

### Study of Ontogenesis of *Aervalanata* (L.) Juss

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**Abstract.** The article presents the method of describing ontogenesis exemplified by *Aervalanata* (L.) Juss. The ontogenesis significance is demonstrated in the botanic research. There are techniques of cultivating *Aerva lanata* (L.) in the conditions of Southern Kazakhstan, the productivity of raw stock and seeds. In the conditions of Southern Kazakhstan, *Aerva lanata* finishes the life cycle with fructification, which is a reliable indicator of adaptation to new conditions. The full ontogenesis takes place when the culture accelerates leading to premature ageing (the plant at the motherland is biannual, it is a single annual when cultivated). *Aerva lanata* yields abundant seeding growth proving its plasticity and successful introduction. Considering its pharmaceutical properties and high value, *Aervalanata* can be recommended for vast cultivation at foothills in the south of Kazakhstan.

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#### Introduction

The herb introduction can be successful providing only with profound knowledge of biology, features of ontogenesis and morphogenesis of the introduced plant in response to the ecological conditions of cultivation. Each plant has its life cycle (the bimorph) with its specific ontogenesis. It is recognized now that the biomorph is a deeply ecological category expressing the species formation background and its adaptivity to modern habitat conditions.

The plant ontogenesis is variable and has various fullness from expanded characteristics when the ontogenesis is the sum of processes making up the development of an open biological system having the onset, the cause motivated links of the development and the natural end»; E.A. Kondratieva – Melvil [1] «The ontogenesis or individual development comprises the entire complex of changes of vital activity and plant structure from its appearance from the zygote or vegetating bud to natural death»; to laconic determination: A. Ims [2] «the fruit is a mature flower»; R.E. Levina [3] «The ontogenesis are genetically determined stages of species development from Diaspora to withering». It is essential for introductory herb assessment because all ontogenesis evolutions is the indicator of successful introduction.

We have studied the ontogenesis of promising medicinal plants for introduction in Southern Kazakhstan, among them *Aervalanata* (L.) Juss. The following age periods have been identified and described: latent (the diaspora type as the propagation organ including the multifruit, fruit, seeds

, size, weight of 1000 fruit and seeds), virginal begins from the budding to the growth beginning, in other words, when first leaves grow from the seed (buds, juvenile immature young vegetating plants), generative (young, middle aged and old generative plants), post-generative (subsenile and senile plants).

The ontogenesis is the process comprising three summands: growth, organogenesis and withering [4].

*The growth* is characterized by the total height, length of one-year buds, metamers, residue. The metamer is the internode, the upper leaf, seed; the residue is a multiannual bud portion with germs [5].

*The organogenesis* is characterized by the duration of monopodial growth, three branching type, the number of buds per year, their types, metamers, the branching sequence, in other words, the intensity, availability of vegetative propagation.

*The withering* is determined as species life expectancy, the value (%) of withering of annual germs, the availability of caudices participation of the multiyear stem composed by residues and connected to the main stem root [5].

*The senile period* is accompanied by the vegetative sphere weakening, cessation of generative budding. T.A. Rabotnov [6] believed that senile species are not essential to judge about life strategy.

The most important ontogenesis indicator is the duration of its periods and stages. Deviations of the stages from the norm disclose the stress situation and permits to predict plant behavior in the conditions of natural and anthropogenic ecological background. The ontogenesis of annual and perennial plants reacts

to the stress situation differently. The annual plants reduce the vegetative sphere to the minimum, but they pass through the generative period. The perennial plants often do not enter into generative period bearing stress in the vegetative state.

The ontogenesis study should be expanded and used for the ecological monitoring and preservation of plant genofund.

The study aim is to explore the biological properties of *Aervalanata* (*L.*) *Juss.* by ontogenetic stages for introduction.

### Material and methods

*Aervalanata* (*L.*)*Juss.* is a biannual (annual if cultivated) herbaceous plant (the tropical weed) from 85.0 - to 110.0 cm tall, with rod root up to 30.0 cm long of gray-white color? The stalks are strongly branched from the root, straight standing, rarer tracing, and silicate, green. The leaves are sequential, short petiolar, elliptical or almost rounded, smooth-edged, puberulent. The flowers are tiny, modest looking, five membered with simple scabrous whitish-greenish or cream floral envelope, covering leaf at the root and two surrounding floral envelopes bunched into numerous alary dense inflorescences (Figure 1).

Chemical composition. The above ground portion reveals O-acilliglicozides,  $\beta$ -cysterin, daucosterin, lilac acid, valic acid, feruloiltiramine, ferulohomovamilline, narcisine and ervitrine. The *Aervalanata* components were first isolated in Uzbekistan [7].

Application. Pharmacological action is diuretic and anti-inflammatory [8-16].

Instruction for administration of *Aervalanata* was approved by the RF Ministry for public health on 17 December 1992. The complex of properties excels all available preparations of vegetable origin; it contains a great number of potassium, calcium. *Aervalanata* is a powerful stimulant of salt exchange in the organism being a strong diuretic prominent for the bile stone dissolution. It relieves inflammation in the biliary tract and bladder, in addenda, in renal pelvis, ad prostate. *Aervalanata* favors resorption of fibromiomas; reduces blood sugar; functions well in treatment hepatic cirrhosis, pancreatic gland; lowers the blood coagulability, thus preventing formation of thrombi in vessels [17-25].

The exploration of seed quality (the energy of budding and germination) was conducted according to the method of M.K. Firsova and the methodological guides of seed care of introduced species [26]. The mass determination of 1000 seeds was under GOST P 51096 – 97 [27].

The phonological observation and registration of pilot seeded plots were conducted by the method of T.A. Rabotnov [28] and I.N. Beideman

[29]. The morphological description of plants was carried out with animate material with the account of works of I.P. Serebraykov [30], A.A. Fedorov, and others [31-34].



**Figure 1 - *Aervalanata* (*L.*) *Juss.* in blossoming phase**

### Results and discussion

For the first time after plant introduction in South Kazakhstan were obtained the methods of cultivating *Aervalanata* (*L.*) *Juss.*

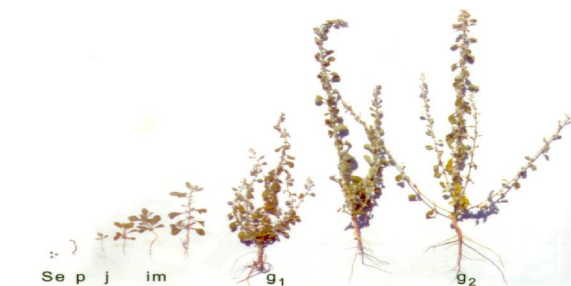
Latent period (Se). The fruit is small, the fruit case has elongated nose. The seeds are fine, 1000 seeds weigh 0.08 g, they are rounded, germ-like with a shining smooth surface, and they begin to germinate on the tenth day. The laboratory germination is 80%. On the third year, the seed germination reduces to 38%.

Virginal period (v). buds (p). the seed lobes are fine, lobe like, petiolar, light-green, 2.0 mm long, 1.0 mm wide, the hypocotyls is white, 0.4 mm long. The root system is pivotal, 1.0 cm long.

The juvenile stage (j). The first pair of leaves appears the twelfth day. The first leaf is simple, lancet-like, 0.8 cm long, 0.2 cm wide. The leaves are arranged opposite. The root penetrates into the soil for 1.8-2.0 cm. on the twenty seventh day the main bud intensifies its growth, first interstitial spaces appear 0.5-0.8 cm long, and the first pair of leaves shoots to 1.0-1.5 cm. The root penetrates into the soil for 3.0 cm.

Immature stage (imp) features the appearance of 3-4 pairs of leaves. The shoot I is about 4.0-6.0 cm. the root is light brown and remains pivotal, it penetrates to 10.0 cm. the lateral roots appear of order II.

Generative period (g) comprises young generative and middle-aged plants. After 8-10 pairs of leaves appear in mid May, the plants are budding. The main shoot is 8.0-10.0 cm high. The root system is 3.0 cm long, ramified to order III. In mid June, the plant begins to blossom. A single shoot has 20-150 buds. The abundant blossoming occurs in late July, the blossoming ends in late September. When the blossoming starts, shoot of order I stops growing reaching 110.0-115.0 cm. at this time the side shoots accelerate growth. A single plant has 6-15 shoots 60.0 cm long. The main shoot is 95.0-110.0 cm long. The branching is basitonic, the shoots grow monopodially. The rosette leaves are simple, whole-edged, sharpened oviforms, the base is pulled away, and the tip is sharpened. The leaf plate is thin. The venation is edge-wise. The heft is weakly ribbed. The short metamer interstice in the basic, middle, and upper tiers amount to from 1.6 up to 2.0 cm. the stem leaves in these tiers amounted to 2.6 up to 3.8 cm, they are from 1.3 to 1.6 cm wide. The root of mature plant is shallow (up to 30 cm), large. It forms lateral roots of order III - IV. The flowers are a complex stalk surrounded by hair (Figure 2). The blossoming peak was observed at 9 A.M. until noon, then the blossoming withered, the flowers are half-open until sunset. The vegetation period of *Aervalanata* lasts until the fall end. Self-seeding occurs frequently.



**Figure 2. Ontogenesis stages of *Aervalanata* (L.) Juss.**

**Cultivation features.** It is established experimentally that *Aervalanata* grows successfully in half-hade and in open sunshine. When the irrigation lacks, the leaf plates reduce in size 2-3 times, plants begin to blossom 10-15 days earlier, and plants reduce 3-4 times versus the plants cultivated with regular irrigation. The abundant self-seeding occurs making the vegetation of seeds occur when immature.

The *Aervalanata* is cultivated from seedling and seeds.

The seedling is cultivated in laboratory at room temperature in early March in wooden boxes. The box bottom is covered with ceramsite or fine gravel (2-4 cm) for draining, and then large-grained sand is strewn. The nutritive soil covers the drain of

the following composition: the leaf humus, the rotten manure, sand (1:1:0.5). The seeds are covered with soil for 1-2 mm. the seedlings are irrigated daily from the watering pot: before budding, the soil is maintained humid. The buds appear on the day 6-10 after seeding. The irrigation is reduced and during 10-15 days the irrigation is done twice a week. If the plant is watered often, the soil algae appear and the buds die out.

The seedlings are planted directly into the well heated soil in late April or early May protected from cold wind, better in the morning in cloudy weather. Irrigation in first days is done every day.

The *Aervalanata* seedlings are planted into open soil in early April in the amount 0.5 kg/hectare. The seeds are buried into soil 1-2 mm deep. The buds appear at the soil temperature 18-20°C in fumed surface layer during 5-6 days (the late April – early May).

The medicinal herb *Aervalanata* is the surface portion, which is cut at the blossoming phase and early fruit-bearing phase (September-October). The herb is cut into pieces up to 20 cm long, dry at the temperature 40-50°C or in the air well ventilated. The tentative calculation shows that the *Aervalanata* produces 118.4 grams per square meter, or recalculated per hectare 16,500 seeds per 1.5-2 kg.

Thus, the *Aerva lanata* finishes its life cycle with fruit bearing in Southern Kazakhstan; it is a reliable indicator of adaptation to new conditions. The plant passes full ontogenesis, which is accelerated resulting in early ageing (the plant is biannual at the motherland and annual in the new conditions). The *Aervalanata* yields abundant self-seeding proving high plasticity and successful adaptation of its introduction.

Taking into account the pharmaceutical properties and valuable qualities, the *Aervalanata* can be recommended for vast cultivation in the foothills of southern Kazakhstan.

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