

# MORPHOGENESIS OF SOME SPECIES EFEMERS OF CENTRAL ASIA

Tursinbaeva Gulbakhor Sultanovna

Pedagogical State University name Nizami, Uzbekistan, Tashkent

**Corresponding author:** Tursinbaeva Gulbakhor Sultanovna

**ABSTRACT:** Morphogenesis of 10 species of ephemerals from 4 families (*Asteraceae*, *Brassicaceae*, *Fabaceae*, *Chenopodiaceae*) in the natural habitats of the Kyzylkum desert and in sowing in Tashkent in the experimental plot was studied. The features of morphogenesis are revealed: prolonged preservation of cotyledons, predominance of rosette form of growth in the juvenile stage, heterophyllia, reduction of vegetative mass under stress conditions, morphological lability.

**Keywords:** ephemera, ontogeny, morphogenesis, lability, Kyzylkum.

## INTRODUCTION

Ephemerals attract attention as a kind of ecological type of plants. Some authors (Keller, 1934, Radkevich, 1934, Nechaev, Vasilevskaya, 1945) refer them to the ecological group of mesophytes, others (Stoker, 1928; Poplavskaya, 1949) - to xerophytes. The instability of the rhythm of development suggests that the ephemera is not quite stable, a young ecological group, possibly with a different genesis (Pyataeva, Granitov, 1962; Popov, 1983). STUDY ephemeral deserts Central Asia absolutely insufficient, biology, ecology; phytocenology ephemerals partially studied L.E. Markov (1966), V.A. Burygin, L.E. Markov (1970, 1971) and other researchers. Some information on the morphogenesis of the ephemerals of the family *Asteraceae* is given by G.F. Begbaeva (2002 a, b). Data on the form of growth, models of branching of desert ephemerals are absent.

## MATERIALS AND METHODS

Morphogenesis of 10 species of ephemerals from 4 families was studied in the Kyzylkum conditions and in sowing on an experimental site in the city of Tashkent. The description was carried out on 10 plants of each species according to the 9 indicators shown in the table, the range of variation of the signs (min-max) is shown. Models of growth and branching are described and sketched in the generative period ( $g_2$ ,  $g_3$ ), under natural growth conditions. Descriptions are made by the method of L.A. Zhukova (1988).

## RESULTS AND DISCUSSION

Family *Asteraceae* Dumort. *Amberboa turanica* Iljin. When sown in late December, shoots appear in late January. The duration of germination 36-40 days. Two light green fleshy cotyledons 0,5 cm long, 0,2 cm wide. Hypocotyl length of 1,0-1,2 cm, diameter 0,1 cm, 1.5-2,0 cm root lengths. Cotyledons were preserved until flowering, reaching 0,8-1,2 cm in length, 0,4 cm in width. By the middle of March, four opposite long elongated leaves appeared. Subsequent leaves alternate with serrated edges. The form of growth in the juvenile stage of rosette (5-7 leaves). The plant is heterophilic: the lower leaves are long (4 cm), wide (2 cm), with weakly marked teeth along the edges. Subsequent rosette leaves and large (length 3,5 cm, shir.2sm) long petioles (1,2 cm) and dissected at the bottom (Fig. 1 a). Stem leaves up to 2 cm long, narrow (0.7 cm), more dissected, with serrated edges. In the presence of 4-5 leaves, the shoot length is 0.3-0.4 cm. The first two internodes are short. Escape first order closed, shortened to 1 cm length. The flowering phase begins in mid-April. In the axils of the first opposite leaves develop shortened generative shoots. On shoots of the second order, two opposite sheets are also formed, in the sinus of one of which

a third-order shoot is formed. By the escape of the third order, the next leaves develop, in the sinuses of which fourth-order closed shoots are formed (Table.).

*Epilasia hemilasia* (Bunge) Grossh. When sown in late December shoots appeared in the third week of January. The duration of the germination period is 25-30 days. Cotyledons long, woolly, 1 cm long, 0,1 cm wide, hypocotyl – 6-9 mm, root 1,5-2 cm long. Cotyledons persist until the middle of March, reaching a length of 5-6 cm at a width of 0,1 cm. In early February, the first elongated linear valuate leaf appears. Leaves alternate: in the upper part of the shoot are opposite, in the lower part - with an enlarged vagina. The form of growth in the juvenile stage of rosette. The flowering phase begins in mid-April. Escape the first order closed, 5 cm in length. The first 4-5 internodes are truncated. In the axils of the first and fourth leaves, shoots of II order develop. On the 5 th leaf node location the next. Shoots of II order exceed in height shoots I of order (Table, Fig. 2).

*Garhadiolus papposus* Boiss. & Buhse. When sown in late December shoots appeared in the second half of February. Period duration germination 50-55 days. Two plate-shaped cotyledons of green color, 0,4 cm long, 0,1-0,2 cm wide. In the first decade of March, the first pair of ovoid, entire leaves is developed. By the end of March, a second pair of jagged edges appears. Form growth of juvenile rosette stage (5-6 leaves). For this species is characterized by heterophyllia. Rosette leaves 3,5-6 cm long, 1-2 cm wide, lyrate, wide, unequal.

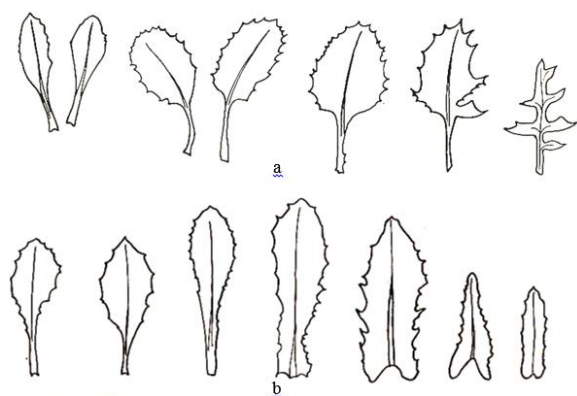


Figure 1. Changing the shape of rosette leaves to apical:  
a – *Amberboa turanica*; b – *Heteracia szovitsii*.

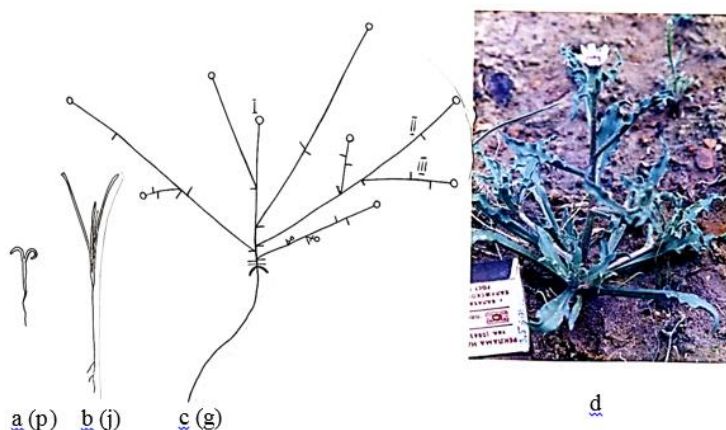


Figure 2. Morphogenesis *Epilasia hemilasia*:  
a - sprout, b - juvenile stage,  
c - branching model in the generative period (I-III branching order),  
d - appearance of plants.

Medium cauline leaves 3-3,5 cm long, 0,3-0,8 cm in width, more pointed, elongate, podiform, with small denticles along the edges, trichomes on the top of the leaf. Upper cauline leaves are smaller with less pronounced denticles along the edges. By mid-April buds appear, the flowering phase begins. Escape of the first order is closed, shortened (0,5 cm in length). In the sinuses of the first opposite leaves, shoots of II order are laid, they are also closed, false-dichotomous branching. In the axils of leaves, shoots of III order are formed: one is shortened, the other is longer. In the sinuses of the upper leaves shoots of IV order are formed.

*Heteracia szovitsii* Fisch. & C.A. Mey. When sown in late December shoots appeared at the end of January. The duration of the sprouting period is 36-40 days. Cotyledons are lamellar oval with a pointed apex, 0,4 cm long, 0,1-0,2 cm wide, retained until the second half of March, reaching 0,9 cm in length, 0,2 cm in width. In early February, the first sheet appeared. The juvenile stage is characterized by: rosette form of growth, delayed growth of interstitial shoots of the first order, rapid planting of leaves. In the process of ontogeny morphological heterophyllia is observed (Fig. B). The leaves are oblong-spatulate, opposite, internodes shortened. The flowering phase begins in mid-April. The main escape (I order) shortened. The point of growth dies and the habit forms shoots of II order.

Family *Brassicaceae* Burnett. *Hymenolobus procumbens* Nutt. The sprouts are very small. Cotyledons 1 mm long, 0,4 mm wide, narrowly lanceolate, sedentate, in a transverse section of a semi-round shape. Hypocotyl and root 12 mm long. When the first leaves appear, the length of the hypocotyl is 8 mm, the root - 7-13 mm. In the upper third of the root, lateral roots are formed. In the generative period, the plant is low, up to 15 cm high, undescended. Escape I of the order straight, often from the base of the branchy. The growth varies from monopodial to hemisymphodial, branching is basitonic, often with hypo-uruperation of lateral shoots to second order. Shoot I order

9-11sm length. The shoots are placed in order II 2-3 leaf axil. All shoots are generative, weakly-leafy, ending with an inflorescence - a brush. Generative organs are formed by 1/3 or along the entire length of the shoot. The number of metamer from 3 to 6, their length is 5-35 mm. Shoots II of order weakly-leafy with integral leaves.

*Isatis minima* Bunge. Seedlings have 2 lamellar, entire-glabrous bare on a short stalk of cotyledon 5 mm in length, 2 mm in width. The shape and size of the leaves vary (heterophylly): lower leaves - oblong-spatulate, stemmed with a blunt tip, entire, naked toothed, 2,0-2,5 cm in length, 0,4-1,0 cm width. Stem leaves middle tiers alternate, sessile, oblong with serrated edges and a pointed tip, 1,5-6,0 cm long, 0,7-2,0 cm wide, rarely omitted 1-3 cell hairs. Upper leaves are grave, lyrate with heart-shaped base, bluntly jagged, 3,0-4,5 cm long, 0,7-1,0 cm wide (Fig. 1 b). The height of the shoot is about 12 to 55 cm. Stem straight, branched to II of order. Shoots long-metameric closed.

Family *Chenopodiaceae* Vent. *Londesia eriantha* Kar. & Kir. Shoots appear in mid-March. Cotyledons are small, oval and pubescent. The form of growth in the juvenile stage of rosette. Leaves in base lanceolate, 1,5-2 cm long, on shoot I of order wider (up to 5 mm) and less pubescent. The leaves of the lateral shoots are already (3 mm in width) and are densely pubescent. The first 2 sheets are opposite, the next. In mid-April, the height of the shoot is about 10-15 cm, II - 5-8 (10) cm. The escape of the order consists of 20-30 metamers. The first two shoots are opposite, the rest are regular, but with alternating short and long internodes. Stems are densely pubescent. Leaves lanceolate 1,0-1,6 cm long, 0,5 wide, densely pubescent with simple hairs on a 2-cell stem with thorns.

Family *Fabaceae* Lindl. *Astragalus campylotrichus* Bunge. Cotyledon sprouting bean-shaped, 4 mm long, 1,5-2 mm wide, smooth. The first leaves are triple, with a pointed apex, on both sides are covered with simple hairs. The leaf of an adult plant is odd-pinnate, with 9-13 leaves, rather densely pubescent with simple hairs. The stem is single, erect, 5-6 cm high. The form of growth in the juvenile stage - poluzetochneya. The leaves are longer than the shoot. The lower 3-4 leaves are shorter than the following. The number of metamers for the shoot is small: 3 internodes 10-20 mm long. Branching up to the second order. Starting from 2-3 knots, specialized generative neolithic shoots develop. Blossoms in April-May. Fruiting in July.

*Astragalus ammophilus* Kar. & Kir. Cotyledon sprouting bean-shaped, smooth, 4 mm long, 1,5-2 mm wide. The first leaves are pinnate, composed of 5 leaflets, with a notch on the apex, with simple hairs on both sides. The leaf of an adult plant consists of 9-13 leaflets, pubescent on both sides. Stem shortened, 5 mm high. The form of growth in the juvenile stage is rosette. Leaves are regular. In the axils of the first leaves, shoots II of the order of 1.4 to 4.7 cm long develop with two interstices: lower - elongated (1.7-3.5 cm), upper - shortened (0.7-1.0 cm). On the shoots of the second order, two sheets are developed, consisting of 7-9 leaflets. In their sinuses, generative neolithic shoots are formed, 0.3-0.8 cm long. Branching is basitonic.

*Onobrychis tavernierifolia* Stocks ex Boiss. A low almost unstable, pubescent plant. Form growth of juvenile rosette stage. Cotyledons stored long period to generative, bean-shaped and large, 6-8 mm long, 3-4 mm wide, pubescent simple hairs. The first leaves are rosette, long-petioled. Petioles 7-15 mm long, pubescent, at the base there are glabrous stipules of horn-shaped form. Leaves either with one apex, or with 3 leaves. The apical leaves large, 10-20 mm long, 10-22 mm wide, rounded and obovate. Leaves pubescent on both sides pressed with simple hairs. Generative shoots neolistvennye, 5-10 cm long.

Morphogenesis and ontogeny of ephemerals significantly differ from representatives of other biomorphs, even such as long-vegetating annuals. Many ephemerals germinate at low temperatures. During sowing in late December sprouts appeared at the end of January and February, the period from germination was 25-50 days. When germination cotyledons are very small, but they persist for a long time, sometimes before flowering (III-IV month) and 2-3 times increase in size. The juvenile stage in most species is rosette or semi-rosette (*Astragalus campylotrichus*). Immaturity stage is not expressed. A short leaf plastochron, morphological heterophylly is characteristic of ephemerals. The ability of plants to adaptively change the duration of the growth process, while maintaining fertility, Zavadsky K.M., Kolchinsky E.M. (1977) is called the accommodation of growth. Escape I order may remain short, partially die or dominate over the side. Flowering generally occurs in April.

Table 1. Morphological indicators ephemeral

№	Тип нарастания	Species	Escape I order			Escape II order					Type of branching
			Length, cm min-max	Number of meta-mers min-max	Length of inter-nodes, cm min-max	Branch node	Length, cm min-max	Number of meta-mers min-max	Length of inter-nodes, cm	Branching order	
I	Моноподильный, апикальный	<i>Isatis minima</i> Bunge	12-55	10-14	3	5	1-3	1-4	3	2	acrotonic
II	Моноподильный, латерально-апикальный	<i>Londesia eriantha</i> Fish. et Mey.	10-15	20-30	2	1-5	5-8 (10)	10-20	0,5-1	2-3	basiton
III	Гемисимподильный	<i>Amberboa turanica</i> Iljin	15-20	5-10	7	1	10-15	5-10	5-7	5	basiton
		<i>Epilasia hemilasia</i> (Bunge) Clarke	5-20	8-10	4	5	2-10	3-5	5	3	basiton
IV	Симподильный, латеральный	<i>Onobrychis tavernierifolia</i> Stocks ex Boiss	2	3-5	0,5-1	1	5-10	3-4	1-3	3	basiton
V	Ложнодихотомический	<i>Heteracia szovitsii</i> Fish. et Mey.	1	1-3	0,5	1-2	10-15	2-3	5-10	4-5	basiton
		<i>Garhadiolus papposus</i> Boiss. et Bunge.	1	3	0,2-0,3	1	1-15	1-3	1-1,5	3-4	basiton

### CONCLUSION

Thus, cotyledons play a large role in the life of the sprout and persist in some species before flowering. Under adverse conditions (dry spring), plants form only 1 leaf and fruit, or cotyledons and fetus. The specificity of such morphogenesis can be attributed to the generative direction of development, in which stress conditions reduce to a minimum the vegetative sphere while maintaining, at least in a minimal volume, generative. This direction of development is opposite to the vegetative, observed in plants of the tree and semi-wood biomorph section (Butnik, Nigmanova, 2010), in which stress conditions cause a reduction or complete elimination of the generative sphere, with minimal vegetative retention. Increased plasticity of ephemerals, according to II. Schmalhausen (1968) - the potential for evolution. L.N. Dorokhina (1998) considers ephemera as a single synfloriscence, including the main axis (inflorescence) and lateral branches (parakladii).

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