



Original Contribution

***CHENOPODIUM BONUS-HENRICUS* L. (PERENNIAL GOOSEFOOT)
IN BULGARIA: II. MORPHOLOGY, CHOROLOGY AND ECOLOGY**

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ABSTRACT

A detailed morphological characteristic of *Chenopodium bonus-henricus* has been made on the basis of data from 10 of its populations. Ecological requirements, peculiarities of reproduction and development and the distribution of the species within Bulgarian flora have been outlined. The morphological analysis constitutes 24 quantitative characters and 11 qualitative ones. The variation statistical and the scanning electron microscope methods have been used. The data are a supplement to the ones given about the species in Flora of the People's republic of Bulgaria and they can be used both for its correct identification and for getting familiar with its characteristics.

Key words: *Chenopodium*, morphology, chorology, ecology

INTRODUCTION

Chenopodium bonus-henricus L. is among the common plants on mountainous pasture grounds in the country. Its medicinal properties and nutritional qualities have been known to people since ancient times. Currently it is among the species included in the Medicinal Plants Act (1) and is considered to be a good food plant (2). Its medicinal properties are due to the high content of three-terpene saponins in the roots (3). Ground roots have diuretic, laxative, enhancing secretory and expectorating effect (4), and an extract from these is used as emulgator in the food industry with the trade name "perennial goosefoot extract". Its leaves contain saponines, fats, starch, vitamin C, phenolcarbonic acids and flavonids and are used like the spinach for cooking various dishes (5). In the 1960^s attempts were made for its cultivation (6). However the species didn't manage to find place among the agricultural crops traditionally cultivated in the country and its natural habitats continue to be exploited.

The objective of this study is to establish the morphological characteristics, distribution and

ecological preferences of the species in the Bulgarian flora. It is a continuation of a study about its population variability (7).

MATERIAL AND METHODS

The morphological characteristics have been made based on data for 10 populations of the species from 6 floristic regions. A total of 30 plants have been collected from each population and 24 quantitative characters of these have been measured. A total of 11 qualitative traits have also been recorded: 1. Shape of stem; 2. Colour of stem; 3. Shape of lamina; 4. Colour of leaf lamina; 5. Type of inflorescence; 6. Colour of perianth; 7. Degree of perianth connation; 8. Presence of keel on petals; 9. Colour of seed; 10. Colour of pericarp; 11. Indumentum.

For a more detailed study of the morphology of generative organs, the Scanning Electron Microscope method has been used. The electron microscope tests have been conducted at the laboratory for X-ray analysis of the Faculty of Chemistry at Sofia University.

The chorology of the species has been established based on available herbarium samples in the three scientific herbaria (SOM, SO, SOA); according to literary data and as a result of personal collections. The chorological

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data have been mapped out according to the UTM-grid system adopted in the country (8).

RESULTS AND DISCUSSION

Morphological characteristics

A perennial herbaceous plant with a fleshy, multi-head root mostly branched in 3-5 parts, reaching length of over 40 cm after the second year and weight up to 620 g. Its above-ground parts are farinose of vesicular hairs. Stems (20)42.83-66.72(97) cm high, erect, multi-ridged, yellowish-green or green-reddish.

Leaves with triangular to rhombic laminas with spear-, arrow- or wedge-shaped base and pointed apex (**Fig. 1**). Basal and middle leaves (4.5)7.08-8.81(15) cm long and (4)6.07-8.73(12.5) cm wide [length/width ratio 1.04-1.3(1.5)], petioles up to 15 cm (**Fig. 1, 1-5**). Upper leaves (1.5)1.87-4.85(5.3) cm long, (1.2)1.26-2.32(3.3) cm wide [length/width ratio 1.2-2.05(2.3)], sessile or with up to 1.5 cm long petioles (**Fig. 1, 6-7**).

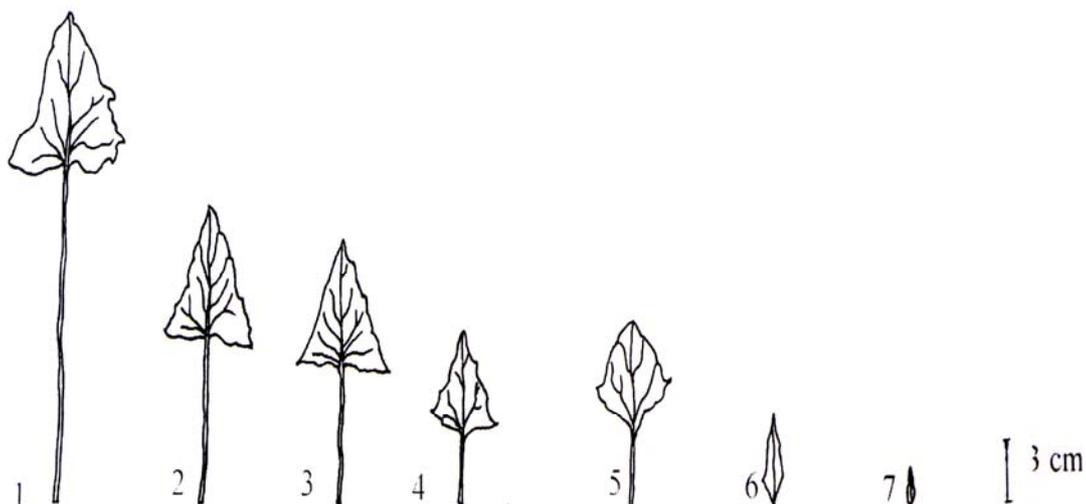


Fig. 1. *Chenopodium bonus-henricus*, variation of shape of basal (1-2), middle (3-5) and upper (6-7) leaves.

Flowers bisexual or female (1.1)1.14-1.43(1.5) mm in diameter, sessile or with up to 0.5 mm long petioles, forming narrow panicle-like inflorescences. Bisexual flowers usually found in the apical inflorescences and females are more often in the lateral ones. The perianth is green to yellowish, preserved on the fruit. Tepals 5 or 4, with approximately equal length (1.25)1.3-1.44(1.5) mm and width (0.4)0.51-0.61(0.7) mm, whole-ended, pointed, wrinkled, not keeled, connate 1/4 to 1/3 of their length (**Plate I, Fig. 1-2**). Stamens (0)5(4). Pollen grains are 20.1-24.3 μ m in diameter, spherical with fairly sharp nanospirules (**Plate I, Fig. 3**). Stigmas 2-3. Pericarp with plied structure, strongly folded, adherent to the seed, 8-10 μ m in diameter (**Plate I, Fig. 4**). Seeds horizontal in apical flowers and vertical in lateral ones, 1.2-1.8 mm in diameter, [length/width ratio 1-1.12(1.2)], edge rounded (**Plate I, Fig. 5**). Testa dark brown to black brown, equally

sculptured on both sides of seed in the shape of plaits, irregular dents, more pronounced in the area of the germinal root (**Plate I, Figs 5-6**).

Phenology: Flowering from May to September, fruiting from June to October.

Reproduction. The species reproduces through seeds. Despite of the plentiful fruit bearing (the total number of seeds from one plant reaches up to 900 pcs.), in all studied populations delay of the self-renewal process has been observed. Seeds are with high germination rate (75-91%) and with sufficient moisture germination occurs for a period of 48 to 72 hours, but after germination young plants develop rather slowly and they are not competitive to the other species in the population. For their successful development moderate moisture and sufficient supply of nitrogen in the soil are needed. The lack of one of these components is detrimental to them.

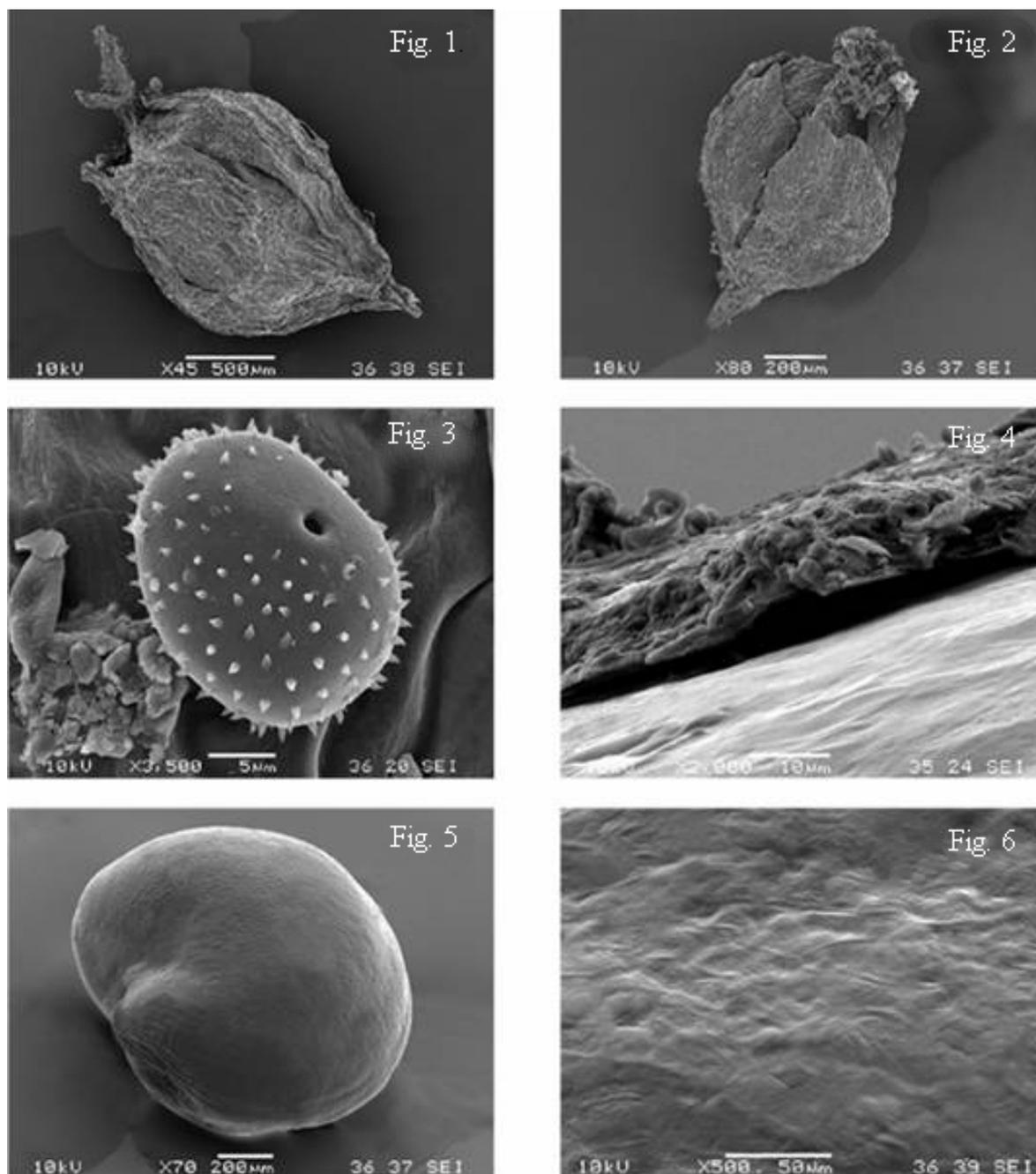


Plate I. Scanning electron micrographs of *C. bonus-henricus*: 1-2 – flowers, 3 – pollen grain, 4 – pericarp, 5 – seed, 6 – seed surface.

Chorology and ecology. *C. bonus-henricus* is spread in South-west Asia, North America and Europe, in the northernmost parts it is more limited in distribution and in the southern and south-eastern parts, as well as on the entire Balkan peninsula, it grows in mountainous regions only (9; 10; 11; 12). In our country it is spread in the mountainous regions all over the country (Fig. 2).

It is a dominating or asectation species in ruderal or anthropophyte communities dominated by

Rumex alpinus L. The most common accompanying species in the communities are *Urtica dioica* L., *Taraxacum officinale* L., *Verbascum longifolium* Ten., *Lepidium ruderae* L., *Polygonum aviculare* L., etc. Its usual habitats are mountainous pasture grounds and summer sheep pens or it grows near barns and abandoned agricultural buildings at an altitude above 800 m. It prefers moderately moist soil well supplied with nitrogen. A limiting factor for its distribution is the altitude.

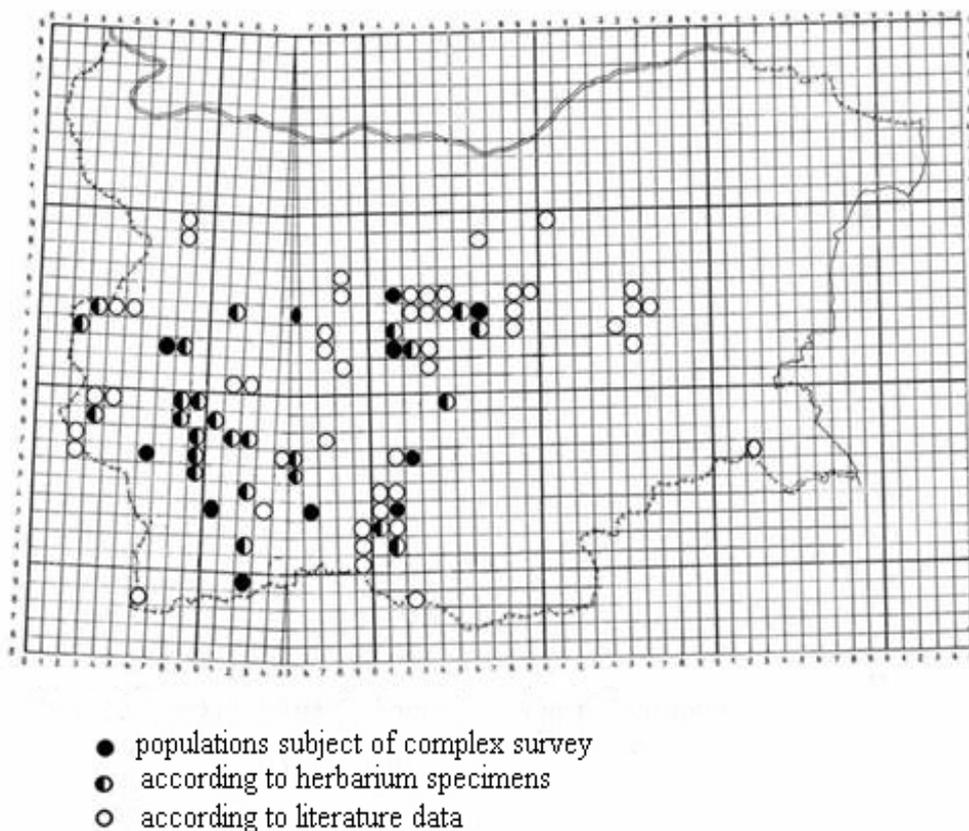


Fig. 2. Distribution of *C. bonus-henricus* L. in Bulgaria.

CONCLUSION

The detailed morphological characteristics of *Chenopodium bonus-henricus* and the data about the distribution, ecological requirements and peculiarities in reproduction and development comprise a supplement to ones specified in Flora of the People's Republic of Bulgaria (9). They can be used both for the correct identification of the species and for acquainting oneself with its characteristics.

Perennial Goosefoot is a ruderal plant and that implies its wide distribution. The adherence of the species to higher altitude and nitrophillic soils actually reduces its area. Having in mind on one hand, the fact that the crisis in animal husbandry decreases the number of animal stock on mountainous pasture grounds and its typical habitats – pastures and summer sheep pens – gradually disappear, and on the other hand, that mainly the roots are collected and therefore irreversible destruction of the whole plant takes place, it is probably again time we attempted its introduction as a crop.

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