Original Article

Biomorphological Features Of Some Medicinal Plants Under The Conditions Of Bukhara (Uzbekistan)

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Abstract

The article is devoted to the study of the growth and development of some medicinal plants from the Asteraceae family - Silybum marianum (L.), Cota altissima (L.) J. Gay; families Fabaceae - Galega officinalis L., Cassia tora L., families Lamiaceae - Lophanthus anisatus (Nutt.) Benth., Salvia officinalis L., families Rutaceae - Ruta graveolens L. in the soil-climatic conditions of Bukhara. The germination of seeds in laboratory and field conditions was determined. The seeds were planted in spring (April) and autumn (November). Autumn crops, except for Ruta graveolens and Salvia officinalis, in the first year of vegetation reached the generative period of ontogenesis (blooming and fruiting), and spring crops remained in the virginal age state. The initial stages of ontogeny of all species have been studied. All of the above-mentioned species are well adapted to the adverse conditions of the Bukhara city.

Keywords: city of Bukhara, ontogeny, latent, virginil, generative, growth and development, air temperature, medicinal plants, annual, perennial, climate.

INTRODUCTION. Currently, in the Republic of Uzbekistan 1200 species have medicinal features. However, in the republic, more than 100 species of medicinal plants are allowed to be used in scientific medicine, including more than 80% of which are wild species (Khojimatov 2021). Today, for the republic's need for medicines, an important task is the rational use of wild medicinal plants and the introduction of promising species to provide the raw material base for pharmaceutical production. Species of the genera Cota, Silybum, Lophanthus, Salvia, Ruta are of interest as sources of essential oils, glycosides, and other substances with valuable pharmacological features (Lavrenov and Lavrenova 2006). Currently, Lavandula officinalis, Lophanthus anisatus, Melissa officinalis, Salvia officinalis, Mentha arvensis, Origanum vulgare, etc. are cultivated as essential oil plants in the CIS countries (Moskvina 2005; Kalinichenko 2013). In this regard, there is a need to study the features of the growth and development of medicinal plants in different soil-climatic conditions of the republic. At present, these species are being studied in the adverse soil-climatic conditions of the Bukhara city.

Bukhara city - due to its natural and climatic conditions, belongs to the zone of a sharply continental arid climate typical to the desert regions of Central Asia, which is characterized by long hot and dry summers and short but rather cold winters with unstable snow cover up to 6-7 cm high. Average annual precipitation 100-200 mm, the average temperature in January in the northern part of the region is 2^0C , in the center and in the south it is about 0^0C, the average temperature in July is +28-30^{0}C, the absolute minimum air temperature reaches 27^0C, and the absolute maximum is +49^{0}C, the average annual temperature is +14,7-15^{0}C. The main amount of precipitation falls in the period from October to April up to 98% of their annual amount. More than 90% of the territory of the Bukhara region belongs to the desert zone (Geographical Atlas of Uzbekistan, 2012).

Until now, studies on the biological characteristics of Cota altissima and Cassia tora have not been carried out and there are fragmentary data in the literature. The biology, phytocenology and resources of Silybum marianum in the Republic of Uzbekistan were studied in more detail by B.A. Nigmatullaev (2019). Some bioecological features

are reflected in the scientific research of I.V. Belolipova, A. Islamova (2001). The reproductive biology of Ruta graveolens was studied by N.K. Rakhimova (2008), according to the anatomical structure of Galega officinalis - I. Sultanbekova (2012). According to the germination of Lavandula officinalis and Lophanthus anisatus seeds – Dusmuratova et al. (2020). All of the above researches were carried out in the Tashkent Botanical Garden of the Academy of Sciences of the Republic of Uzbekistan. Scientific researches on the study of ontogenesis in various environmental conditions have not been carried out so far.

MATERIALS AND METHODS. The research was carried out for two years (2021-2022) at the experimental areas of the Faculty of Agronomy and Biotechnology of the Bukhara State University in Bukhara. The objects of study: Silybum marianum (Asteraceae), Cota altissima (Asteraceae), Galega officinalis (Fabaceae), Cassia tora (Fabaceae), Lophanthus anisatus (Lamiaceae), Salvia officinalis (Lamiaceae), Ruta graveolens (Rutaceae) are introduced to the soil-climatic conditions of Bukhara.

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Picture. Research objects: a) Silybum marianum b) Cota altissima c) Galega officinalis d) Cassia tora e) Lophanthus anisatus f) Salvia officinalis g) Ruta graveolens

Silybum marianum – monotypic genus and species, biennial thorny plant 80-100 cm high. Blossoms in April-May, bears fruit in May-June. The plant is spread in Western and Central Europe, southern regions of Russia and Ukraine, Western Siberia, as well as in America, Asia. In Uzbekistan, it occurs in Kashkadarya and Surkhandarya regions (Khojimatov 2021). In folk medicine, Silybum marianum is used for diseases of the liver, gallbladder, spleen, chronic constipation, hemorrhoids, articular rheumatism, chronic bronchitis, powdered seeds for the treatment of hepatitis, cirrhosis, liver (Lavrenov and Lavrenova 2006). The pharmacological features of S. marianum can be seen in international journals (Mnatsakanyan et al. 2015; Gasimova et al. 2017).

Cota altissima – an annual weed plant, 30-90 cm high. Blossoms in April-June, bears fruit in late June-July. It grows in fields, along roads, in wastelands. In Uzbekistan, it is spread in the Samarkand and Surkhandarya regions, as well as in the Crimea, the Caucasus, Southern Europe, Iran (Flora of Uzbekistan 1962). It has a high antibacterial effect. The plant is able to slow down the growth of fungi in the body. About 40 species are found in the CIS. Almost all species of this genus are plants with a strong odor and a bitter taste; they are not eaten by livestock. Some species contain alkaloids, essential oils, dyes and are medicinal plants (Larin et al. 1956).

Galega officinalis – perennial herbaceous plant, 40-100 cm high. It is spread in the European part of Russia, the Caucasus, Ukraine, Moldova. Grows along the river banks and roads among bushes, in forests (Lavrenov and Lavrenova 2006). Herbs and seeds are used for medicinal purposes. In Czechoslovakia, it is bred for the

pharmaceutical industry (Macku and Krejcha 1970). Saponins, alkaloids, carbohydrates, tannin substances, flavonoids, carotene, phenolcarboxylic acids, tannin, bitter substances were found in the grass. In folk medicine, the herb in the form of infusions, decoctions, and mixture is used for diabetes mellitus, as a diuretic, pathogenic, lactogenic and anthelmintic agent (Lavrenov and Lavrenova 2006).

Cassia tora – an annual plant, 30-90 cm high. The fruits contain many useful components, vitamin A, as well as trace elements - selenium, copper, zinc, calcium. Useful features of Cassia tora: improves visual function, helps in cleansing the liver of harmful substances (toxins), lowers cholesterol levels in the blood, reduces high blood pressure, increases the elasticity of the vascular walls, helps in burning extra pounds. In oriental medicine, the plant has been used for many centuries. The second name of Cassia tora is "Chinese coffee beans", this is a tea that resembles a coffee drink in taste and aroma (https://agronom.guru/tsvetyi/dikorastushhie-tsvetyi/kassiya-tora).

Lophanthus anisatus – perennial herbaceous plant, 70-100 cm high. Species of this genus are found in Western and Eastern Siberia, Central Asia and the Far East. Under natural conditions, it grows in North and Central America. In medicine, it is used as a medicinal and essential oil. In the human body normalizes the process of metabolism. It is used in many diseases - atherosclerosis, angina pectoris, prostatitis, in lowering blood pressure, pneumonia, gastritis, liver treatment. In addition, it reduces the aging process in the body, increases immunity, aging disappears, and increases efficiency (Kozak and Turdugulova 2013).

Salvia officinalis – perennial shrub, heights from 20 to 80 cm, sometimes up to 100 cm. Blooms in May-June. In Uzbekistan, it is cultivated in small areas in order to obtain medicinal raw materials (Khojimatov, 2021). This plant grows in Moldova, Ukraine, Krasnodar Territories, Crimea. The plant originates from the Mediterranean region, where it grows wild on southern warm rocky slopes (Macku and Krejcha 1970). The leaves are used for medicinal purposes. The leaves are used for chronic bronchitis, hypertension, atherosclerosis. It has a calming, disinfectant, expectorant, hemostatic, anti-inflammatory, choleretic and diuretic features (Lavrenov and Lavrenova 2006). Flowers are used to obtain the antibacterial drug sylvan. In folk medicine, the leaves of Salvia officinalis are used for gastritis, colitis, liver disease, kidney disease, bronchitis as an expectorant (Medicinal Plants of Kazakhstan 1996; Khojimatov 2021).

Ruta graveolens – semi-shrub with point essential oils, 20-100 cm in height. Blooms in June-July. Grows on rocky and gravelly slopes. It is spread in all southern regions of Russia and Ukraine. It is a poisonous medicinal plant (Botanical Atlas, 1963). The leaves contain essential oil, rutin, bitter and tannin substances, alkaloids. In folk medicine, it is used to improve appetite. The plant has general tonic, anti-inflammatory, antiseptic, analgesic and wound healing features. An infusion of leaves is used for children as an anthelmintic (Lavrenov and Lavrenova, 2006). R. graveolens is also an industrial plant. Root oil is used in the production of cognac, in the preparation of oriental liquor, and in the perfume industry (Botanical Atlas, 1963).

For seed germination in laboratory and field conditions, the methods of T.A. Rabotnov (1960) and "Guidelines for seed science" (1980) are used. The initial stages of plant ontogenesis were studied according to the method of T.A. Rabotnov (1950) and I.G. Serebryakova (1952). The cycle of seasonal development was studied according to I.V. Borisova (1972) and I.N. Beideman (1974).

RESULTS AND DISCUSSION.

Latent period. The seeds of Silybum marianum are oval, faceted, shiny with a tuft. The length of the tuft is 1.0-1.5 cm white. Seed size is 5-8 x 3-4 mm. The color is yellow, from light brown to dark brown. The weight of 1000 pieces of seeds is 25-27 grams. Under laboratory conditions, the optimum temperature for seed germination is 20-30^{0}C. At this temperature, the seeds began to germinate on the third and fourth days and consisted 85-90%. Under field conditions, seed germination was 30-40% when planted in mid-May.

Virginal period. Sprouts. Due to the adverse cold spring, the seeds were planted in mid-May in 2021. Therefore, the plant in the first year of vegetation remained in the juvenile age state in the form of a rosette of leaves. In the same year, the seeds were planted in autumn in mid-November, mass shoots appeared in early March (4-5.03) of 2022 in spring. During this period, the average air temperature was 15.7^{0}C, relative air humidity of 50%. The length of the cotyledon leaf was 0.8-1.2 cm, the width was 0.3-0.5 cm, the length of the hypocotyl was 2-2.5 cm. The root reaches 3-4 cm. After 5-6 days (10.03) the first real leaves are formed.

Juvenile stage. The beginning of the juvenile stage (the formation of the first true leaves) was observed on March 10. At this time, from one to 4 true leaves were formed (size 1.0-1.5 x 0.5-0.7 cm). At the end of March (03.28.2022), the length of the leaves of some specimens was 3.0-3.5 cm, with width 1.0-1.2 cm. The cotyledon leaves are still preserved with length 1.5-2.0 cm and 1.0-1.2 cm width. At this time, the average air temperature became 11.6^{0}C, relative humidity of 58%. At the beginning of April (02.04), at an average air temperature of 17.2^{0}C, the relative humidity of the air was 44%, and the number of true leaves increased to 5-7 pieces. In mid-April (12.04), the size of the leaves increased to 6-7 x 2.0-2.5 cm. At the end of April (26.04), at an air temperature of 20.7^{0}C and a relative air humidity of 48%, the number of leaves in many juvenile specimens did not increase, but the leaf plate expanded, the length of the leaves was 10-12 cm, with the width 3-5 cm. Lateral shoots were not noted . The virginal period of Silybum marianum lasts 60-70 days (from March to May 15). In mid-May, the number of leaves increased to 15 pieces and a stem appeared with 12-14 cm high , 2 buds formed on the stem at an average temperature of 22.8^{0}C, relative air humidity of 43%. The plant goes into a generative age state.

Generative period. At the end of May (25.05), at an average air temperature of 28^{0}C, relative air humidity of 33%, the height of plants reaches 20-30 cm, 2-7 buds form on one stem and 2-3 flowers open at the same time, as well as 1-2 lateral shoots. In early June, in most plants the height reaches 30-40 cm, mass flowering is noted, there are 2 lateral shoots, 5-8 cm long. It should be noted that lateral shoots appear in the virginal period in most species but in Silybum marianum it happens in generative period of ontogenesis. At the beginning of July (03.07), the height of the plants reached 50-70 cm, seeds began to ripen in the basket. The diameter of the basket is 3-5 cm. In mid-July (14.07), from 30 to 83 ripen seeds were noted on one basket. In plants, 50% of the leaves dried up. The size of the leaves is 20-25 x 10-12 cm. The root is a tap-root, at the end of the first year of vegetation 20-25 cm of depth penetrated. Many lateral roots of the second and third order are noted. Thus, the generative period of Silybum marianum lasted 60-65 days (from May to July 15). The total duration of the growing season was 130-135 days (from March 4 to July 15).

Latent period. Seeds of Cota altissima are very small, 1.8-2.0 mm long, 0.7-1.0 mm wide. Weight of 1000 pieces of seeds is 0.3-0.4 gr. The optimum temperature for seed germination is 15-17^{0}C. At this temperature, the seeds germinated 15% on the fourth day, 63% on the seventh day , 81% on the eleventh day and 84% on the twentieth day. In field (adverse weather conditions) the seed germination was 20-30% when planted in mid-May. In autumn planting was (favourable weather conditions) 60-70%.

Virginal period. Sprouts. The planted seeds of Cota altissima in April 2021 did not germinate due to a very cold spring. The seeds were planted again on May 12 of the same year at a temperature of 27-29^{0}C. Mass shoots appeared after 6-7 days. At the end of the stage, the root of the seed reached 3-4 cm in length. The seedling stage lasts only 10-12 days. In 2021, the seeds were planted in mid-November. Mass shoots appeared in the spring of March 20, 2022, at an average temperature of 5.8^{0}C, relative humidity of 68%. The length of the cotyledon leaf was 0.4-0.5 cm, width - 0.2-0.3 cm. The root reached 1.5-2 cm.

Juvenile stage. At the end of March, juvenile plants have 1-4 true leaves, 1.5-2.0 cm long, 0.6-0.8 cm wide. The root reaches 2-3 cm depth, forms small roots of the second order. The length of the leaves is up to 3-4 cm. In early April (02.04.2022), the number of leaves increased to 15-20 pieces, their length with the petiole is 7-10 cm. 5^{0}C temperature, relative air humidity was 53%. The length of the leaves with the petiole is 15-20 cm, intensive plant growth is noted. The plants forming two lateral shoots 2-3 cm long, were in the virginal age state. The root is a tap-root, deepens to 7-8 cm. A large number of thin roots of the second order, 2-4 cm long, are observed. At the beginning of June (06.02.2022), with a plant height of 25-30 cm, buds formed, that is, the plant passes into a generative age state. The duration of the virginal age state is 70-75 days.

Generative period. The generative plant in mid-June (15-20.06) began to bloom. At this time, the height of the plants reached 35-45 (50-60) cm. All leaves remained green. At the end of June (26.06), the height of the plants reached up to 80-90 cm, it simultaneously bloomed and fruited massively. All leaves were green. 10-15 annual lateral shoots of the second order were noted. They appeared from the base of the lower middle and upper parts of the stem. At the beginning of July (3.07) the seeds were fully ripen. On one basket 100-225 mature seeds were formed. On one bush collected 2-10 grams of full-fledged seeds. Thus, in 2022, under the conditions of Bukhara, 100% of plants reached the generative period of ontogenesis. The duration of the generative period of Cota altissima is 35-40 days (10.06-15.07). The total duration of the growing season was 115-120 days.

Latent period. Seeds of Galega officinalis are slightly reniform, smooth, greenish-yellow. Their length is 2.0-2.5 mm with the width of 1.0-1.2 mm. The weight of 1000 pieces of seeds is 6.2-6.7 grams. Seeds germinated in three days were up to 30%, and on the twelfth day were up to 60%. The optimum germination temperature is 25-30^{0}C. Under field conditions, seed germination was 40-45% when planted in early May, and 50-60% when planted in autumn.

Virginal period. Sprouts. The planted seeds in mid-May 2021 sprouted singly after 4-5 days, and after 10 days mass germination was observed. The seedling root deepened by 2-3 cm. The seedling stage was 5-7 days. During the autumn (November) planting, mass shoots appeared in the spring on March 10, 2022. At this time, the average air temperature was 12.3^{0}C, the relative humidity of the air was 77%. The height of the seedling reached 1-2 cm, there were two leaves, 0.5-0.8 cm long, 0.4-0.5 cm wide.

Juvenile stage. The beginning of the juvenile stage was observed on March 15, 2022. At a height of 2-3 cm from them, the first and second true leaves are located, 1.0-1.5 cm long with petioles, 0.5-0.8 cm wide. The main root deepened 3-4 cm. At the end of March (28.03) and early April (02.04) at an average temperature of 11.6-17.2^{0}C, relative air humidity was 44-58%, plant height reached 5-10 cm, had up to 13 true leaves, 1.5-2.5 cm long, 1.0-1.2 cm wide. The root deepened by 5-8 cm. In mid-April, the number of leaves doubled, and at the end of April (24.04) intensive plant growth was noted. Plants that do not form lateral shoots immediately pass into an adult virginal state. At this time, the average air temperature was 22.7^{0}C, the relative humidity of the air was 54%. Plant height reached 15-18 cm. The leaves are arranged in pairs, their dimensions were 2-3.5 x 1.3-1.5 cm. %, the height of the virginal plant was 20-22 cm, the root deepened 12-16 cm, several thin lateral roots of the second order were formed in the amount of 10-15, their length was 3-4 cm, and there were also many small roots of the third order 0.3-0.5 cm long. At the end of May (26.05), plant height reached 25-35 cm, at an average air temperature of 26.4^{0}C, relative humidity of air 33%, the number of true paired leaves increased to 40-50 pieces. Plants are in adult virginal state. Cotyledon leaves dried up. Renewal buds are located in the root collar. The length of the tap-root reaches 18-20 cm. The first lower leaves began to dry out. The duration of the virginal period is 90-95 days.

Generative period. In the middle of June (15.07) buds are formed, the height of plants reaches 40-50 cm. Buds last until the end of June. At the beginning of July (2.07) the flowering phase is noted and this continues until the end of this month. Up to four annual shoots 40-50 cm long were noted on one bush. The root in mid-July (14.07) deepens to 25-30 cm. The length of lateral roots reaches 15-28 cm.

Latent period. Cassia tora seeds are pale brown, tetrahedral. Length is 5-6 mm, width is 2-3 mm. Weight of 1000 pieces of seeds is 28-30 gr. Under laboratory conditions at a temperature of 15-17^{0}C, 56% seeds germinated. The optimum germination temperature was 25-30^{0}C. At this temperature, the seeds germinated 100%. Field germination in autumn planting is 50-60%.

Virginal period. Sprouts. The seeds planted in mid-November 2021 sprouted on the experimental area in the spring at the end of March (28.03), 2022. At this time, the average temperature was 11.6^{0}C, the relative humidity of the air was 58%. The seedlings are green, 1-2 cm in height, the cotyledon leaves are round, their length and width are the same of 1 cm. The root of the seedlings deepened by 3-4 cm.

Juvenile stage. In early April (02.04), the height of Cassia tora shoots was 3-4 cm, the first true leaves are formed, and on April 12, up to five true leaves. The root deepens 5-7 cm, several thin lateral roots are formed. At the end of April (26.04), the height of juvenile plants reaches 8-12 cm, the root deepened to 7-9 cm. At this time, the average air temperature was 20.7^{0}C, relative air humidity of 48%. At the beginning of May (03.05) the cotyledon leaves turned yellow, but were still preserved. The number of leaves did not increase, but the size of the leaves was 1-2 cm long, 1.0-1.5 cm wide. All leaves remained green. At the end of May (26.05), the height of juvenile plants reached 13-15 cm, at an air temperature of 26.4^{0}C, relative air humidity of 33%. The leaves are compound, five-parted. Each section has three paired true leaves. The root is branched, has several lateral roots, 6-7 cm long. The juvenile stage in the life of plants lasted two months (April-May).

Generative period. At the beginning of June (5.06) with a plant height of
20-25cm, buds were already formed. In the middle of June (15.06) the first flowers opened. At this time, the average air temperature was 26^{0}C, relative air humidity of 32%. At the end of this month (26.06), at a height of 30 cm, 2-3

flowers opened on each bush, the formation of buds continued. The number of leaves has increased. Drying of the leaves was not observed. In mid-July (14.07), at an average air temperature of 31^0C, relative air humidity of 28%, the height of some bushes reached 60-95 cm. 3-6 flowers opened on each bush. Flowers open in the morning and evening, close during the day. Visiting bees for flowers are observed. The number of lateral shoots is up to four, their length is 15-20 cm. And the number of paired leaves increased to 18, their size were 5-6 x 3-4 cm. The appearance of pods was noted, their length was 1-14 cm. The main tap-root deepens to 18-20 cm. Many lateral roots of the second order are 10-15 cm long, third-order roots are 1-3 cm. In August, the plant height reached 100-120 cm. Up to 20 pods were formed on each bush, their length is 13-21 cm. Each pod has 16-37 seeds, flowering and bud formation continues.

Latent period. The seeds of Lophanthus anisatus are dark brown, 1.5-2.0 mm long and 0.7-1.0 mm wide. Weight of 1000 pieces of seeds is 1.0-1.35 gr. The optimum temperature for seed germination is 25-**28^{0}C**. Seeds germinate singly in 7-8 days after the start of the experiment, and massively - in 12-15 days of 80%. Seed germination lasts 20-25 days. Under field conditions, seed germination was 40-45%.

Virginal period. Sprouts. The planted seeds of Lophanthus anisatus in mid-November 2021, sprouted in the spring of March 20, 2022, at an average temperature of 5.8^0C, relative air humidity of 68%. The length of the sprouted cotyledon leaf in Lophanthus anisatus is 0.4-0.5 cm, the width is 0.2-0.3 cm. At the end of the seedling stage, the root reaches 2.0-2.5 cm in length. The seedling stage of plants is only 6-7 days.

Juvenile stage. At the end of March (27.03), the height of Lophanthus anisatus seedlings was 1.5-2.0 cm, 3-5 true leaves were formed. The root deepens to 3.0-3.5 cm. At this time, the average air temperature was 9.3^0C, the relative humidity of the air of 64%. In mid-April (13.04), the number of leaves in juvenile plants doubled (8-10 pieces), 1.0-1.5 cm long, 0.7-1.0 cm wide without petioles. Plant height reached 4-6 cm. In late April (26.04) and early May (03.05), when the average air temperature was 20.7-20.9 ^{0}C, relative air humidity of 48-74%, intensive plant growth was noted in Lophanthus anisatus, without forming lateral shoots it reached 10-15 cm tall, the number of leaves has increased to 10-11 copies. The root is fibrous, deepens 4-5 cm deep, a large number of thin roots are noted. At the end of May (26.05), the height of the plants reached 20-25 cm. At this time, the plant was in a green virginal age state. On June 12, the height of virginal plants reached 25-30 cm without forming lateral shoots. The number of leaves did not increase, their size was 3-4 x 2-2.5 cm. The duration of the virginal period was 3 months (20.03-20.06).

Generative period. At the end of June (26.06), the height of Lophanthus anisatus reached 35-45 cm, buds were formed. The number of leaves increased to 14-18 pieces. The roots are fibrous, deepening up to 15 cm. In mid-July (14.07), the height of the plants reached 80-100 cm, mass flowering was noted. 2-10 lateral shoots were formed on one bush, 20-30 cm long, spike-shaped inflorescences formed on them. Flowers were pale yellow. The duration of the generative period is two months (July-August). The total duration of vegetation of plants is five months.

Latent period. The seeds of Salvia officinalis are small, black-brown nuts. All plants are fragrant. Seed length - 2-3 mm, width - 1.5-2.0 mm. Weight of 1000 pieces of seeds - 6.49-7.10 gr. Under laboratory conditions at a temperature of 20-25^{0}C, they sprouted singly after 3 days, and massively after 5-7 days up to 93%. Under field conditions, seeds planted in spring germinated 35-40%.

Virginal period. Sprouts. When planted in autumn (14.11) 2021, shoots appeared in early March (10.03) 2022. At this time, the seedlings had two rounded cotyledons, 4-5 mm long and wide, and two lanceolate leaves 1-2 cm long, 0.5-0.7 cm wide. The root has deepened to 2 cm, branching weakly.

Juvenile stage. The appearance of the first and second leaves was noted at the end of March (28.03) at an average air temperature of 11.6^0C, relative air humidity of 58%. The roots deepened to 3–4 cm. The height of juvenile plants was 1.5–2 cm. In early April (02.04), the plant had up to 6 true leaves, and the root penetrated to a depth of 5–6 cm. The seedling stage lasted up to 30–35 days.

Immature stage. At the end of April (26.04), at an average air temperature of 20.7^0C, relative air humidity of 48%, 4-6 lateral shoots 2-3 cm long appear in plants. The height of immature plants reached 8-10 cm. The number of leaves increased to 20-30, there are many small leaves at the bottom of the stem. After 3 months at the end of May (26.05), the height of immature plants reached 15-16 cm. The length of the leaves is 4-5 cm without petioles, and with a petiole

7-9 cm, 1-1.5 cm wide. The root deepens to 10-12 cm , branched. A lot of thin lateral roots appear, 5-6 cm long. In mid-June (12.06) at an average air temperature of 20^0C, relative air humidity of 32%, the average height of Salvia officinalis was 20 cm and the plant passed into an adult virginal state. In virginal plants, the number of leaves increased even more, their sizes are 6-7 x 2-2.5 cm without petioles. There are a lot of small leaves, 0.5-1.0 cm long, 0.3-0.5 cm wide. It should be noted that, in Salvia officinalis, renewal buds are laid along the stems from May, and they last until the end of July. At the end of June (26.06), the height of the plants reached up to 30 cm, having up to 6-7 lateral shoots, 12-18 cm long. At this time, the average air temperature was 30^0C, the relative air humidity of 29%. Thus, Salvia officinalis in the conditions of Bukhara in the first year of vegetation remained in an adult virginal state. According to the literature data, the plant forms generative shoots in the second year of vegetation.

Latent period. Seeds of Ruta graveolens in capsules, numerous, 2-2.5 mm long, 1-1.5 mm wide, dark gray, sinuously wrinkled on the surface. Weight of 1000 pieces of seeds is 1.0-1.9 gr. The optimum germination temperature is 15-17^0C. Seeds germinate massively after 11 days - 57%, after 15 days - 72%, after 26 days - 75% after the start of the experiment. Seed germination lasts 25-26 days. In the field, planted seeds germinate up to 50-60% in spring.

Virginal period. Sprouts. In the conditions of Bukhara, when planted in autumn of 2021, seedlings appeared in early March (10.03) 2022. Two green lanceolate cotyledons, 5-7 mm long and 1.5-2.0 mm wide, are brought to the surface. Cotyledons function until the end of this month. After the cotyledons, two lanceolate leaves appear, 0.4-0.5 mm long and 2.0 mm wide.

Juvenile stage. The appearance of the first true leaves dissecting into 3 segments was noted on March 14-15. At the end of March, the plant height reached 2.0-2.5 cm, had 4-6 true leaves and a weakly branching tap-root 3-6 cm long. In early April (02.04), the height reached 3-4 cm, the number of leaves was 8-9, the root deepened by 7-10 cm. The cotyledon leaves began to dry out. At this time, the average air temperature was 17.2^0C, relative air humidity of 44%. In mid-April (12.04), the height of the plants reached 8-12 cm, the root deepened to 12-13 cm, the length of the lateral roots was 11-12 cm, there was a lot of small roots. At the end of May (26.05), without forming lateral shoots, the plant passed into an adult **virginal state** at a height of 15-20 cm, the root deepened to 13-16 cm, keeping its main feature. All leaves were green. At this time, the average air temperature was 26.4^0C, relative air humidity of 33%. In mid-June (12.06) and at the end of June (26.06), the number of leaves increased to 13-17, and the root deepened to 16-17 cm. There are many lateral roots of the second and third order. The number of lateral roots of the second order is 12-15, their length is 5-7 cm, the length of lateral thin roots of the third order is 2-3 cm.

In mid-July (12.07), the height of the plants reached 25 cm, the number of leaves increased to 20-25. The tap-root deepened to 17-18 cm, and the length of the lateral roots of the second order to 10-15 cm. Thus, the whole month of July Ruta graveolens at a height 25-30 cm in the first year of vegetation remained in a virginal age state.

CONCLUSIONS

The studied species of Silybum marianum, Cota altissima, Galega officinalis, Cassia tora, Lophanthus anisatus in the conditions of Bukhara in the first year of vegetation reached the generative period of ontogenesis (when planted in autumn), and Salvia officinalis and Ruta graveolens were in a green adult virginal state. According to the literature, these plants reach the generative period in the second year of vegetation. Depending on weather conditions, the seeds of medicinal plants should be planted, mainly in the spring (March-April).

However, due to the adverse weather conditions in 2021, cold, spring frosts in the Bukhara city, the seeds were planted in mid-May. Therefore, they remained in the juvenile and virginal age state. Autumn crops (in November) gave positive results.

Thus, the duration of all phases of development depends on the soil and climatic conditions. The change in the timing of these phases in the direction of adaptation to local conditions serves as a reliable criterion for the success of the fitness of the studied species.

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