Pak. J. Bot., 49(3): 1057-1061, 2017.

A STUDY OF THE ENVIRONMENTAL-CENOTIC CONFINEDNESS OF *ATRAGENE SPECIOSA* WEINM. (RANUNCULACEAE) IN THE SOUTH OF WESTERN SIBERIA

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Abstract

Atragene speciosa Weinm.of the family Ranunculaceae is an adventitious species. It has reserves of raw materials of the third category, i.e., it is a rare and non-exploited plant in KuznetskyAlatau and in Tomsk Region, Russia. In those areas of Western Siberia in plant communities with *Atragene speciose* Weinm. there are 124 species, of which 82 species grow in KuznetskyAlatau, 75 species in Tomsk Region, and 29 species grow together with *Atragene speciosa* Weinm. In KuznetskyAlatau and Tomsk egion at the same time.

Key words: *Atragene speciosa*, Western Siberia, Environmental-cenotic confinedness.

Introduction

Currently, the expansion of the range of medicinal products through the introduction of new drugs of nootropic action is one of the priorities in the world of medicine (Deeb *et al*., 2013; Ikram *et al*., 2015; Shilova *et al*., 2013; Shinwari & Qaiser, 2011). The chemical properties of the aerial part of *Atragene speciosa* Weinm. were studied at the E.D. Goldberg SB RAMS Institute of Pharmacology; the scientists established the expressive nootropic activity of *Atragene speciosa* Weinm. shoots (Shilova *et al*., 2013). *Atragene speciosa* Weinm. is widely used in folk medicine as a tonic, and for nervous diseases. People of Siberia, Tibet, the Far East and China have been using *Atragene speciosa* Weinm. since ancient times to treat various diseases. A decoction of its flowers is used to treat cardiovascular disease, stomach, liver and lung cancer in the Altai Mountains. An infusion of the aerial part is used for the treatment of gastrointestinal diseases, colds and epilepsy. *Atragene speciosa* Weinm. shoots are used to treat liver disease, pulmonary tuberculosis, pneumonia, headache, rheumatism, hunk and kidney diseases (Krylov *et al*., 1993; Minaeva, 1991; Shilova *et al*., 2010). *Atragene speciosa* Weinm. in Tibetan medicine is considered to be a radical remedy for the treatment of cancer (Shilova *et al*., 2013). However, the limit or absence of stocks of raw materials associated with the peculiarities of the biology of the species is an obstacle to the development of medicinal plant preparations.

Materials and Methods

The occurrence and abundance of species in plant communities with *Atragene speciosa* Weinm. in these regions were studied based on an analysis of 100 geo-botanical descriptions of flora and plant resources given by the author and the laboratory staff of the Institute of Biology and Biophysics, Tomsk State University, in KuznetskyAlatau and Tomsk Region from year 2005 to 2015 (Nekratova, 2005). Geo-botanical districts were considered when studying the spreading of *Atragene speciosa* Weinm. through KuznetskyAlatau: I - Barzas taiga, II - Kuznetsk-Altai high-mountain, III – North Kuznetsk-Altai dark-light coniferous, IV – East Kuznetsk-Altai midland dark-light coniferous, V - Balyksinsky mountain taiga, VI - Batenevsky lowland forest-steppe (Maskaev, 1976; Nekratova, 2005). Geo-botanical descriptions of *Atragene speciosa* Weinm. are given mainly for the East Kuznetsk-Altai midland dark-light coniferous district. In Tomsk Region geo-botanical descriptions are given for Tomsk and Molchanovskiy districts. The ecological and geographical confinement of *Atragene speciosa* Weinm. was established according to the classification developed by L.I. Malyshev (Malyshev, 1965) and later supported by other botanists (Krasnoborov, 1976; Revushkin, 1988; Sedelnikov, 1988). N.A. Nekratova's approach was taken as a foundation in this research based not only on the occurrence of certain species in a lap-zonal area, but also taking into account their frequency in the vegetation (Nekratova *et al*., 1991).

The following eco-geographical groups and subgroups have been adopted:

1. The High-mountain subgroup includes species which mostly grow in the high-mountains.

1.1. The Arcto-highland subgroup has a modular nature, since it contains species which grow in the alpine zone, the arctic and sub-arctic regions, and a number of species which go down into the forest belt.

1.2. The Mountain-high-mountain subgroup includes species which grow mostly in the alpine zones but going down to forest zone.

2. The Mountain group includes species which grow in mountains, mostly lower than the high-mountain zone.

2.1. The High-mountain-mountain subgroup includes species that grow in the mountains, but also in the highlands.

2.2. The Mountain subgroup itself consists of the species which are spread mostly in the forest zone.

2.3. The Mountain-steppe subgroup contains species living mainly in mountainous steppes and entering the forest belt and in the highlands.

2.4. The Adventitious-mountain subgroup includes plain-mountain species with eco-cenotic optimum in mountain habitats.

3. The Adventitious group unites species which are equally spread both in the plains and also in the mountains.

In order to determine the raw material base of the species, it is necessary to conduct a resource assessment of the medicinal plants and establish the resource category. We used the classification of the resource categories proposed by Nekratova for *Atragene speciose* Weinm. (Nekratova *et al*., 2005). The natural resources of the first category have species acting as a dominant or edificators of indigenous cenoses or successional lines. The natural resources of this group of species can serve as a reliable source of medicinal raw materials for large-scale use in rational exploitation. The natural resources of the second category are noted in the species which are confined to a varying degree of cenosis where they grow with increased abundance. Some species of this category are connected with indigenous cenosis and their successive rows. In general, medicinal plants of this group are an additional source of crude drugs for smaller-scale usage. The third category includes species that are not widely spread in territories with sparse populations because of their biological characteristics. They also include species that are quite rare in this region for historical reasons and due to prevailing environmental conditions. The fourth category includes species of limited growth in this territory; the procurement of these types of raw materials in this region is not permitted. Collecting seed material in limited quantities may be allowed. The types of the third and fourth categories are non-commercial.

Results and Discussion

Atragene speciosa Weinm. is confined to the East Kuznetsk-Altai midland dark-light coniferous district in Kuznetsk Alatau and grows in sub-taiga and forest-steppe zones. It has cenotic confinement to bushy *Spiraea chamaedryfolia* L., *Spiraea media, Lonicera altaica* Pall., *Caragana arborescens* Lam., *Rosa acicularis* Lindl., *Ribes atropurpureum* C.A. Mey., *Rubus idaeus* L. forb-grass-sedge, forb-grass, sedge-grass-propionic-spurge-willowherb, large-herb-cereal, cereal-forb-grass-sedge, and forb-grass-sedge communities with a predominance of *Carex macroura* Meinsh., *Calamagrostis langsdorffii* (Link) Trin., *Calamagrostis obtusata* Trin., *Chamaenerion angustifolium* (L.) Scop., *Crepis sibirica* L., *Equisetum pretense* Ehrh., *Euphorbia pilosa* L., *Paeonia anomala* L., *Poa sibirica* Roshev., *Thalictrum minus* L., *Viola uniflora* L. Related species are: *Aconitum septentrionale* Koelle, *Cacalia hastata* L., *Geranium pseudosibiricum* J. Mayer, *Heracleum dissectum* Ledeb., *Lathyrus gmelinii* Fritsch, *Polemonium caeruleum* L., *Trollius asiaticus* L. etc. Arborescent stratum is represented by: *Abies sibirica* Ledeb., *Betula pendula* Roth, *Larix sibirica* Ledeb., *Padus avium* Mill., *Picea obovate* Ledeb., *Pinus sibirica* Du Tour, *Populus tremula* L., *Sorbus sibirica* Hedl.

Atragene speciose Weinm. grows in pine, larch, birch, and mixed forests in Tomsk Region. Arborescent stratum is represented by: *Pinus sylvestris* L., *Betula pubescens* Ehrh.,*Populus tremula* L., *Abies sibirica* Ledeb., *Pinus sibirica* Du Tour, *Sorbus sibirica* Hedl., *Larix sibirica* Ledeb. In the herb layer following species prevail: *Pteridium aquilinum* (L.) Kuhn, *Carex macroura* Meinsh.,*Calamagrostis epigeios* (L.) Roth, *Phleum pratense* L., *Aegopodium podagraria* L., *Adenophora lilliifolia* (L.) A. DC.Related species are: *Melica nutans* L., *Phlomis tuberosa* (L.) Moench, *Cacalia hastata* L., *Filipendula ulmaria* (L.) Maxim., *Veratrum nigrum* L., *Lathyrus vernus* (L.) Bernh., *Lathyrus gmelinii* Fritsch, *Lathyrus pratensis, Vicia cracca* L., *Vaccinium vitis-idaea* L., *Vaccinium myrtillus* L. etc.

Based on the analysis of geo-botanical descriptions in communities with *Atragene speciosa* Weinm. In KuznetskyAlatau and in Tomsk Region, the occurrence of species in these plant communities with the indication of their abundance is shown in Table 1.

Therefore, *Atragene speciosa* Weinm. is an adventitious species. It has reserves of raw materials of the third category, i.e. it is a rare and non-exploited plant in Kuznetsky Alatau and in Tomsk Region. In those areas of Western Siberia in plant communities with *Atragene speciosa* Weinm. there are 124 species, of which 82 species grow in KuznetskyAlatau, 75 species in Tomsk Region, and 29 species grow together with *Atragene speciosa* einm. In KuznetskyAlatau and Tomsk Region at the same time.

The following species belong to them: *Abies sibirica* Ledeb., *Aconitum septentrionale* Koelle, *Betula pendula* Roth, *Cacalia hastate* L., *Calamagrostis langsdorfii* (Link) Trin., *Caragana arborescens* Lam., *Carex macroura* Meinsh., *Chamaenerion angustifolium* (L.) Scop., *Cimicifuga foetida* L., *Crepis sibirica* L., *Dianthus superbus* L., *Galium boreale* L., *Larix sibirica* Ledeb., *Lathyrus gmelinii* Fritsch, *L. vernus* (L.) Bernh., *Lilium pilosiusculum* (Freyn) Miscz., *Maianthemum bifolium* (L.) F.W. Schmidt, *Matteuccia strutiopteris* (L.) Tod., *Paris quadrifolia* L., *Pinus sylvestris* L., *Pleurospermum uralense* Hoffm., *Rosa acicularis* Lindl., *Rubus saxatilis* L., *Solidago virgaurea* L., *Sorbus sibirica* Hedl., *Spiraea media* Schmidt, *Stellaria bungeana* Fenzl, *Thalictrum minus* L., *Vaccinium vitis-idaea* L., *Viola uniflora*. These species, mainly of conifer forests, form the basis of the *Atragene speciosa* Weinm. cenosis system for these regions.

Table 1. Occurrence of species with *Atragene speciose* Weinm.in plant communities.

	Species	Tomsk region (abundance in % of the total projective cover)	KuznetskyAlatau (abundance in % of the total projective cover)
1.	*Abies sibirica* Ledeb.	1-2 %	1-3 %
2.	*Achillea asiatica* Serg.	1-2 %	–
3.	*Achyrophorus maculatus* (L.) Scop.	–	2 %
4.	*Aconitum barbatum*Patr. ex Pers.	–	1-3 %
5.	*A. pascoi* Worosch.	–	1 %
6.	*A. septentrionale* Koelle	1 %	2-4 %
7.	*A. volubile* Pall. ex Koelle	–	2 %
8.	*Adenophora lamarkii* Fisch.	–	1-2 %
9.	*A. lilliifolia* (L.) A.DC.	1-2	–
10.	*Adoxa moschatellina* L.	–	1 %
11.	*Aegopodium podagraria* L.	1-2	–
12.	*Alchemilla vulgaris* L.	2-3	–
13.	*Anemonoides altaica* (C.A.Mey) Holub.	1-2	–
14.	*A. caerulea* (DC.) Holub	1-2	–
15.	*A. narcissiflora* L.	–	1 %
16.	*Anemone ranunculoides* (L.) Holub	–	2 %
17.	*Artemisia tanacetifolia* L.	–	1 %
18.	*Athyriumfilix-femina* (L.) Roth ex Mert.	1-2	–
19.	*Atragenespeciosa* Weinm.	2-3	1-3 %
20.	*Betula pendula* Roth	10 %	5-20 %
21.	*Betula pubescens* Ehrh.	1 %	–
22.	*Bupleurum aureum* Fisch. ex Hoffm.	–	5 %
23.	*Cacalia hastate* L.	2-3 %	2-3 %
24.	*Calamagrostis epigeios* (L.) Roth.	1 %	–
25.	*C. langsdorfii* (Link) Trin.	3 %	10 %
26.	*C. obtusata* Trin.	–	8-10 %
27.	*Campanula glomerata* L.	–	2 %
28.	*Caragana arborescens* Lam.	2-3 %	1-2 %
29.	*Carex macroura* Meinsh.	15 %	25-30 %
30.	*Carum carvi* L.	1-2 %	–
31.	*Chamaenerion angustifolium* (L.) Scop.	1-2 %	1-20 %
32.	*Cimicifuga foetida* L.	1 %	1-2 %
33.	*Corydalis bracteata* (Steph.) Pers.	10 %	–
34.	*Cotoneaster uniflora* Bge.	–	1-2 %
35.	*Crepis sibirica* L.	1 %	5 %
36.	*Cypripedium guttatum* Sw.	–	1 %
37.	*Dianthus superbus* L.	1-2 %	3 %
38.	*Dryopteris carthusiana* (Vill.) H.P. Fuchs	1-2 %	–
39.	*D. filix-mas* (L.) Schott.	–	1 %
40.	*Epilobium palustre* L.	–	1 %
41.	*Equisetum pretense* Ehrh.	–	5 %
42.	*E. sylvaticum* L.	5 %	3 %
43.	*Erigeron acris* L.	2-3 %	–
44.	*Erythroniums ibiricum* (Fisch. et C.A.Mey.) Krylov	1-2 %	–
45.	*Euphorbia pilosa* L.	–	5-8 %
46.	*Filipendula ulmaria* (L.) Maxim.	2-3 %	–
47.	*Fragaria vesca* L.	1 %	–
48.	*Galium boreale* L.	1 %	1-2 %
49.	*G. palustre* L.	–	1-2 %
50.	*Gentiana macrophylla* Pall.	–	1 %
51.	*Geranium albiflorum* Ledeb.	–	1 %
52.	*G. pseudosibiricum* J.C. Mayer	–	3 %
53.	*Gymnocarpium dryopteris* (L.) Newman	2-3 %	–
54.	*Heracleum dissectum*Ldb.	–	1-3 %
55.	*Humulus lupulus*L.	2-3 %	–
56.	*Impatiens noli-tangere* L.	–	1 %
57.	*Lamium album* L.	–	2 %
58.	*Larix sibirica*Ledeb.	10 %	5-7 %
59.	*Lathyrus gmelinii* Fritsch	1-2 %	1-3 %
60.	*L. pratensis* L.	1-2 %	–
61.	*L. vernus* (L.) Bernh.	1-2 %	2 %
62.	*Lilium pilosiusculum* (Freyn) Miscz.	1 %	1 %
63.	*Linaria vulgaris* Mill.	2-3 %	–
64.	*Linnaea borealis* L.	–	1 %

Table 1. (Cont'd.)..

	Species	Tomsk region (abundance in % of the total projective cover)	KuznetskyAlatau (abundance in % of the total projective cover)
65.	*Loniceraaltaica* Pall. ex DC.	–	1-5 %
66.	*L. tatarica* L.	1 %	–
67.	*Maianthemum bifolium* (L.) F.W. Schmidt	1 %	1 %
68.	*Matteuccia strutiopteris* (L.) Tod.	3 %	1 %
69.	*Melica nutans* L.	2-3 %	–
70.	*Oxalis acetosella* L.	–	7 %
71.	*Padus avium* Mill.	–	1-2 %
72.	*Paeonia anomala* L.	–	1-8 %
73.	*Paris quadrifolia* L.	1 %	1 %
74.	*Phleum pretense* L.	1 %	–
75.	*Phlomis tuberosa* L.	2-3 %	–
76.	*Picea obovate* Ledeb.	–	1-2 %
77.	*Pinus sylvestris* L.	5 %	1 %
78.	*Plantago media* L.	2-3 %	–
79.	*Pleurospermum uralense* Hoffm.	1 %	2 %
80.	*Poa annua* L.	1-2 %	–
81.	*P. palustris* L.	2-3 %	–
82.	*P. sibirica* Roshev.	–	3-30 %
83.	*Polemonium caeruleum* L.	–	3-5 %
84.	*Ptarmica impatiens* (L.) DC.	1-2 %	–
85.	*Pteridium aquilinum* (L.) Kuhn	30 %	–
86.	*Pyrola media* Sw.	1-2 %	–
87.	*Ribes atropurpureum* C.A. Mey.	–	2-3 %
88.	*R. nigrum* L.	–	1 %
89.	*Rosa acicularis* Lindl.	1 %	2 %
90.	*R. majalis* Herrm.	2-3 %	–
91.	*Rubus idaeus* L.	–	2-5 %
92.	*R. sachalinensis* Levl.	–	1 %
93.	*R. saxatilis* L.	3 %	1-3 %
94.	*Salix caprea* L.	1-2 %	–
95.	*Sambucus sibirica* Nakai.	–	1 %
96.	*Sanguisorba officinalis* L.	1-2 %	–
97.	*Saussureacontroversa*DC.	–	2 %
98.	*Sedum hybridum* L.	–	2 %
99.	*Senecio erucifolius* L.	–	1 %
100.	*S. nemorensis* L.	–	1 %
101.	*Silene nutans* L.	2-3 %	–
102.	*Solidago virgaurea* L.	2-3 %	1 %
103.	*Sorbus sibirica* Hedl.	1 %	10-30 %
104.	*Spiraea chamaedryfolia* L.	–	3-25 %
105.	*S. media* Schmidt.	3-5 %	50 %
106.	*Stellaria bungeana* Fenzl	1-2 %	2 %
107.	*S. graminea* L.	1-2 %	–
108.	*Thalictrum flavum* L.	2-3 %	–
109.	*Th. foetidum* L.	–	2-3 %
110.	*Th. minus* L.	1 %	1-6 %
111.	*Th. simplex* L.	1-2 %	–
112.	*Trifolium lupinaster* L.	–	2 %
113.	*Trollius asiaticus* L.	–	2-5 %
114.	*Urtica dioica* L.	–	5-7 %
115.	*Vaccinium myrtillus* L.	1 %	–
116.	*V. vitis-idaea* L.	2-3 %	2 %
117.	*Veratrum lobelianum* Bernh.	–	1 %
118.	*V. nigrum* L.	2-3 %	–
119.	*Viburnum opulus* L.	1 %	–
120.	*Vicia cracca* L.	1-2 %	–
121.	*Viola biflora* L.	–	1 %
122.	*V. hirta* L.	1-2 %	–
123.	*V. mirabilis* L.	1-2 %	–
124.	*V. uniflora* L.	2-3 %	1-8 %
125.	*Zygadenus sibirica* (L.) A. Gray	–	1 %

Annotation. The sign "–" shows the absence of geo-botanical descriptions of species in the territory

Conclusion

Based on the analysis of geo-botanical descriptions in communities with *Atragene speciosa* Weinm. in KuznetskyAlatau and in Tomsk Region we show the occurrence of species in these plant communities with the indication of their abundance. *Atragene speciosa* Weinm. is confined to the East Kuznetsk-Altai midland dark-light coniferous district in Kuznetsk Alatau and grows in sub-taiga and forest-steppe zones. *Atragene speciosa* Weinm.grows in pine, larch, birch, and mixed forests in Tomsk Region. In those areas of Western Siberia in plant communities with *Atragene speciosa* Weinm.there are 124 species, of which 82 species grow in KuznetskyAlatau, 75 species in Tomsk Region, and 29 species grow together with *Atragene speciosa* Weinm. in Kuznetsky Alatau and Tomsk Region at the same time.

Acknowledgements

The work was completed in the framework of the TSU competitiveness improvement program.

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(Received for publication 24 March 2016)