

# On some biomorphological peculiarities of seedlings of *Vavilovia formosa* (Stev.) Fed. (Fabaceae)

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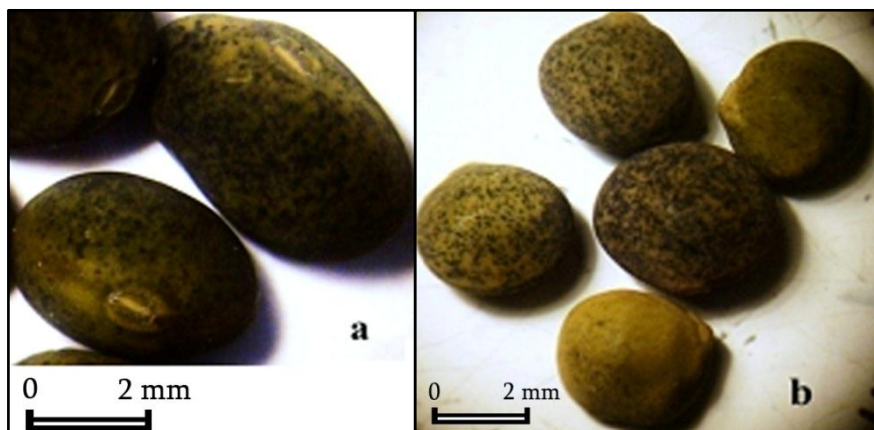
**Abstract:** Wild perennial pea, *Vavilovia formosa* is a rare representative of the alpine flora, and its growing in *ex situ* conditions is very complicated. The assumption that the border between cataphylls and true leaves of perennial Fabaceae coincides with the border between wintering and annual plant parts is confirmed by observations on *V. formosa* samples grown from seeds in laboratory conditions and in natural habitats.

**Key words:** biomorphology, *ex situ* conservation, ontogeny, *Vavilovia formosa*

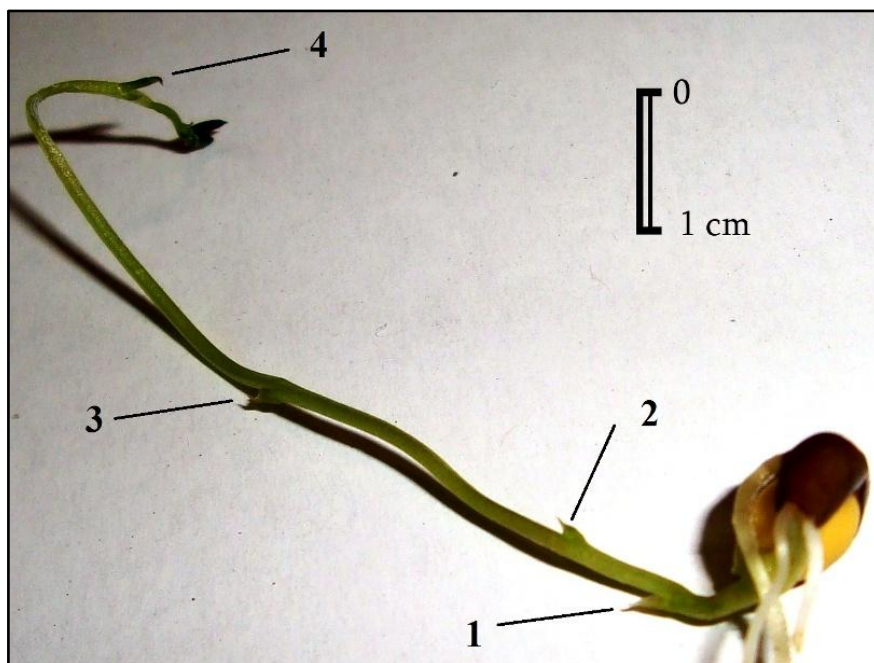
Wild perennial pea, *Vavilovia formosa* (Stev.) Fed., is a rare representative of the alpine upper-mountain flora with distribution confined to small areas of moving detritus and screes. That is why its growing in *ex situ* conditions is very complicated. Moderate air temperature, even lower ground temperature, continuous hydration (from melting glaciers), together with sufficient aeration of the substrate, dryness of the upper layers of the scree and a low concentration of mineral salts in the soil with pH 6.5-7.0 are important for the successful growing of this plant (1, 2). Nevertheless, attempts to grow and study *V. formosa* in other conditions continue.

The aim of this work was to study the early stages of *V. formosa* ontogeny on samples grown from seeds in laboratory conditions. The seedling morphology was also studied in natural habitats (Geghama ridge, Mt. Sevsar, 2014). Seeds were collected in the territory of Armenia from two populations: from the slopes of Geghama ridge (Mt. Sevsar, 3200-3300 m asl., 2002) and Syunik ridge (Mt. Ukhtasar, 3300-3350 m asl., 2012).

The *V. formosa* seeds from the slopes of Mt. Sevsar (Fig. 1a) are mostly elongated or roundish-oval, flattened (5.0 mm × 4.8 mm × 2.8 mm - 3 mm × 2.4 mm - 2.5 mm), while the seeds from the vicinity of Mt. Ukhtasar (Fig. 1b) are almost spherical, less flattened (3.8 mm × 3.7 mm - 3.8 mm × 2.8 mm - 2.9 mm).



**Figure 1.** *Vavilovia* seeds from two Armenian populations: Geghama ridge, Mt. Sevsar (a), and Syunik ridge, Mt. Ukhtasar (b)



**Figure 2.** A twelve-day old seedling of *V. formosa* with basal scale leaves (1-4)

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Seed surface is smooth, the color is dark olive with black dots or spots. Immature seeds are bright brown. Seed hilum is broadly-ovate (0.7 mm - 0.8 mm × 0.5 mm) with thin white coating and a white line on the border of the cotyledons. Chalaza trail is dark brown or black, inconspicuous.

Seeds were germinated in laboratory conditions in Petri dishes on humid filter paper. After 5 days, the swollen seeds were scarified, necessary for their germination 10-12 days after sowing. The seedlings were transplanted into small containers with soil and gravel, with holes on the bottom and on the entire surface to ensure proper aeration of the root system. They were watered sparingly, mainly from the pallet.

The root system of *V. formosa* seedlings usually has a taproot and numerous lateral roots. However, in the early stages of germination, in some seedlings, the taproot ceases to grow and whitish adventitious roots form near the cotyledonary node (Fig. 2). In other plants, reducing the taproot and lateral root formation to the fourth order was observed (Fig. 3). The seedling hypocotyl had a length of 6 (7) mm, epicotyl 4 (5) mm, 2nd internode length 4 (6) mm, 3rd 17 mm and 4th 20 (23) mm.

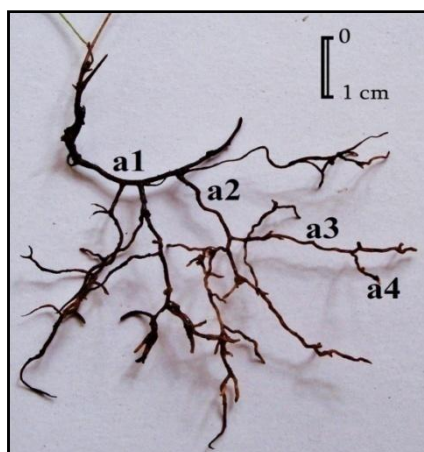
Four cataphylls (scaly leaves) are observed at the base of the seedling (Fig. 2). The first cataphyll is on the outer side of the epicotyls bend, 1.8 mm - 1.9 mm × 1.0 (1.2) mm, acutely lanceolate, entire, with a prominent main vein, with membranous edges narrowly at the base and widely at the top. The next two cataphylls are alternate, tridentate, with acutely lanceolate middle tooth, 1.9 mm × 1.8 mm (the second), 1.8 mm × 1.2 mm (the third). The fourth cataphyll is greenish, 3.0 mm × 1.0 (0.9) mm, lateral teeth are 0.8 mm. It should be mentioned that earlier three cataphylls were reported for the *Vavilovia* seedling (4). Leaflets of first true leaves are obovate, about 5 mm × 4 mm, sparsely pubescent with white, soft trichomes from abaxial side and by edges and almost glabrous from adaxial side. Stem and leaf petioles are covered with sparse, minute (0.03 mm - 0.05 mm), narrowly clavate, reddish glandular hairs.

Seed germination of *V. formosa* is hypogeal. Naturally epicotyl, three next internodes and 3(4) cataphylls remain under moving scree layer. They lack chlorophyll (Fig. 4), unlike seedlings obtained in laboratory conditions (Fig. 2, 5a). In all cataphyll axils, buds are formed, from which in laboratory conditions the shoots of the following orders are developed (Fig. 5A and 5B).

The assumption that the border between cataphylls and true leaves of perennial Fabaeae coincides with the border between wintering and annual plant parts (3), is confirmed by observations on *V. formosa*. In autumn in natural habitats, under a layer of scree, wintering hypogeal shoots of renewal develop from the buds in axils of cataphylls (Fig. 5C). Annual aerial part of the plant during the first year of development represents unbranched orthotropic shoot up to 5-6 cm in height. By the end of the growing season, up to 10-13 leaves with elongated internodes are formed on a plant in the laboratory, the same number of leaves and short internodes are observed under natural conditions.

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**Figure 3. Root system of *V. formosa* in the first year of development under laboratory conditions: reduced main taproot (a1) and lateral roots (a2, a3 and a4)**

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**Figure 4. A *V. formosa* plant in the first year of development on the moving scree slope of Mt. Sevsar, at the beginning of September**



**Figure 5. The *V. formosa* development features in 18 (A) and 33 days (B) after germinating in laboratory conditions and the basal part of the *V. formosa* plant in the first year of development in natural conditions at the beginning of September (C): seed (a) and hypogeal shoots of renewal (b)**