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Aliens in the Bulgarian flora

B. A. KUZMANOV & S. I. KOŽUHAROV

The influence of man on the Bulgarian flora dates from ancient times and an analysis of the aliens in the country meets serious difficulties. One of the reasons of most importance is the fact that the Balkan peninsula has for long been a crossroads and its variety of climate permits the growth of many elements from different floristic series.

We shall try to characterise the different groups of aliens in the Bulgarian flora, with special reference to some typical examples. On a broad basis, the role of man in the changes of Bulgarian flora has been discussed by STEFANOV & KITANOV (1962) and data are also provided by KOLEV (1966), KOŽUHAROV & KUZMANOV (1967) and GANČEV & PROKOPIEV (1959).

The first group, the archaeosynanthropic plants (in the sense of HYLANDER 1960) is the largest and consists of annuals, biennials and perennials connected with cultivated plants of more or less disturbed areas. The oldest entered the country following the first cultivated plants such as *Triticum monococcum*, *T. dicoccum* and *T. aegilopoides* (the latter still growing on the borders of the fields). Their seeds have been found in tombs dating from 3000-2600 B.C., and with them are species of *Polygonum* and *Melampyrum*, as well as *Vicia ervilia*, *Lens culinaris*, *Galium aparine*, *Linum angustifolium* (ARNAUDOV & VASILEVA 1948). The species *Urtica urens*, *Stellaria media*, *Caucalis daucoides*, *Lithospermum arvense*, *Lamium amplexicaule*, *Berberis vulgaris* and *Prunus spinosa* are referred to the same period (STEFANOV & KITANOV 1962). The later development of the alien component of the flora is connected with the decrease of the oak-zone of the Balkans on the one hand and the increase of agricultural activity on the other in the time of Thracian culture. To this later period (2500-2000 B.C.) *Hordeum hexastichum*, *Pisum* spp., *Lithospermum arvense*, *Echium vulgare*, *Bromus arvensis* and *Juglans regia* are referred (ARNAUDOV 1939).

The bronze age is supposed to contribute many new plants, some of which were food plants such as *Ficus carica*, *Vitis silvestris*, *Pyrus communis*, *Sorbus domestica*, *Cydonia oblonga*, *Allium cepa*, *A. sativum*, *Prunus avium*, *Amygdalus communis*, *Punica granatum* as well as *Hordeum vulgare*, *Trigonella foenum-graecum*, *Lathyrus cicera*, *Medicago lupulina*. All these plants have played an important role in the Thracian lands (STEFANOV & KITANOV 1962; ARNAUDOV & PETROVA 1955) and have

been followed in all probability by some of the most common archaeosynanthropic weeds, such as *Avena fatua*, *Agropyron repens*, *Lolium temulentum*, *Vaccaria pyramidata*, *Spergula arvensis*, *Ranunculus arvensis*, *Papaver rhoeas*, *Sinapis arvensis*, *Raphanus raphanistrum*, *Capsella bursa-pastoris*, *Conium maculatum*, *Anagalis arvensis*, *Convolvulus arvensis*, *Matricaria chamomilla*, *Parietaria officinalis*, *Euphorbia cyparissias*, *Melissa officinalis*, *Rubia tinctorium* as well as by species of *Chenopodium*, *Atriplex* and *Amaranthus*.

Some more recent aliens are supposed to be connected with the Roman invasion in the Balkans (229 A.D.) (STEFANOV & KITANOV 1962). These are *Rumex patientia*, *Prunus armeniaca*, *Atriplex hortensis*, *Brassica rapa* v. *rapifera*, *Vigna sinensis*. For the period close to the Turkish invasion 23 species were counted by STEFANOV & KITANOV (1962) among which *Equisetum arvense*, *Aristolochia clematitis*, *Trigonella coerulea*, *Datura stramonium*, *Erigeron campestris*, *Chelidonium majus*, *Hesperis matronalis*, *Isatis tinctoria*, *Galega officinalis*, *Polygonum fagopyrum* seem to have been widely distributed. In this period the country was still covered by dense forest (ŠIŠMANOV 1891), and the migration of plants was probably not easy.

It seems most likely that the main part of the aliens forming the group of neosynanthropic plants (in the sense of HYLANDER 1960) spread in the central part of the Balkan peninsula in the first part of the 17th century. In this period trade activity and the movement of people and animals increased, and this was accompanied by a great decrease in forest cover. Since that time many species have moved inside the peninsula along the main roads which are still of importance. These run along the valleys of the rivers Struma, Mesta, Marica, Arda, Tundza and the Danube as well as to the main Black Sea ports. Special attention must also be paid to the north-eastern "door" of the country, the Dobrudza, where many species came from. More recently, the importance of the roads crossing the western frontier has obviously increased.

The group of neosynanthropic plants may be subdivided into several groups.

1. Plants introduced by man unintentionally, and established with a more or less wide distribution.

The first record of members of this group in the period 1546-1549 (BELON DU MANS, 1555; bulg. ed. 1953) shows about 60 names of alien species, weeds and ruderals. Some of them were introduced with increasing sheep and cattle rearing and these are *Chenopodium bonus-henricus* (in the alpine area), *Trigonella monspeliaca*, *Melilotus officinalis*, *Draba verna*, *Stellaria media*. Some have been introduced with various seeds of different cultivated plants and among these are *Carthamus lanatus*, *Delphinium consolida*, *Chondrilla juncea*, *Alkanna tinctoria*, *Lepidium sativum*, *Papaver rhoeas*, *Rumex patientia*, *Gladiolus segetum*, *Phalaris canariensis*, *Hibiscus trionum*, *Abutilon theophrasti*, *Malva sylvestris*, *M. neglecta*, *Melilotus officinalis*, *Datura stramonium*, *Xanthium spinosum*, *X. italicum*, species of *Amaranthus*.

This group is still increasing. Thus, the case of *Galinsoga parviflora* is well documented. In 1943 STOJANOV (1947) found it for the first time in Bulgaria in a single locality (Sofia) on arable land. It has spread in the last 20 years as a weed in many other localities in various parts of Central and Western Bulgaria (KOLEV 1966).

The other species, *G. quadriradiata*, first found in 1953 (KOLEV 1953) is still restricted to the Sofia region (KOLEV 1966).

One cannot say when *Erigeron canadensis* penetrated into the flora of Bulgaria, as JOVET (1963) has done for France, but today it is widespread in the whole country in disturbed habitats.

Ailanthus glandulosa, introduced in the 19th century (STEFANOV & KITANOV 1962), is now naturalized and reproduces freely in some parts.

2. *Established plants introduced intentionally by man in several or single localities but which persist and propagate freely for a long time without the influence of man.*

In this group we can include all the plants introduced into the country during the 15th, 16th and 17th centuries according to the new tendencies mentioned earlier. Some of them are still largely cultivated. To this period we can refer, following STEFANOV & KITANOV (1962), *Morus alba*, *Nigella sativa*, *Papaver somniferum*, *Cicer arietinum*, *Pimpinella anisum*, *Apium graveolens*, *Rosa damascena*, *Peganum harmala*, *Ziziphus vulgaris*, *Setaria italica*, *Mentha piperita*, *Lycium barbarum*; and to the period of the 18th and 19th centuries *Borago officinalis*, *Pastinaca sativa* and *Cucurbita pepo*. We shall now deal with some of these species which are of special interest.

Castanea sativa (native in S.W. Bulgaria) is cultivated in several localities but has not escaped. It forms a small forest in W. Stara Planina mountain near Berkovica. This has been treated by some authors as a preglacial relict (STOJANOV 1950a), but recently it has been proved to be planted by man some 200 years ago (STEFANOV 1958; STEFANOV & KITANOV 1962).

Juglans regia is found nowadays in many localities mixed with *Carpinus orientalis* forming small woods, and in some places the species propagates quite freely.

Ricinus communis is cultivated and in several localities it has escaped. The same is true of *Euphorbia marginata* which is widely cultivated. *Amaranthus paniculatus* has escaped as a casual in the Struma valley (KOVAČEV 1966); *Chenopodium ambrosioides*, probably cultivated in the past (MARKOVA 1966), has been found as a casual near Varna. *Polygonum orientale* is cultivated and escaped in many places. *Bilderdykia aubertii* is often cultivated as a decorative plant but has escaped and is established in several disturbed areas propagating freely (JORDANOV 1966: 250, 260). *Phytolacca americana* has escaped and is established in various parts of the country (GEORGIEV 1966), and *Portulaca oleracea* is often found as an escape near villages and towns.

Rheum raponticum is one of the most representative cases. Most authors (STOJANOV & STEFANOV 1924; TURRILL 1929; LOZINA-LOZINSKAJA 1936; STOJANOV 1938; STEFANOV & KITANOV 1962; WEBB 1964; VĂLEV 1966) treat the species as a Bulgarian endemic, restricted to several localities in Rila mountain (LOZINA-LOZINSKAJA 1936;

Rhodopi by mistake). From the phytogeographical point of view this is a problem, since all other species of the genus grow in temperate and subtropical Asia (AIRY SHAW in WILLIS 1966). On the other hand LINNAEUS (1753) cited a large area for the species ("habitat in Thracia, Scithia", l.c.: 531), which indicates the species has been described from cultivated specimens. RECHINGER (1958) rightly notes: "Ob *R. rhaponticum*, wie mehrfach angenommen wurde, selbst in Rhodope-Gebirge in Bulgarien ursprünglich einheimisch war, ist äusserst zweifelhaft; die Art dürfte dort nur kultiviert und verwildert vorkommen". JORDANOV & KUZMANOV (in JORDANOV 1966: 218) pointed to the fact that this species was found and still is growing in the immediate vicinity of the Rila monastery (a thousand years old), and they think that most probably it was cultivated long ago by the monks in the monastery, whence it has escaped. Otherwise one could hardly explain why it is restricted to such a small area.

Elaeagnus angustifolia is cultivated and established in one locality at the sea shore. *Spartium junceum* is widely cultivated as an ornamental and is established in two localities: at the sea shore and in Southern Pirin mountain (KUZMANOV, unpubl.). *Coriandrum sativum* is found as a weed in two localities in Eastern Rhodopi and W. Bulgaria near Breznik (STOJANOV & STEFANOV 1924, 1948).

Montia sibirica (from N. America) has been found in Rila mountain at an altitude of 1350 m by streams, propagating freely. Evidently it has been cultivated in the garden of the ancient king's cottage at the resort Borovec and escaped (STEFANOV 1951).

Armoracia rusticana, cultivated as a vegetable, has escaped in several localities.

Very interesting is the case of two species of *Opuntia* (JORDANOV 1970: 25-26). In 1938 *Opuntia tortispina* and *O. compressa* were cultivated experimentally in a small rocky island (by the southern sea shore near the river Ropotamo). At the beginning of the war the experiment was abandoned, but the species spread progressively, competing remarkably well with the limited number of native species. After a period of about 30 years, they have succeeded in colonising a large part of the island. The influence of man in the area is relatively weak, so this process has developed in almost natural conditions and is a good example of competition between species of completely different phytogeographical areas. On a more limited scale, this has happened here also with *Aster linosyris*.

Elodea canadensis was introduced into the country at the end of the 19th or the beginning of the 20th century (JORDANOV 1963: 224-227; STEFANOV & KITANOV 1962) for experiments in the University. Now it has escaped and has been found successfully vegetatively in several localities in W. and S. Bulgaria (JORDANOV 1963).

Narcissus pseudonarcissus is cultivated as an ornamental and has recently been found as an escape in S.W. Bulgaria (HINKOVA 1960). *Setaria italica* is cultivated but has also escaped (GEORGIEV 1963).

Acorus calamus has been found as a casual, escaped from cultivation in the past and reproducing vegetatively near Sofia and Kazanlăk (KUZMANOV 1964).

Another illustrative case is *Platanus orientalis*. The species is native in S.W. Bulgaria and E. Rhodopi mountains. It has been cultivated from ancient times and in one place in C. Rhodopi near Bačkovo (distr. Plovdiv) it propagates freely along the river Čaja, forming a natural-looking forest (BROWICZ 1964).

3. Casual plants introduced unintentionally by man and restricted to a few localities.

Urtica pilulifera was found in one locality in the Struma valley (KOŽUHAROV & KUZMANOV 1962). *Euphorbia maculata* was recently recorded from several localities in W. Bulgaria (KUZMANOV 1961; KOŽUHAROV & KUZMANOV 1962).

Different species of *Amaranthus* are also representative of this group: *A. lividus*, *A. deflexus* (found first in S. Bulgaria, but later in different parts of the country: KOVAČEV 1966). *A. spinosus* was recently found in the Struma valley (KITANOV 1950); it was first found for the Balkan Peninsula in N. Greece by STOJANOV & STEFANOV (STOJANOV & JORDANOV 1938).

Chenopodium multifidum from S. America has been recently found in several localities (MARKOVA 1966).

Oxalis stricta from N. America was reported as a naturalised weed from Sofia (STOJANOV & STEFANOV 1948). *Zygophyllum fabago* is established in two localities in N.E. Bulgaria (STOJANOV, KITANOV & VELČEV 1953). *Lepidium sativum* is found as a naturalised weed in potato fields in W. Rhodopi (STEFANOV 1950) and *Melilotus indica* is established in two localities, in the Struma valley and near Sofia.

Ceratocarpus arenarius, from the steppe region of Russia, found recently in several localities in N.W. Bulgaria, Dobrudza (STOJANOV 1950b; STOJANOV, KITANOV & VELČEV 1953), shows a tendency to become established on a larger scale.

Juncus tenuis, found in 1929 for the first time, in Sofia (STOJANOV & STEFANOV 1948), is now found in several localities in Rila and near the Bulgarian-Jugoslavian frontier as an established plant (KOŽUHAROV & KUZMANOV 1962). *Eleusine indica* is established in two localities near Kjustendil and Petrič in W. Bulgaria (STOJANOV, STEFANOV & KITANOV 1966). Some plants of *Paspalum distichum* were found in 1959 in one locality in the south part of the Struma valley (VELČEV & BONDEV 1961). Later (from 1964-1969) it was found to be established some 100 km northwards by the river (BONDEV 1964) and in the southern part of the Marica valley (VIHODCEVSKI 1969).

Hedypnois rhagadioloides is found in several localities by the southern sea-shore and in the Struma valley (STOJANOV, STEFANOV & KITANOV 1967). At the sea-shore in one locality *Otanthus maritimus* has been found (near the river Popotamo); in about ten years it has spread and now is found in several localities northwards along the sea coast; the furthest is at the estuary of the river Kamčia some 100 km away from the first published point (DELIPAVLOV 1961; VIHODCEVSKI 1963). *Sagittaria latifolia* was found first near Sofia in 1930 (JORDANOV 1963: 221) probably as an escape from the neighbouring park "Vrana" and is now established in the rivers and marshes of the surrounding area (KITANOV 1953).

Najas graminea is found in one locality (near Plovdiv) in the rice-fields, evidently introduced as a weed (JORDANOV 1963: 212). *Trifolium ligusticum* is found in *Pinus maritima* culture in Strandža (STEFANOV 1963). *Leontice leontopetalum* is found in four localities, each of them on a "road", in the Tundža, Marica and Struma valleys. It was first recorded for a locality near the town of Svilengrad (near the frontier with Turkey) in 1930 (JORDANOV 1932). Recently it has been found inside the country (near the town of Jambol) (ČEŠMEDŽIEV 1967) and in another four new localities in

the Thracian plain (MARKOVA 1970), as well as in the Struma valley near the town of Sandansky, always as a weed.

A most recent example of an escape of an ornamental plant from a restricted garden cultivation is *Oenothera biennis* which is now scattered all over the country along the roads (STOJANOV, STEVANOV & KITANOV 1967).

Azolla filiculoides is now growing successfully in the irrigation channels in distr. Pleven (PETROV 1970) in the immediate vicinity of the Danube as well as in lake Srebărna, which gets its water from the Danube (V. VELEV, unpubl.). Both localities are believed to be recently invaded and there are many reasons to expect the spread of this species in the Danube plain (PETROV 1970; VELEV).

4. *Plants introduced and cultivated in the past which persist for a long time in one or several localities as though naturalised.*

Several trees of *Malus trilobata* have been found in the E. Rhodopi mountains near by or within cultivated areas; most probably they have been planted in the past, introduced from N. Greece.

This is also the case with *Quercus macrolepis* in the E. Rhodopi mountains which evidently remains from a past cultivation (BONDEV & GANČEV 1966) as well as *Diospiros lotus* and *D. kaki* in some parts of S. Bulgaria. *Amorpha fruticosa* is worth mentioning; it grows in some places along the Danube, after being introduced in some parts of the Danube plain (for stabilisation of the dykes).

5. *Plants extensively cultivated for a long time.*

This group is very large and we shall mention some representatives of three subgroups:

Trees and shrubs cultivated recently and mainly as ornamentals: *Populus euramericana, Salix babylonica, Pinus maritima, Pseudotsuga douglasii, Picea pungens, Sequoiadendron giganteum, Thuja occidentalis, Th. orientalis, Maclura pomifera, Broussonetia papyrifera, Hibiscus syriacus, Ziziphus vulgaris, Sophora japonica, Gleditsia triacanthos, Laburnum vulgare, Caragana arborescens, Wistaria sinensis, Koelreuteria paniculata, Pawlownia imperialis, Mahonia aquifolium, Buxus sempervirens, Larix europaea, Tsuga canadensis, Abies concolor, Chamaecyparis lawsoniana, Juglans nigra, Quercus rubra, Morus nigra, Berberis japonica, Magnolia obovata, M. stellata, M. kobus, Liriodendron tulipifera, Philadelphus inodorus, Ph. coronarius, Deutzia gracilis, D. scabra, Ribes aureum, R. sanguineum, R. rubrum Platanus occidentalis, Spiraea japonica, S. douglasii, S. latifolia, S. thunbergii, S. prunifolia, S. cantoniensis, Cotoneaster horizontalis, C. rotundifolia, C. microphylla, Kerria japonica, Chaenomeles japonica, Albizzia julibrissin, Robinia hispida, Melia azedarach, Euonymus japonicus, Acer negundo, A. palmatum, A. saccharinum, Parthenocissus tricuspidata, P. quinquefolia, Tilia americana, Cornus alba, Forsythia suspensa, Fraxinus americana, Catalpa ovata, C. bignonioides, Lonicera tatarica, Symphoricarpus racemosus*, etc.

Annual to perennial herbaceous plants cultivated in gardens and parks: many members of this group were known about the end of the 16th century; some of them are *Fritillaria imperialis*, *Tulipa* spp., *Lilium candidum*, *Hoya carnosa*, *Pelargonium radula*, *Dahlia variabilis*, *Cheiranthus cheiri*, *Dianthus caryophyllus*, *Arundo donax*, *Helianthus annuus*. The following species are more recently introduced: *Dicentra spectabilis*, *Bergenia crassifolia*, *Hydrangea* spp., *Hemerocallis flava*, *Mirabilis jalapa*, *Phlox paniculata*, *Tropaeolum majus*, *Salvia splendens*, *Hosta japonica*, *Yucca filamentosa*, *Iris germanica*, *Aquilegia vulgaris*, *Sempervivum assimile*, *Ocimum basilicum*, *Chrysanthemum parthenium*, *Iris florentina*.

Crops: very large parts of Bulgaria are occupied by cultivated fields and they determine to a large extent the landscape of the country. Among the most frequent crops in Bulgaria nowadays are: *Triticum vulgare*, *Secale cereale*, *Hordeum vulgare*, *Zea mays*, *Linum usitatissimum*, *Vicia sativa*, *Helianthus annuus*, *Pisum sativum*, *Nicotiana tabacum*, *Solanum tuberosum*, *Solanum lycopersicum*, *Beta vulgaris*, *Phaseolus vulgaris*, *Gossypium hirsutum*, *Fragaria vesca*, *Vitis vinifera*, *Ribes nigrum*, *Rubus idaeus*, *Medicago sativa*, and many vegetables: *Allium* spp., *Brassica* spp., *Raphanus* spp., *Solanum* spp., *Hibiscus esculentus*, *Capsicum annuum*, etc.

The treatment of the aliens in the Bulgarian flora is difficult to summarize. In general, the archaeosynanthropic plants are difficult to distinguish from the native. In both the Flora of Bulgaria (STOJANOV, STEFANOV & KITANOV 1966, 1967) and "Flora R. P. Bulgaricae" (JORDANOV 1963-1970) they are numbered and treated as native species. For the neosynanthropic plants there is a considerable diversity in the treatment of various groups by the authors of "Flora R.P. Bulgaricae". Usually plants introduced unintentionally by man are numbered and the data are given as for the natives.

Cultivated plants are only mentioned in the Flora of Bulgaria, while in "Flora R.P. Bulgaricae", data are given in four groups:

— species effectively naturalised or escaped and widespread (these are included in the keys and given full descriptions, but not numbered);

— species widely cultivated for a long period but not naturalised (these are not normally included in the keys, but are briefly described);

— species cultivated on a limited scale (these are not included in the key, and are given only a brief description);

— species cultivated in houses as decorative plants (these are not included in the keys either, and are given only a very brief description). See KUZMANOV & KOŽUHAROV (1968).

It should be noted that aliens are often treated in various ways in floras because there are few or no reliable data as to their origin. Examples of this (*Rheum*, *Castanea*, etc.) have been given above.

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