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An Investigation on the Autecological of Endemic *Iris taochia* Woronow Ex Grossh. (*Iridaceae*) Distributed in the North East Anatolia Region

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Abstract: This study is subjected to determine the autecological properties of *Iris taochia* Woronow ex Grossh. (*Iridaceae*) distributed in North East Anatolia. *I. taochia*, endemic Irano-Turanian element, is distributed only in the vicinity of Tortum (Erzurum). The chemical and physical analysis have been carried out on soil and plant samples have been collected from six different localities in North East Anatolia. According to the results of plant nutrient analysis, it has been found out that N, P, K, Ca, Na, Mn, Zn and Cu contents are high in above-ground parts during the vegetative growth period and they are high in below-ground parts during the generative growth period. According to the soil analysis, it is obtained that the plant generally prefers sandy-argilloceous-loamy and loamy-sandy type of soil, with a medium alkaline or neutral, non-saline, calcareous in soils in regard of pH.

Key words: *Iris taochia*, endemic, rarely plant, autecology

INTRODUCTION

Iridaceae family, a large and diverse family of about 80 genera is distributed in tropical and sub-tropical region of North Hemisphere. One of the most important genus of this family, *Iris* L., is represented by five subgenus (*Iris*, *Limniris*, *Susiana*, *Scorpiris* and *Hermodactyloides)* in Turkey (Güner, 1980; Kandemir and Engin, 1998). In our country, there are 37 species of *Iris* L. genus having a very important economic potential related with its flowers. The fourteen of this species are endemic and the rate of endemizm is 37.8% (Koca, 1996; Kandemir and Engin, 2000a). The species of *Iris* L. genus are perennial, herbaceous plants with a rhizomatous or bulbous, below-ground stem. These plants have economical importance since their usage in decoration and medicine. Furthermore, local people use the rhizomes of these plants to treat eczema. It is known that the rhizomes have diuretic effects and the seeds are used for gas remover (Baytop, 1984; Engin *et al.*, 1998). Besides, the species of *Iris* L. are the most prominent ones grown in gardens, parks and on balconies (Kandemir and Engin, 2000b; Kandemir, 2003).

Iris species are used for the treatment of cancer, inflammation, bacterial and viral infections because of their medicinal importance (Hanawa *et al.*, 1991). I ribosomal inactivating protein (RIP) isolated from *Iris* L. bulbs were determined to have piscicidal, antineoplastic, antioxidant, anti-tumor, antiplasmodial and antituberculosis properties (Hideyuki *et al.*, 1995; Miyake *et al.*, 1997; Bonfils *et al.*, 2001). Futhermore, roots decoction of the some *Iris* species (*I. germanica*) has been used in dropsies, anti-spasmodic, emmenagogue, stimulants as diuretic, aperient, gall bladder diseases, in fever and enlargement of the liver, for catarrhal ailment of children (Atta-ur-Rahman *et al.*, 2003). Iridals which are triterpenoids can be isolated from various *Iris* species. They are used by perfumers for their pleasant violet-like scent. Some iridals can play a role as constituents of cell membranes comparable to that of sterols (Taillet *et al.*, 1999).

It is known that eight species of Subgenus *Iris* Sect. *Iris* is grown in Turkey. Four of these species (*I. junonia* Schott et Kotschy ex Schott, *I. purpureobractea* (Mathew, 1984). *I. taochia* and *I. schachtii* Markgraf) are endemic and six of these species are grown in natural areas. Two of species are especially grown in cultivate areas as natural hybrids. Sect. *Iris* species are known with their close similarities and have much hybridisation with each other. Moreover, Sect. *Iris* constitutes the base of garden varieties (Koca, 1996). Drug is obtained from the species of this section in the industry of pharmacy and perfume (Baytop, 1984).

The *I. taochia* is a rhizomatous plant and its length is 18.5-30 centimeters (Fig. 1). The number of flowers are 2-5, yellow and purple colored. *I. taochia* is used as a decorative plant because of its sweet-smelling and showy flowers. This species is not grown outside of its natural ecologic area. Therefore, according to IUCN endangered categories, *I. taochia* distributing only in the vicinity of Tortum (Erzurum) is in the VU (Vulnerable) category (Ekim *et al.*, 2000).

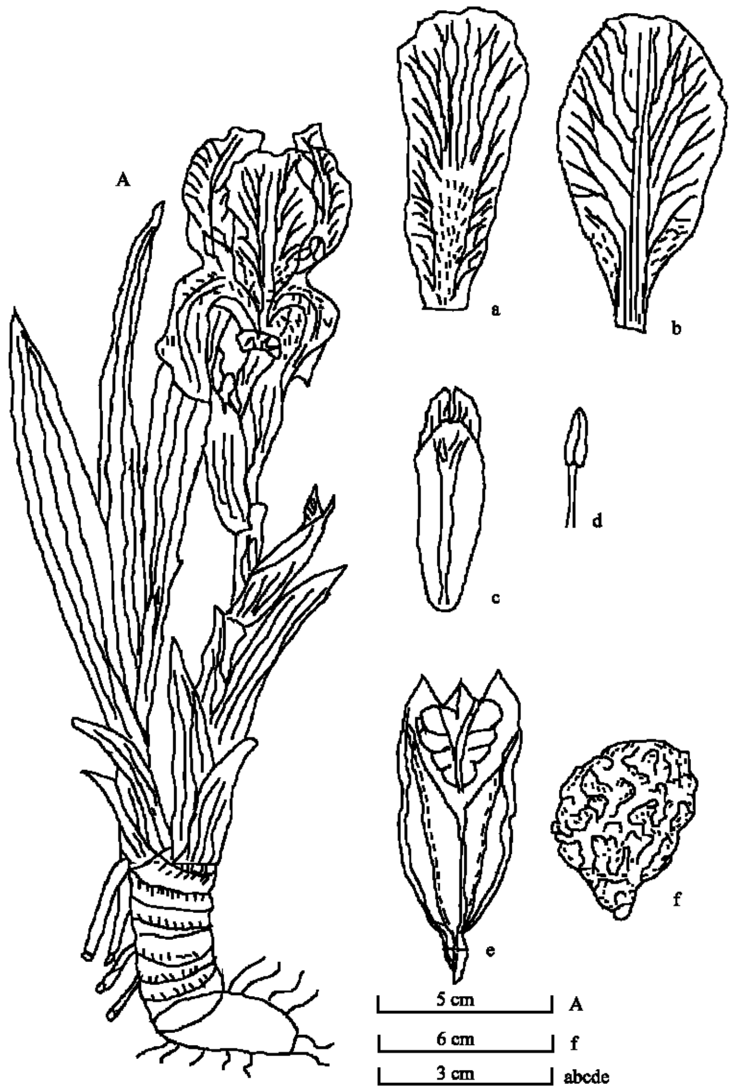


Fig. 1: General appearance of *I. taochia* A: Plant a: Out tepal b: Inner tepal c: Style d: Stamen e: Capsule f: Seed

The purpose of this study is to determine the autecological properties of endemic *I. taochia* distributing in a limited region in Turkey.

MATERIALS AND METHODS

The soil and plant samples of the *I. taochia* have been collected from six different localities in vicinity of Tortum (Erzurum) during vegetative and generative growth period (Fig. 2). Specimens have been preserved in the herbarium at Ondokuz Mayis University Amasya Education Faculty. This study has been carried out between 2003-2005 years. The localities plant samples collected are listed below.

- A8 Erzurum: Vicinity of Tortum Lake, stony areas, 1600 m, 18.6.2003, Kandemir, 351
- A8 Erzurum: Between Tortum and Oltu (2 km from Tortum), rocky areas, 1650 m 18.6.2003, Kandemir, 352
- A8 Erzurum: Near Tortum, stony areas, 1500 m, 20.6.2003, Kandemir, 353
- A8 Erzurum: Between Tortum and Yusufeli (2 km from Tortum), stony areas, 1890 m, 22.6.2003, Kandemir, 354
- A8 Erzurum: Between Tortum and Ispir, rocky areas, 1900 m, 22.6.2003, Kandemir, 355
- A8 Erzurum: Between Tortum and Artvin (3 km from Tortum), stony areas, 1700 m, 23.6.2003, Kandemir, 356.

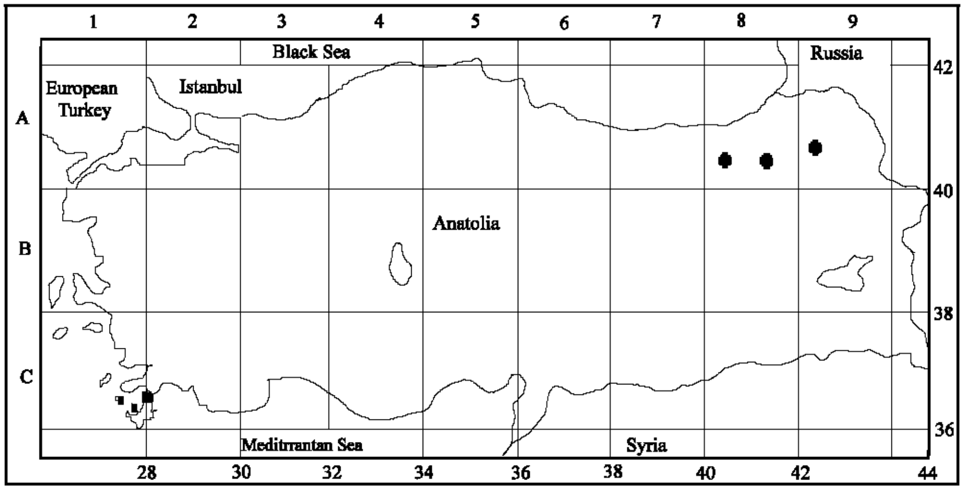
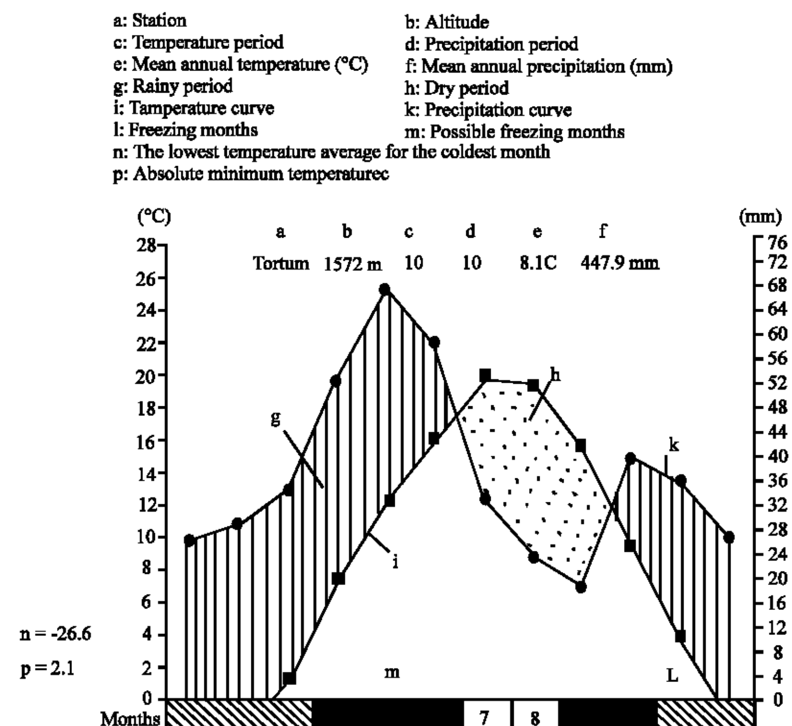


Fig. 2: The distribution of *I. taochia* in Turkey. ● : *I. taochia*



Temperature	-4	-2.6	1.4	7.5	12.1	16	19.9	19.5	15.5	9.4	3.7	-1.6
Rain	26.2	29.2	35	52.8	67.5	59	33.1	23.5	19	39.8	36.2	26.6

Fig. 3: Climatic diagram pertaining to Tortum meteorology station

Climate of research areas: In order to explain climatical properties of the localities of samples, data from Tortum meteorology station has been obtained from the Ministry of Environment and General Directorate of National Meteorology Archives (State Meteorology Institute, 1995). Via the Walter's Method (Walter, 1956), climate diagrams for the plant sampling areas have been drawn in Fig. 3. According to Emberger's method (Emberger, 1952), it has been determined that Tortum and Oltu have Continental precipitation regime (Sm.Sp.A.W); Erzurum has Transition Precipitation Regime-Mediterranean tendency first Variant (Sp.W.Sm.A).

Analysis of plant and soil samples: Plant and soil samples (10 plants from each area) have been collected from the localities cited above in the vegetative and generative growth periods. Approximately 1 kg of soil has been collected from the depths of 0-20 cm from each locality for analysis. The samples have been transported to the laboratory in polyethylene bags. The soil samples have been dried with air and sifted with a standard 2 mm sieve. The soil texture has been determined by Bouyoucus hydrometer method, pH values and total salinity (%) have been measured by Beckman pH meter and Conductivity Bridge apparatus, respectively. Field capacity and wilting point have been determined by centrifugation and pressure membrane extractor. The difference between the field capacity and wilting point gives the available water percent. Soil nitrogen (%), organic matter (%), $CaCO_3$, K (%) and P (%) have been determined, respectively, by Kjeldahl's method, Walkley-Black method, Scheibler Calcimeter (Bayrakli, 1987), Perkin Elmer 2280 atomic absorption spectrophotometer with ammonium asetate and ammonium moliybdate-stannous chloride method following extraction with ammonium fluoride (Allen *et al*., 1986).

N, P, K, Ca, Na, Mn, Zn and Cu contents of the above and below-ground parts of *I. taochia* have been determined. The below and above-ground parts of plant samples have been divided into small pieces and dried at in an oven for 48 h and they have been then powdered in a Hammer Mill and ground in a Wiley Mill so that they would pass through a 20-mesh sieve. All samples have been digested in a mixture of nitric and perchloric acids (4:1) with the exception of the samples taken for N analysis, which have been digested with sulphuric acid and selenium using Kjeldahl apparatus. P% and K% have been determined using the ammonium-molybdate-stannous-chloride method and Perkin Elmer 2280 atomic absorption spectrophotometer (Allen *et al*., 1986; Kaçar, 1972), respectively. Calcium (Ca), sodium (Na), manganese (Mn), zinc (Zn) and copper (Cu) contents have been determined according to the methods given in detail by Kaçar (1972). During vegetative and generative periods, the differences between above and below-ground parts of the basis nutrient contents have been evaluated by the SPSS statistical software programme (Norusis, 1991).

RESULTS

Phenological observations: It is known that the phenological development of this species can differ related to habitate and altitude. In Table 1, we give the phenological development of this species. The plant is distributed on the open areas, dryish, calcareous places, rocky slopes at an altitude of 1500-2000 m.

Table 1: Phenological stages of *I. taochia*

Leaf development and primary shoot	At the beginning of May
Leaf maturation	In the end of May
Flowering	In the middle of June
Complete flowering	In the end of June
Fruit	At the beginning of July
Seed maturation	In the middle of July
Drying of upper part of plant	In the end of July

The physical and chemical results of the soil analysis: The results of physical and chemical analysis of the soil samples collected from the distrubution area of *I. taochia* have been presented in Table 2. As can be seen from Table 2, the species grows on sandy-argilloceous-loamy and loamy-sandy soils. The pH of the soil samples ranges from 7.19 to 8.10. Total salinity values range between quite low extremes. The percentage of salt ranges from 0.04 to 0.07. The percentage of $CaCO_3$ ranges from 8.975 to 15.630 in the soil where the species grows. The percentage of water holding capacity (WHC) ranges from 10 to 30. The field capacity, wilting point and available water of the soil samples range from 10.21 to 20.42, 6.29 to 13.28 and 3.09 to 7.14, respectively. The organic matter, nitrogen, phosphorus and potassium contents have been found to be 2.65 to 5.00%, 0.261 to 0.940%, 0.0011 to 0.0042% and 0.025 to 0.067% in the soil, respectively.

The nutrient elements contents of the plant samples: The nutrient elements (N, P, K, Ca, Na, Mn, Zn and Cu) contents of below-ground parts of plant during vegetative and generative growth period have been shown in Table 3. Total nitrogen contents are between 0.457-0.991% (0.72±0.083) in the vegetative period and 0.612-1.047% (0.86±0.064) in the generative period. The phosphorus contents are from 0.106 to 0.356% (0.23±0.040) in the vegetative period and 0.242 to 0.530% (0.34±0.044) in the generative period. On the other hand, potassium contents range from 0.57 to 0.96% (0.77±0.057) in the vegetative period and 0.87 to 1.22% (1.01±0.054) in the generative period. Total calcium, sodium, manganese, zinc and copper contents have been found between 1.58-2.66% (2.16±0.17), 0.12-0.36% (0.24±0.038), 40-80 (60.8±6.63), 38.8-71.4 (58.0±5.07) and 8-16 (12.7±1.22) in the vegetative period and 1.80-2.97% (2.50±0.20), 0.34-0.57% (0.46±0.036), 50-95 (73.3±6.67), 55.4-90.2 (70.8±4.89) and 12-20 (16.0±1.36) in the generative period.

N, P, K, Ca, Na, Mn, Zn and Cu contents of the above-ground parts of the plants have been given in Table 4. Total nitrogen contents have been found between 1.582-2.452% (2.11±0.126) in the vegetative period and 1.176-1.942% (1.66±0.111) in the generative period, while the phosphorus ranges from 0.216 to 0.560% (0.390±0.063) in the vegetative and from 0.102 to 0.474% (0.260±0.059) in the generative period. Potassium is

Table 2: Physical and chemical analysis results on the soil samples of *I. taochia* habitate

Locality	Texture class	Soil pH	Water holding capacity (%)	Total salinity (%)	$CaCO_3$ (%)	Field capacity (atm.)	Wilting point (atm.)	Available water (atm.)	N (%)	P (%)	K (%)	Organic matter (%)
1	Sandyargilloceousloamy	7.95	15	0.06	11.940	12.85	9.76	3.09	0.940	0.0012	0.025	3.67
2	Sandyargilloceousloamy	8.05	10	0.05	14.620	15.40	11.49	3.91	0.860	0.0011	0.035	5.00
3	Loam-sandy	7.19	30	0.07	8.975	18.64	12.12	6.52	0.525	0.0021	0.051	3.92
4	Sandyargilloceousloamy	7.65	15	0.04	10.625	14.72	10.67	4.05	0.650	0.0015	0.067	4.87
5	Loamy-sandy	7.25	20	0.07	9.720	20.42	13.28	7.14	0.261	0.0042	0.048	2.65
6	Sandyargilloceousloamy	8.10	10	0.06	15.630	10.21	6.29	3.92	0.345	0.0035	0.029	4.32
Means± SE		7.70±0.17	16.7±3.07	0.06±0.005	11.92±1.09	15.4±1.52	10.6±0.99	4.77±0.67	0.60±0.11	0.002±0.005	0.04±0.006	4.07±0.35

Table 3: N, P, K, Ca, Na, Mn, Zn and Cu contents in below-ground parts (rhizome, root) of *I. taochia*

Locality	N (%) * / **	P (%) * / **	K (%) * / **	Ca (%) * / **	Na (%) * / **	Mn (ppm) * / **	Zn (ppm) * / **	Cu (ppm) * / **
1	0.620/0.881	0.267/0.302	0.88/1.05	1.96/2.48	0.22/0.52	50/65	66.2/75.6	12/14
2	0.795/0.905	0.106/0.242	0.80/1.10	2.50/2.78	0.12/0.34	40/50	38.8/62.2	16/20
3	0.457/0.612	0.192/0.288	0.68/0.87	1.58/1.80	0.26/0.52	70/80	47.5/55.4	12/16
4	0.991/1.047	0.320/0.530	0.74/0.97	2.44/2.97	0.36/0.45	80/95	59.4/68.9	8/12
5	0.875/0.986	0.356/0.405	0.96/1.22	1.86/2.10	0.34/0.57	75/85	71.4/90.2	16/20
6	0.565/0.760	0.156/0.276	0.57/0.89	2.66/2.90	0.18/0.38	50/65	64.7/72.5	12/14
Means±SE and	0.72/0.86	0.23/0.34	0.77/1.01	2.16/2.50	0.24/0.46	60.8/73.3	58.0/70.8	12.7/16.0
	±0.083/±0.064	±0.040/±0.044	±0.057/±0.054	±0.17/±0.20	±0.038/±0.036	±6.63/±6.67	±5.07/±4.89	±1.22/±1.36
p-values	t=-1.40 p>0.05	t=-1.81 p>0.05	t=-3.10 p<0.05	t=-1.30 p>0.05	t=-4.12 p<0.05	t=-1.33 p>0.05	t=-2.82 p<0.05	t=1.81p>0.05

*: Vegetative period **: Generative period

Table 4: N, P, K, Ca, Na, Mn, Zn and Cu contents in above-ground parts (stem, leaf, flower, fruit and seeds) of *I. taochia*

Locality	N (%) * / **	P (%) * / **	K (%) * / **	Ca (%) * / **	Na (%) * / **	Mn (ppm) * / **	Zn (ppm) * / **	Cu (ppm) * / **
1	2.240/1.804	0.324/0.102	1.20/0.96	0.72/0.56	0.12/0.09	70/55	85.6/66.2	16/12
2	1.946/1.619	0.232/0.182	2.70/1.89	1.24/0.87	0.24/0.10	65/45	70.6/42.8	20/16
3	2.310/1.834	0.216/0.134	2.88/1.80	0.80/0.64	0.14/0.08	70/60	55.6/34.2	12/8
4	1.582/1.176	0.560/0.348	2.54/1.78	1.44/0.75	0.32/0.15	60/45	63.4/39.6	16/14
5	2.142/1.623	0.470/0.320	2.72/1.54	1.50/1.18	0.28/0.16	55/40	68.2/47.9	12/10
6	2.452/1.947	0.540/0.474	1.86/1.43	2.28/1.66	0.18/0.10	75/55	46.3/38.4	310/8
Means±SE and	2.112/1.667	0.390/0.260	2.31/1.57	1.330/0.94	0.213/0.113	65.83/50.0	65.0/44.85	14.33/11.33
	±0.126/±0.111	±0.063/±0.059	±0.270/±0.140	±0.231/±0.168	±0.033/±0.014	±3.0/±3.16	±5.50/±4.67	±1.50/±1.34
p-values	t=2.64 p<0.05	t=1.51 p>0.05	t=2.43 p<0.05	t=1.35 p>0.05	t=2.83 p<0.05	t=3.63 p<0.05	t=2.79 p<0.05	t=1.50 p>0.05

between 1.20-2.88% (2.31±0.270) in the vegetative period and 0.96-1.89% (1.57±0.140) in the generative period. On the other hand, total calcium, sodium, manganese, zinc and copper contents range from 0.72 to 2.28% (1.33±0.231), 0.12 to 0.32% (0.21±0.033), 55 to 75 (65.43±3.0), 46.3 to 85.6 (65.0±5.50) and 12 to 20 (14.33±1.50) in the vegetative period and 0.56 to 1.66% (0.94±0.168), 0.08 to 0.16% (0.113±0.014), 40 to 60 (50.0±3.16), 34.2 to 66.2 (44.85±4.67) and 8 to 16 (11.33±1.34) in the generative period.

DISCUSSION

In this study, the autecological properties of *I. taochia* have been investigated and its distribution areas in the vicinity of Tortum have been determined. *I. taochia* has been put into Vu (Vulnerable) plant category by Ekim *et al*. (2000). According to the results obtained in this study, *I. taochia* is a vulnerable species in the distribution localities (Table 6).

The taxonomic and cytological characteristics of a species give the idea about whether the species is paleoendemic and neoendemic related to its geographical distribution. If an endemic taxon is a limited species, this is a paleoendemic species. Besides, the paleoendemic taxons grow in very special conditions and their distribution areas have a decreasing tendency (Gemici *et al*., 1992). *I. taochia* is a limited endemic species and its distribution area has shown a decreasing tendency. We have thought that *I. taochia* could be paleoendemic in the light of prior literature cited above.

It can be shown from Table 2 that *I. taochia* grows in sandy-argilloceous-loamy and loamy-sandy soils. It has been reported by various researchers that plants such as *Iris pseudacorus* L. (Iridaceae) (Engin *et al*., 1998) and *Cistus cretus* L., *C. salviifolius* L. (Cistaceae) (Baslar *et al*., 2002) generally grow in sandy-arglilloceous -loamy and loamy-sandy soils. Soil pH values are 7.19-8.10. That is to say, this plant grows better in the light alkaline and neutral soil. It has been observed that such as *Iris pseudacorus* L. (Engin *et al*., 1998), Iris nectarifera Güner (*Iridaceae*) (Kandemir and Engin, 1998) and *Alkanna haussknechtii* (*Boraginaceae*) (Akcin *et al*., 2004) prefer light alkaline and neutral

Table 5: Raining regime types and Bio-climate layers of meteorology stations where the species are found

Stations	P	PE	S	M	M	Q	Precipitation regime types	Bio-climate layer according to Q-values
Tortum 1550 m	464.3	126.0	4.58	27.5	-5.9	48.9	Continental precipitation regime (Sm.Sp.A.W)	Semi-dry mediterranean climate
Erzurum 1870 m	448.8	100.7	2.96	34.0	-30.4	25.3	Transition precipitation regime-mediterranean tendency first variant (Sp.W.Sm.A)	Semi-dry mediterranean climate
Oltu 1275 m	378.9	116.8	3.97	29.4	-7.0	36.6	Continental precipitation regime (Sm.Sp.A.W)	Semi-dry mediterranean climate

Sp: Spring, W: Winter, Sm: Summer, A: Autumn

Table 6: The population density in localities of *I. taochia* where samples were collected

	Plant No. (per 100 m^2)	
Locality year	2003 year	2004 year
Tortum Lake Vicinity	27	19
Tortum and Oltu district	12	9
Tortum district	18	12
Tortum and Yusufeli district	22	16
Erzurum and Ispir district	15	10
Tortum and Artvin district	13	7

soils, as does *I. taochia.* This plant grows in soils containing medium levels of $CaCO_3$ (Table 2). Species such as *Iris pseudacorus* L. (Engin *et al*., 1998), *I. nectarifera* Güner (Kandemir and Engin, 1998), *Iris histrioides* Foster (*Iridaceae*) (Kandemir and Engin, 2000b), *Chrozophora tinctoria* L. (Euphorbiaceae) (Baslar and Mert, 1999), *Cistus cretus* L., *C. salviifolius* L. (Baslar *et al*., 2002) have been reported to prefer soils with a medium level of $CaCO_3$. The proportion of total salinity ranges from 0.04 to 0.07%. The total salinity is very low in all localities. The field capacity, wilting point, water holding capacity and available water values are within normal limits for all localities (Öztürk and Seçmen, 1992).

I. taochia grows in rich soils in respect of organic matter. It has been reported that *Iris pseudacorus* L. (Engin *et al*., 1998), *Chrozophora tinctoria* and *Rubia tinctorum* (Baslar and Mert, 1999), *I. galatica* Siehe (*Iridaceae*) (Kandemir and Engin, 2000a), *Iris histrioides* (Kandemir and Engin, 2000b), *Alkanna haussknechtii* Bornm. (Akcin *et al*., 2004) and *Iris sari* Schott ex Baker (*Iridaceae*) (Kandemir, 2003) grow in soils with very rich organic matter. This species prefers nitrogenous soils. *Iris nectarifera* (Kandemir and Engin, 1998), *Iris sari* (Kandemir, 2003), *I. galatica* (Kandemir and Engin, 2000a), Iris histrioides (Kandemir and Engin, 2000b) and *Sternbergia lutea* (L.) Ker-Gawl. Ex Sprengel and *Narcissus tazetta* subsp. *tazetta* (Amaryllidaceae) (Kutbay, 1999) have also been reported to prefer nitrogen-rich soils. The soil potassium values in soil of *I. taochia* are shown in Table 2. The soil potassium values of *I. taochia* vary from 0.025 to 0.067%. The potassium content is within optimum limits in all localities. It has been reported by various researchers that plants such as *I. nectarifera* (Kandemir and Engin, 1998), *I. pseudacorus* (Engin *et al*., 1998), *I. galatica* (Kandemir and Engin, 2000a), *I. histrioides* (Kandemir and Engin, 2000b) and *I. sari* (Kandemir, 2003) prefer soils with sufficient potassium. The phosphorus content is lowest in all localities due to the fact that pH and $CaCO_3$ values are inherently interrelated and interdependent (Kaçar, 1972). Therefore, the P is stored in the form of insoluable calcium-phosphate in the alkaline soil, and the plant can not get any benefit of the phosphate. K contents in soil are quite high as well. It is because of the fact that K is a very phloem-mobile ion while P is rather phloem-immobile (Stewart and Press, 1990). It is possible to say that potassium accumulates the metabolism in tissues due to its high mobility as indicated by Woodwell *et al*. (1975).

It is a well-known fact that nitrogen content in plants varies generally between 0.2 and 6% (Kaçar, 1972). The dry-weight phosphorus content of plant optimally is between 0.05-0.43% (Kaçar, 1972). According to dry-weight of the plant, concentration of total K% is found as 0.2-11%. N, P and K concents in the below and above-ground parts in *I. taochia* in the vegetative and generative periods are between optimal limits in all localities (Table 3 and 4). It has been reported that plants should contain at least 0.93% of Ca and that the optimum range of 4-7%. Plants normally contain 0.01-10% total Na, 10-694 ppm Mn, 2-240 ppm Zn and 1-500 ppm Cu (Kaçar, 1972). According to these results, contents Ca, Na, Mn, Zn and Cu are within normal limits for each growth period in the above and below-ground parts (Table 3 and 4).

The contents of macroelements in above-ground parts are higher in the vegetative period than those in the generative period. Meristematic tissues have high nutrient concents (Moorby and Beresford, 1983; Werger and Hirose, 1991). This can be explained by the intensive physiological activities in the above-ground parts in the vegetative period and by the transportation of elements to the above-ground. Furthermore, rates of N, P and K are high in green above-ground parts due to young cell with high cytoplasm at the beginning of the generative period. However, a reasonable decrease can be observed in these elements because of the thickening of cellwalls in the middle of the vegetation period. The elements are transported to the below-ground parts for the plant survival until the next vegetative period.

It has been observed during generative period that N, P, K, Ca, Na, Mn, Zn and Cu contents are higher in the below-ground parts than in the above-ground parts (Table 3). The reason behind high content of N, P, K, Ca, Na, Zn, Mn and Cu in below-ground parts of plant in the generative period is the transportation and position of nutritive materials from drying above-ground part to deposition organs at the end of the vegetation period. Another reason is the survival of the plant with its below-ground part up to the next vegetative period. Similar results related to nutrient contents have been observed in the previous autecological studies on other *Iris* L. species (Engin *et al.*, 1998; Kandemir and Engin, 1998; 2000a, b; Kandemir, 2003).

The significant differences have been found between the vegetative and generative periods in terms of N, K, Na, Zn and Mn contents in the above-ground part of the plant ($p<0.05$). There are significant differences in the K, Na and Zn contents in the below-ground parts between the vegetative and generative periods. One reason might be the high mobility of ions K in this plant. However, the differences are not statistically significant in the vegetative and generative periods of P, Ca and Cu contents in the above and below-ground parts of the plant ($p>0.05$).

When the climatic diagrams are examined, it is seen that all localities have a noticeable summer drought (Fig. 3). In the evaluations carried out according to Emberger's method (Emberger, 1952), it has been determined that Tortum and Oltu have continental precipitation regime (Sm.Sp.A.W); Erzurum has Transition Precipitation Regime- Mediterranean tendency first Variant (Sp.W.Sm.A) (Table 5). According to these results, *I. taochia* shows a distribution in localities which have continental precipitation regime and transition regime-Mediterranean tendency first variant. In this respect, the species has a limited range of tolerance; hence, it can be concluded that *I. taochia* has relatively low ecological tolerance.

It has also been determined according to Q values that Tortum, Oltu and Erzurum are on the semi-dry Mediterranean Bioclimatic zone (Table 5). Besides, all localities have less rain. Therefore, the transition of basic elements to sub-horizones all localities is low, pH and lime proportion in the soil samples are higher because of the lack of rain (Table 2).

In this study autecological properties of *I. taochia* have been presented in detail. We hope that this investigation will illuminate autecological properties of *Iris* species which also have economical importance. Besides, this endemic species in our country can be used in maintaining the gene source and cultivation.

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