific Herald of Chernivtsy University. Biology (Biological Systems), N 6 (1), pp. 64—71.
15. *Rakhmetov, D.B.* (2007), Novi introdutsenty v fitoenergetytsi Ukrainy [New introducts in phytoenergy of Ukraine]. Mat. Mizhnar. konf. "Promyslova botanika: stan ta perspektyvy rozvytku" [Industrial botany: the state and prospects of development]. Donetsk, pp. 370—376.
16. *Rakhmetov, D.B., Korabliova, O.A., Stadnichuk, N.O., et al.* (2015), Katalog roslyn viddilu novyh kultur [Catalog of plants of the Department of New Cultures]. Kyiv: Fitosotsiotsentr, 112 p.
17. *Rakhmetov, D.B., Zaimenko N.M., Gaponenko M.B., et al.* (2017), Adaptatsiya introdukovanyh roslyn v Ukraini [Adaptation of introduced plants in Ukraine]. Kyiv: Fitosotsiotsentr, 515 p.
18. *Smyth, C.R.* (1997), Native grass, sedge and legume establishment and legume-grass competition at a coal mine in the Rocky Mountains of southeastern British Columbia. International Journal of Surface Mining, Reclamation and Environment, vol. 11, N 2, pp. 105—113. https://doi.org/10.1080/09208119708944068
19. *Stadnichuk, N.O., Bondarchuk, O.P., Rakhmetov, D.B., and Fishchenko V.V.* (2014), Vydy rodu *Astragalus* L. v Lisostepu Ukrayiny: introduktsiya ta perspektyvy vykorystannya na biopalyvo [*Astragalus* L. species, the Forest-Steppe of Ukraine: introduction and perspectives on biofuels]. Biologichni resursy i novitni biotexnologii vyrobnytstva biopalyv [Biological resources and newest biotechnologies for biofuel production]. Kyiv: Fitosotsiotsentr, pp. 102—109.
20. *Vaynagy, I.V.* (1974), O metodike izucheniya semennoj produktivnosti rastenij [On the methodology of studying plants seed production]. Botan. Zhournal [Botan. Journal], vol. 59, N 6, pp. 826—831.
21. *Wenkui, Li and Fitzloff, J.F.* (2001), Determination of Astragaloside IV in Radix Astragali (*Astragalus membranaceus* var. *monghulicus*) Using High-Performance Liquid Chromatography with Evaporative Light-Scattering Detection. Journal of Chromatographic Science, vol. 39, pp. 459—462.
22. *Williams, M.* (1980), Purposefully Introduced Plants that Have Become Noxious or Poisonous Weeds. Weed Science, vol. 28, N 3, pp. 300—305. https://doi.org/10.1017/S0043174500055338
23. *Yan-Feng, Huang, Lu, Lu, Da-Jian, Zhu, et al.* (2016), Effects of *Astragalus* Polysaccharides on Dysfunction of Mitochondrial Dynamics Induced by Oxida-

tive Stress. Oxidative Medicine and Cellular Longevit. doi: 10.1155/2016/9573291
24. *Yu, Fang, Zhi-Lei, Yan and Ji-Chen, Chen* (2015), Effect of chemical fertilization and green manure on the abundance and community structure of ammonia oxidizers in a paddy soil. Chilean journal of agricultural research, vol. 75, N 4, pp. 488—496. http://dx.doi.org/10.4067/S0718-58392015000500015
25. *Zaytsev, G.N.* (1978), Fenologiya travyanistyikh mnogoletnikov [Phenology of perennials herbs]. Moscow: Nauka, 148 p.
26. *Zyman, S.M., Mosyakin, S.L., Bulakh, O.V., et al.* (2004), Ilyustrovanyy dovidnyk z morfolohiyi kvitkovykh roslyn [Illustrated guide to the morphology of flowering plants]. Uzhhorod: Medium, 156 p.
27. *Zyman, S.M., Mosyakin, S.L., Hrodzynskyy, D.M., et al.* (2012), Ilyustrovanyy dovidnyk z morfolohiyi kvitkovykh roslyn [Illustrated guide to the morphology of flowering plants]. Kyiv: Fitosotsiotsentr, 176 p.

Recommended by O.M. Vergun
Received 12.06.2018

О.П. Бондарчук, Д.Б. Рахметов

Національний ботанічний сад імені М.М. Гришка НАН України, Україна, м. Київ

ОЦІНКА УСПІШНОСТІ ІНТРОДУКЦІЇ РОСЛИН ВИДІВ РОДУ *ASTRAGALUS* L. В УМОВАХ ПРАВОБЕРЕЖНОГО ЛІСОСТЕПУ УКРАЇНИ

Мета — оцінити успішність інтродукції рослин видів роду *Astragalus* L. в умовах Правобережного Лісостепу України.

Матеріал та методи. Предмет дослідження — багаторічні рослини видів роду *Astragalus*: *A. galegiformis* L., *A. cicer* L., *A. falcatus* Lam., *A. glycyphyllos* L., *A. ponticus* Pall., *A. monspessulanus* L., *A. onobrychis* L., *A. sulcatus* L., *A. canadensis* L., *A. dasyanthus* Pall. Дослідження біолого-морфологічних та онтоморфогенетичних особливостей рослин проводили на інтродукційних ділянках відділу культурної флори Національного ботанічного саду імені М.М. Гришка НАН України за загальноприйнятими методиками. Обробку отриманих результатів здійснювали методами дисперсійного аналізу і статистичної оцінки середніх даних з використанням програми Microsoft Excel (2010).

Результати. Установлено вікові стани онтоморфогенезу рослин видів роду *Astragalus* та сезонні ритми росту і розвитку рослин. Визначено морфологічні ознаки для порівняння досліджених видів рослин. За оцінкою успішності інтродукції рослин з-поміж видів роду *Astragalus* 2 види (*A. ponticus, A. monspessulanus*) було визнано перспективними, а 4 (*A. galegiformis, A. cicer, A. falcatus, A. glycyphyllos*) — особливо перспективними

Висновки. За біолого-морфологічними особливостями і господарсько-цінними ознаками відібрано перспективні форми та сортозразки видів роду *Astragalus* для лікарського, кормового та енергетичного використання. Введення в сільське господарство видів рослин цього роду дасть змогу зменшити антропогенне навантаження та зберегти природні місця зростання, а також значно розширити сировинну базу традиційних культур родини *Leguminosae* (*Fabaceae*).

Ключові слова: види роду *Astragalus* L., онтоморфогенез, успішність інтродукції, Правобережний Лісостеп України.

А.П. Бондарчук, Д.Б. Рахметов

Национальный ботанический сад имени Н.Н. Гришко НАН Украины, Украина, г. Киев

ОЦЕНКА УСПЕШНОСТИ ИНТРОДУКЦИИ РАСТЕНИЙ ВИДОВ РОДА *ASTRAGALUS* L. В УСЛОВИЯХ ПРАВОБЕРЕЖНОЙ ЛЕСОСТЕПИ УКРАИНЫ

Цель — оценить успешность интродукции растений видов рода *Astragalus* L. в условиях Правобережной Лесостепи Украины.

Материал и методы. Предмет исследования — многолетние растения видов рода *Astragalus*: *A. galegiformis* L., *A. cicer* L., *A. falcatus* Lam., *A. glycyphyllos* L., *A. ponticus* Pall., *A. monspessulanus* L., *A. onobrychis* L., *A. sulcatus* L., *A. canadensis* L. *A. dasyanthus* Pall. Исследования биолого-морфологических и онтоморфогенетических особенностей растений проведены на интродукционных участках отдела культурной флоры Национального ботанического сада имени Н.Н. Гришко НАН Украины по общепринятым методикам. Обработку полученных результатов осуществляли методами дисперсионного анализа и статистической оценки средних данных с использованием программы Microsoft Excel (2010).

Результаты. Установлены возрастные состояния онтоморфогенеза растений видов рода *Astragalus*, их сезонные ритмы роста и развития. Определены морфологические признаки для сравнения исследованных видов растений. По оценке успешности интродукции растений среди видов рода *Astragalus* 2 вида (*A. ponticus, A. monspessulanus*) определены как перспективные, а 4 (*A. galegiformis, A. cicer, A. falcatus, A. glycyphyllos*) — как особенно перспективные.

Выводы. На основании биолого-морфологических особенностей и хозяйственно-ценных признаков отобраны перспективные формы и сортообразцы видов рода *Astragalus* для лекарственного, кормового и энергетического использования. Внедрение в сельское хозяйство видов растений этого рода позволит уменьшить антропогенную нагрузку и сохранить природные места произрастания, а также значительно расширить сырьевую базу традиционных культур семейства *Leguminosae* (*Fabaceae*).

Ключевые слова: виды рода *Astragalus* L., онтоморфогенез, успешность интродукции, Правобережная Лесостепь Украины.