



## Taxonomic analysis of the flora of the Shirvan zone of Azerbaijan

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### Abstract

The results of taxonomic analysis of the flora of the Shirvan zone of Azerbaijan, which belongs to both the Greater Caucasus and Kura-Araz botanical-geographical regions have been presented in the paper. Taxa established in the territory of Shirvan are distributed according to the highest plant divisions. 2061 species of Higher plants (Higher spore plants, Gymnosperms, Angiosperms), included in families and genus characteristic of the Shirvan flora have been identified, 41.22% (5000 species), of which are included in the flora of Azerbaijan, 29.44% (7000 species) - belong to the Caucasian flora. 1 species of algae, 6 species of lichens, 3 species of mosses were identified in the region during the study. Most of the defined species are edificators, assemblers, dominants or subdominants of natural vegetation.

**Keywords:** taxonomy, vegetation, taxon, flora

### Introduction

The richest biodiversity of the flora of Azerbaijan [Flora of Azerbaijan, 1950-1961], and in particular the Shirvan zone has long attracted the attention of botanists. This region belongs to both the Greater Caucasus and the Kura-Araz botanical-geographical region. In this connection, it was of interest to us to carry out a taxonomic analysis of the flora of this zone. Unfortunately, taxonomic knowledge is far from complete. Taxonomy, as the most significant section of systematization, requires the establishment of taxonomic ranks, that is, the implementation of the correct gradation procedure, which provides for the sequential inclusion of a class in a class, in other words, it involves the classification of objects, phenomena or categories according to some attribute or principle and explores the issues of volume and mutual relationship subordinate groups or categories [Smirnov E.S., 1969] <sup>[2]</sup>. Distribute among the higher taxa included in the flora of the region, to determine the range of flora of the territory, to distribute the flora of Shirvan between genera and species of large families and to distribute species in the main genera of the flora of Shirvan as a result of the taxonomic analysis of the flora was the purpose of the research

### Material and Methods

The object of the study was the vegetation cover of the Shirvan zone of Azerbaijan. The studies were carried out in the conditions of field routes with the indication of GIS coordinates. The research was carried out in three stages: 1. Cameral preparatory; 2. Field laboratory; 3. Concluding and generalizing. Over 1000 herbarium materials have been collected, which were transferred to the Herbarium Fund of the Institute of Botany of ANAS during the years of research. Collection, drying and monitoring of the collected herbarium materials were carried out according to the generally accepted method [Alekhin, V.V., 1950] <sup>[1]</sup>. Morphological characters (height of plants, degree of branching, presence of hairs or their absence, shape of leaves and underfoils, their size, shape of a group of

inflorescences, root system of plants) of some species were determined during the route expedition [Programs for geobotanical research, 1952]. The vegetation classification of the study area was carried out and about 300 geobotanical descriptions were selected for eco-biological analyzes [Beideman, I.N., 1954, 1960, 1962; Hajiyev, V.D. et al, 2008; Efendiyev, R.M., 2007] <sup>[4, 5, 6, 7]</sup>.

### Results and Discussion

The territory of Shirvan belongs to both the Greater Caucasus and Kura-Araz botanical-geographical regions, which is why it differs from other regions by its peculiar flora. 2061 species of higher plants (Higher spore plants, Gymnosperms, Angiosperms), included in families and genera characteristic of the Shirvan flora, were identified, 41.22% (5000 species), of which are included in the flora of Azerbaijan, 29.44% (7000 species) - belong to the Caucasian flora as a result of our geobotanical studies over the years of research, based on the numerous herbarium materials and literature sources collected by us <sup>[8-10]</sup>. 1 species of algae, 6 species of lichens, 3 species of mosses were identified in the region during the study. So, Angiosperms make up 98.21% of the total flora, 26.69% of which are monocotyledonous (550 species), 71.52% are dicotyledonous (1474 species) plants. An increase in the number of dicotyledons is observed in the relationship between representatives of monocotyledonous and dicotyledonous plants, which seriously affects the number of these species and families. This fact indicates that the varieties are found in large taxa (groups).

The rest of the taxa: higher spore and gymnosperms are represented by 37 species, together they make up 1.79%. 61 species (2.95%) found in the study area are trees, shrubs - 85 species (4.13%), dwarf shrubs - 47 species (2.29%), 59 semi-shrubs (2.86%), grasses 1809 species (87.77%), as well as perennial 1058 species (51.34%), annual-biennial 751 species (36.43%) of plants. Taxa established on the territory of Shirvan are distributed among the higher plant divisions in the following order (Table 1)

**Table 1:** Distribution by higher taxa included in the flora of Shirvan

№	Taxa	Number			By total number, in%		
		Species	Genus	Family	Species	Genus	Family
1	<i>Equisetophyta</i>	5	1	1	0,24	0,13	0,69
2	<i>Polypodiophyta</i>	19	16	8	0,92	2,09	5,56
3	Gymnospermae ( <i>Pinophyta</i> )	13	8	6	0,63	1,05	4,17
4	<i>Angiospermatophyta</i>	2024	739	129	98,21	96,73	89,58
A	Class 1. <i>Monocotyledoneae</i>	550	173	31	26,69	22,64	21,53
B	Class 2. <i>Dicotyledoneae</i>	1474	566	98	71,52	74,09	68,05
	Total:	2061	764	144	100	100	100

The largest taxonomic units of the plant world are represented by species as a percentage in the divisions as can be seen from the data in the table: Horsetail - *Equisetophyta* 0.24%, Vascular spore - *Polypodiophyta* 0.92%, Gymnosperms - *Gymnospermae* or *Pinophyta* 0.63%. The remaining 98.21% of the species are included in the Angiosperm division - *Angiospermatophyta*. Angiosperms are divided into 2 classes: the class of monocots - *Monocotyledoneae* of this division has 550 (26.69%) species, and dicotyledons - *Dicotyledoneae* 1474 (71.52%) species.

The spectrum of the flora of the territory (table. 2) has developed under specifying plant species distributed in the territory of Shirvan as a result of the research conducted in 2008-2015 years. The presented spectrum covers all the diversity of the modern flora of Shirvan, scattered among the families and genus of various species of wild and cultivated plants in this territory. The taxonomic spectrum reflected new taxa discovered by researchers, as well as the latest taxonomic and nomenclature changes and additions after the publication of the eight-volume edition "Flora of Azerbaijan" (I-VIII, 1950-1961) [10].

**Table 2:** The spectrum of the flora of Shirvan territory

№	Families	Number of genus	According to the total number, in%	Number of species	According to the total number, in%
1	2	3	4	5	6
1.	<i>Equisetaceae</i> Michx. ex Dc.	1	0,13	5	0,24
2.	<i>Pteridaceae</i> Reichenb.	3	0,39	3	0,14
3.	<i>Polypodiaceae</i> Bercht. et J. Presl	1	0,13	1	0,05
4.	<i>Aspleniaceae</i> Newm.	3	0,39	4	0,2
5.	<i>Dryopteridaceae</i> R. - C.Ching	4	0,53	5	0,24
6.	<i>Marsileaceae</i> Mirb.	1	0,13	1	0,05
7.	<i>Salviniaceae</i> T. Lestib.	1	0,13	1	0,05
8.	<i>Azollaceae</i> Wettst.	1	0,13	1	0,05
9.	<i>Ophioglossaceae</i> (R.Br.) Agardh	2	0,26	3	0,14
10.	<i>Taxaceae</i> S.F. Gray	1	0,13	1	0,05
11.	<i>Pinaceae</i> Adans.	1	0,13	2	0,1
12.	<i>Cupressaceae</i> S.F.Gray	3	0,39	8	0,4
13.	<i>Ephedraceae</i> Dumort	1	0,13	5	0,24
14.	<i>Lauraceae</i> Juss.	1	0,13	1	0,05
15.	<i>Nymphaeaceae</i> Salisb.	1	0,13	1	0,05
16.	<i>Colchicaceae</i> DC.	2	0,26	3	0,14
17.	<i>Liliaceae</i> Cuss.	3	0,39	24	1,16
18.	<i>Smilacaceae</i> Vent.	1	0,13	1	0,05
19.	<i>Orchidaceae</i> Juss.	13	1,7	36	1,74
20.	<i>Iridaceae</i> Juss.	3	0,39	11	0,53
21.	<i>Hemerocallidaceae</i> R.Br.	1	0,13	1	0,05
22.	<i>Asphodelaceae</i> Juss.	2	0,26	3	0,14
23.	<i>Hyacinthaceae</i> Batsch	6	0,79	24	1,16
24.	<i>Alliaceae</i> C. Agardh.	1	0,13	20	0,97
25.	<i>Amaryllidaceae</i> J. St. - Hil.	2	0,26	6	0,29
26.	<i>Convallariaceae</i> Noran.	1	0,13	2	0,1
27.	<i>Asparagaceae</i> Juss. Vc.	1	0,13	4	0,2
28.	<i>Arecaceae</i> Schultz - Sch.	2	0,26	2	0,1
29.	<i>Juncaceae</i> Juss.	2	0,26	16	0,78
30.	<i>Cyperaceae</i> Juss.	16	2,1	64	3,1
31.	<i>Sparganiaceae</i> F. Rudolphi	1	0,13	2	0,1
32.	<i>Typhaceae</i> Juss.	1	0,13	6	0,29
33.	<i>Poaceae</i> Barnhart	103	13,48	292	14,15
34.	<i>Butomaceae</i> Mirb.	1	0,13	1	0,05
	<i>Najadaceae</i> Cuss.	2	0,26	3	0,14

35.	<i>Alismataceae</i> Vent.	2	0,26	4	0,2
36.	<i>Juncaginaceae</i> Rich.	1	0,13	1	0,05
37.	<i>Potamogetonaceae</i> Dumort.	1	0,13	7	0,34
38.	<i>Ruppiaceae</i> Horan. ex Hutch.	1	0,13	2	0,1
39.	<i>Zannichelliaceae</i> Dumort.	1	0,13	2	0,1
40.	<i>Zosteraceae</i> Dumort.	1	0,13	2	0,1
41.	<i>Araceae</i> Juss.	1	0,13	2	0,1
42.	<i>Lemnaceae</i> S.F.Gray.	2	0,26	3	0,14
43.	<i>Acoraceae</i> Martinov	1	0,13	1	0,05
44.	<i>Cannaceae</i> L.	1	0,13	1	0,05
45.	<i>Dioscoreaceae</i> Lindl	1	0,13	1	0,05
46.	<i>Ceratophyllaceae</i> S.F. Gray	1	0,13	1	0,05
47.	<i>Nelumbonaceae</i> Dumort.	1	0,13	1	0,05
48.	<i>Berberidaceae</i> Juss.	2	0,26	3	0,14
49.	<i>Ranunculaceae</i> Juss.	15	1,97	40	1,94
50.	<i>Papaveraceae</i> Adans.	3	0,39	13	0,63
51.	<i>Hypocoaceae</i> (Dumort.) Willk.	1	0,13	1	0,05
52.	<i>Fumaruaceae</i> DC.	1	0,13	5	0,24
53.	<i>Molluginaceae</i> Hutch.	1	0,13	1	0,05
54.	<i>Aizoaceae</i> Rudolphi	1	0,13	1	0,05
55.	<i>Portulacaceae</i> Adans.	1	0,13	2	0,1
56.	<i>Caryophyllaceae</i> Juss.	22	2,89	65	3,15
57.	<i>Amaranthaceae</i> Juss.	1	0,13	6	0,29
58.	<i>Chenopodiaceae</i> Vent.	25	3,28	65	3,15
59.	<i>Polygonaceae</i> Juss.	6	0,79	23	1,12
60.	<i>Plumbaginaceae</i> Juss.	3	0,39	3	0,14
61.	<i>Platanaceae</i> T. Lestib.	1	0,13	1	0,05
62.	<i>Fagaceae</i> Dumort.	2	0,26	5	0,24
63.	<i>Corylaceae</i> Mirb.	3	0,39	4	0,2
64.	<i>Juglandaceae</i> DC. ex Perleb	1	0,13	2	0,1
65.	<i>Hypericaceae</i> Juss.	1	0,13	7	0,34
66.	<i>Ebenaceae</i> Guerke	1	0,13	3	0,14
67.	<i>Primulaceae</i> Vent.	5	0,66	12	0,58
68.	<i>Violaceae</i> Batsch	1	0,13	8	0,4
69.	<i>Tamaricaceae</i> Link.	2	0,26	6	0,29
70.	<i>Reaumuriaceae</i> Ehrenb. ex Lindl.	1	0,13	2	0,1
71.	<i>Frankeniaceae</i> J.St. – Hil. ex S.F. Gray	1	0,13	2	0,1
72.	<i>Salicaceae</i> Mirb.	2	0,26	16	0,78
73.	<i>Cucurbitaceae</i> Juss.	5	0,66	8	0,39
74.	<i>Capparaceae</i> Juss.	2	0,26	2	0,1
75.	<i>Brassicaceae</i> Burnett	45	5,91	80	3,87
76.	<i>Resedaceae</i> DC. ex S. F. Gray	1	0,13	3	0,14
77.	<i>Cistaceae</i> Juss.	2	0,26	4	0,19
78.	<i>Malvaceae</i> Juss.	9	1,19	25	1,21
79.	<i>Moraceae</i> Link.	4	0,53	5	0,14
80.	<i>Cannabaceae</i> Endl.	2	0,26	3	0,14
81.	<i>Urticaceae</i> Juss.	3	0,39	5	0,24
82.	<i>Euphorbiaceae</i> Juss.	4	0,53	17	0,82
83.	<i>Thymelaeaceae</i> Juss.	3	0,39	5	0,24
84.	<i>Crassulaceae</i> DC.	2	0,26	8	0,4
85.	<i>Saxifragaceae</i> Juss.	4	0,53	10	0,48
86.	<i>Haloragaceae</i> R.Br.	1	0,13	2	0,1
87.	<i>Rosaceae</i> Adans.	26	3,41	79	3,83
88.	<i>Lythraceae</i> J.St. - Hill	2	0,26	6	0,29
89.	<i>Punicaceae</i> Horan.	1	0,13	1	0,05
90.	<i>Onagraceae</i> Juss.	3	0,39	9	0,45
91.	<i>Myrtaceae</i> Adans.	1	0,13	2	0,1
92.	<i>Fabaceae</i> Lindl.	39	5,1	164	7,96
93.	<i>Aceraceae</i> Juss.	1	0,13	8	0,4
94.	* <i>Hippocastanaceae</i> DC	1	0,13	1	0,05
95.	<i>Sapindaceae</i> Juss.	1	0,13	1	0,05

96.	<i>Rutaceae</i> Juss.	2	0,26	2	0,1
97.	<i>Meliaceae</i> Juss.	1	0,13	1	0,05
98.	<i>Simaroubaceae</i> DC.	1	0,13	1	0,05
99.	<i>Anacardiaceae</i> Lindl.	3	0,39	3	0,14
100.	<i>Linaceae</i> DC. ex Perleb	1	0,13	11	0,53
101.	<i>Oxalidaceae</i> R.Br.	1	0,13	1	0,05
102.	<i>Geraniaceae</i> Adans.	2	0,26	21	1,02
103.	<i>Zygophyllaceae</i> R.Br.	5	0,65	5	0,24
104.	<i>Polygalaceae</i> Hoffmgg	1	0,13	4	0,2
105.	<i>Celastraceae</i> R.Br.	1	0,13	4	0,2
106.	<i>Santalaceae</i> R. Br.	1	0,13	3	0,2
107.	<i>Rhamnaceae</i> Juss.	4	0,53	6	0,29
108.	<i>Elaeagnaceae</i> Adans.	2	0,26	4	0,2
109.	<i>Vitaceae</i> Juss.	2	0,26	4	0,2
110.	<i>Cornaceae</i> Dumort.	1	0,13	1	0,05
111.	<i>Eucommiaceae</i> Engl.	1	0,13	1	0,05
112.	<i>Araliaceae</i> Juss.	1	0,13	3	0,14
113.	<i>Apiaceae</i> Lindl.	63	8,24	92	4,46
114.	<i>Sambucaceae</i> Batsch ex Borkh.	1	0,13	1	0,05
115.	<i>Caprifoliaceae</i> Adans.	3	0,39	9	0,44
116.	<i>Valerianaceae</i> Batsch	2	0,26	15	0,72
117.	<i>Dipsacaceae</i> Juss.	3	0,39	8	0,4
118.	<i>Campanulaceae</i> Adans.	2	0,26	13	0,62
119.	<i>Menyanthaceae</i> Dumort.	1	0,13	1	0,05
120.	<i>Asteraceae</i> Dumort.	83	10,86	218	10,58
121.	<i>Rubiaceae</i> Juss.	8	1,09	29	1,4
122.	<i>Gentianaceae</i> Juss.	2	0,26	10	0,48
123.	<i>Apocynaceae</i> Adans.	3	0,39	4	0,2
124.	<i>Asclepiadaceae</i> Borkh.	2	0,26	2	0,1
125.	<i>Solanaceae</i> Adans.	7	0,92	13	0,64
126.	<i>Convolvulaceae</i> Juss.	4	0,53	9	0,44
127.	<i>Cuscutaceae</i> Dumort.	1	0,13	4	0,2
128.	<i>Boraginaceae</i> Adans.	19	2,48	41	1,99
129.	<i>Oleaceae</i> Hoffmgg. & Link	4	0,53	6	0,29
130.	<i>Scrophulariaceae</i> Juss.	16	2,1	59	2,86
131.	<i>Orobanchaceae</i> Vent.	4	0,53	22	1,07
132.	<i>Plantaginaceae</i> Juss.	1	0,13	9	0,44
133.	<i>Bignoniaceae</i> Juss.	2	0,26	2	0,1
134.	<i>Lentibulariaceae</i> Rich.	1	0,13	1	0,05
135.	<i>Verbenaceae</i> Juss.	3	0,39	4	0,2
136.	<i>Lamiaceae</i> Lindl.	18	2,35	60	2,91
137.	<i>Betulaceae</i> C. A. A g ardh	2	0,26	7	0,34
138.	<i>Celtidaceae</i> Mirb.	2	0,26	3	0,14
139.	<i>Loranthaceae</i> D. Don	2	0,26	2	0,1
140.	<i>Tiliaceae</i> Juss.	1	0,13	2	0,1
141.	<i>Datisceae</i> Lindl.	1	0,13	1	0,05
142.	<i>Hippuridaceae</i> D. C.	1	0,13	1	0,05
143.	<i>Pyrolaceae</i> Lindl.	3	0,39	3	0,14
	Total	764	100	2061	100

The number of genus and species of large families of the advanced first group of the flora of the region is represented by *Poaceae* Barnhart - 103 genus (13.48%) and 292 species (14.15%); *Asteraceae* Dumort - 83 genus (19.86%), 218 species (10.58%); *Apiaceae* Lindl. - 63 (8.24%) genus, 92

species (4.46%); *Caryophyllaceae* Juss. - 22 genus (2.89%), 65 species (3.15%); *Boraginaceae* Cuss. - 19 genus (2.48%), 41 species (1.99%), and most families consist of 1-9 genus and species have been shown in the table also (Table 3).

**Table 3:** Distribution of flora of Shirvan between genus and species of large families

№	Families	Genus	In general quantity,%	Species	In general quantity,%
1	2	3	4	5	6
2.	<i>Poaceae</i> Barnhart	103	13,48	292	14,15
3.	<i>Asteraceae</i> Dumort.	83	10,86	218	10,58
4.	<i>Apiaceae</i> Lindl.	63	8,24	92	4,46

5.	<i>Brassicaceae</i> Burnett	45	5,91	80	3,87
6.	<i>Fabaceae</i> Lindl.	39	5,1	164	7,96
7.	<i>Rosaceae</i> Adans.	26	3,41	79	3,83
8.	<i>Chenopodiaceae</i> Vent.	25	3,28	65	3,15
9.	<i>Caryophyllaceae</i> Juss.	22	2,89	65	3,15
10.	<i>Boraginaceae</i> Adans.	19	2,48	41	1,99
11.	<i>Lamiaceae</i> Lindl.	18	2,35	60	2,91
12.	<i>Scrophulariaceae</i> Juss.	16	2,1	59	2,86
13.	<i>Cyperaceae</i> Juss.	16	2,1	64	3,1
14.	<i>Ranunculaceae</i> Juss.	15	1,97	40	1,94
15.	<i>Orchidaceae</i> Juss.	13	1,7	36	1,74
16.	Остальные семейства представлены 1-9 родами и видами	261	25,18	706	34,31
17.	Total:	764	100	2061	100

The species of 680 genus are unevenly distributed have been revealed from the analysis of the flora of the territory. They are not all the same in terms of the number of births. There is a genus (*Gagea* Salisb., *Orchis* L., *Juncus* L., *Carex* L.,

*Bromus* L., *Avena* L., *Ranunculus* L., *Astragalus* L., *Trifolium* L., etc.), which include dozens of species and play a huge role in the formation and development of vegetation (Table 4).

**Table 4:** Distribution of species in the main genus of the flora of Shirvan

№	Genus	Species	%
1.	<i>Carex</i> L.	25	1,21
2.	<i>Astragalus</i> L.	24	1,16
3.	<i>Veronica</i> L.	23	1,11
4.	<i>Vicia</i> L.	21	1,02
5.	<i>Allium</i> L.	20	0,97
6.	<i>Hieracium</i> L.	19	0,92
7.	<i>Crucianella</i> L.	17	0,82
8.	<i>Galium</i> L.	17	0,82
9.	<i>Gagea</i> Salisb.	17	0,82
10.	<i>Trifolium</i> L.	15	0,73
11.	<i>Orchis</i> L.	14	0,68
12.	<i>Aegilops</i> L.	14	0,68
13.	<i>Ranunculus</i> L.	14	0,68
14.	<i>Euphorbia</i> L.	14	0,68
15.	<i>Cerastium</i> L.	14	0,68
16.	<i>Chenopodium</i> L.	13	0,63
17.	<i>Poterium</i> L.	13	0,63
18.	<i>Rosa</i> L.	13	0,63
19.	<i>Cirsium</i> Mill. et. Scop.	13	0,63
20.	<i>Geranium</i> L.	13	0,63
21.	<i>Juncus</i> L.	12	0,58
22.	<i>Avena</i> L.	12	0,58
23.	<i>Festuca</i> L.	12	0,58
24.	<i>Poa</i> L.	12	0,58
25.	<i>Campanula</i> L.	12	0,58
26.	<i>Medicago</i> L.	12	0,58
27.	<i>Valerianella</i> Hill	11	0,53
28.	<i>Bromus</i> L.	11	0,53
29.	<i>Orobanche</i> L.	11	0,53
30.	<i>Linum</i> L.	11	0,53
31.	<i>Artemisia</i> L.	11	0,53
32.	<i>Salsola</i> L.	10	0,48
33.	<i>Hordeum</i> L.	10	0,48
34.	<i>Elytrigia</i> Desv.	10	0,48
35.	<i>Papaver</i> L.	10	0,48
36.	<i>Lathyrus</i> L.	9	0,44
37.	<i>Cyperus</i> L.	9	0,44
38.	<i>Dianthus</i> L.	9	0,44
39.	<i>Stipa</i> L.	9	0,44
40.	<i>Salix</i> L.	9	0,44
41.	<i>Althaea</i> L.	9	0,44
42.	<i>Bupleurum</i> L.	9	0,44
43.	<i>Centaurea</i> L.	9	0,44
44.	<i>Plantago</i> L.	9	0,44
45.	<i>Iris</i> L.	8	0,39

46.	<i>Atriplex</i> L.	8	0,39
47.	<i>Viola</i> L.	8	0,39
48.	<i>Lepidium</i> L.	8	0,39
49.	<i>Onobrychis</i> Hill	8	0,39
50.	<i>Amoria</i> C.Presl	8	0,39
51.	<i>Acer</i> L.	8	0,39
52.	<i>Erodium</i> L'Her.	8	0,39
53.	<i>Chondrilla</i> L.	8	0,39
54.	<i>Salvia</i> L.	8	0,39
55.	<i>Nepeta</i> L.	8	0,39
The rest 709 genus are represented by 1-7 species			67,57
Total		2061	100

The largest number of species belongs to the *Carex* L. genus, which accounts for 25 species. The genus with more than 10 species includes *Astragalus* L., *Veronica* L., *Gagea* Salisb., *Orchis* L., *Allium* L., *Hieracium* L., *Juncus* L., *Aegilops* L., *Bromus* L., *Avena* L., *Chenopodium* L., *Ranunculus* L., *Medicago* L., *Trifolium* L., *Rosa* L., *Euphorbia* L., *Valerianella* Hill and etc. The number of species in other genus ranges from 8-10 cm (Table 4). Most of them are edificators, assemblers, dominants or subdominants of natural vegetation.

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