A MORPHOLOGICAL SURVEY AND A TAXONOMIC REVISION OF THE GENUS SECALE L. (TRITICEAE, POACEAE) IN IRAN

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The taxonomic status of the genus *Secale* L. in Iran was reviewed. Morphological and taxonomic aspects of the taxa belonging to the genus were studied based on a total number of 50 accessions and 104 herbarium sheaths from a wide range of distribution of the genus in Iran. The results of this study showed that the genus *Secale* occurs in Iran with two species: 1- *Secale cereale* L. subsp. *cereale* and subsp. *ancesterale* Zhuk., and 2- *Secale strictum* (C. Presl) C. Presl subsp. *strictum* var. *strictum* and var. *ciliatiglume* (Boiss.) Fred. & G. Petersen.

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Key words. Taxonomy, *Secale,* Iran.

مطالعه ریخت شناسی و بازنگری تاکسونومیک جنس(Secale L. (Triticeae, Poaceae

در ایران

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موقعیت تاکسونومیک جنس .*Secale* L در ایران مورد بازنگری قرار گرفت. موارد ریخت‌شناختی و تاکسونومیک تاکسون‌های متعلق به جنس مزبور بر پایه مجموعاً تعداد ۵۰ نمونه جمعیتی و ۱۰۴ نمونه هرباریومی از دامنه گسترش وسیعی از این جنس در ایران مطالعه شد. مشاهدات حاصل از این مطالعه نشان داد که جنس *Secale* در ایران با دو گونه:

1- *Secale cereale* L. subsp. *ancestrale* Zhuk., & subsp. *cereale*.
2- Secale strictum. (C. Presl) C. Presl subsp. *strictum* var. *strictum and* var. *ciliatiglume* (Boiss.) Fred. & G. Petersen

حضور دارد.

Introduction

Despite being a small genus, but *Secale* L. is economically one of the relatively important cereals growing particularly in the cold areas. Regarding the genus has wild, cultivated and weed plants, hybridisation characterized by high pollen fertility and seed set along with introgression between cultivated and wild taxa have caused many taxonomic confusions and complexity in the genus *Secale*. This situation has been resulted in unnecessary splitting and poorly circumscribing the taxa and also constructing non clear-cut or even conflicting keys, which is well revised by Frederiksen & Petersen (1997 & 1998).

The taxonomic situation of the genus, have been treated in different ways in Iran. Boissier (1879) in his account of the taxon recognized three species: *S. montanum* Guss. with two vars. *ciliatiglume* Boiss. and *anatolicum* Boiss., *S. cereale* L. and *S. fragile* Bieb. occurring in this country. Parsa (1950) accepted the two first species including two varieties for the flora of Iran. Bor (1970) increasing the number of *Secale* spp. in Iran, reported seven species as growing in this country which are: *S. montanum*, *S. cereale*, *S. ciliatiglume* (Boiss.) Grossh., *S. anatolicum* Boiss., *S. afghanicum* (Vavilov) Roshev., *S. segetale* (Zhuk.) Roshev., and *S. silvestere* Host. This study is aimed to clarify the infra-generic taxonomic status of *Secale* in Iran.

Materials and Methods

This study was carried out using a total number of 50 accessions collected for this study and 105 herbarium specimens form the herbaria: HIU (herbarium of Isfahan University) 38 specimens, TARI (Research Institute of Forests and Rangelands) 44 specimens, IRAN (Plant Pests and Diseases Research Institute) 17 specimens, TUH (Herbarium of Tehran University) 5 specimens and HBAU (Herbarium of Bu-Alisina University) one specimen. In order to obtain enough materials for morphological studies and providing herbarium specimens, the collected accessions were grown in the experimental field of Isfahan University. Totally, 19 qualitative (using all the materials) and 30 quantitative (using only plants grown from the accessions) morphological characters were assessed among the materials studied. The herbarium specimens obtained form the grown accessions are deposited in the HIU.

In order to express statistically and also to show the variability of the quantitative observations in the genus the main descriptive statistics: mean, median, standard deviation, variance and first and third quarters were calculated. Number of individuals studied for each statistic is represented in Table 1.

Results

Morphological observations:

1-Qualitative characters:

Duration, three different forms of duration: annual, biennial, and perennial were observed among the materials studied.

Spike features, spike showed a wide range of general forms from ovoid to more or less oblong and straight or slightly curved at apex.

Rachis fragility, this character appeared to be variable among the specimens studied and showed three different classes: totally fragile, partly fragile, and totally tough.

Presence of hairs beneath the spike, this character showed a wide range of variation from totally glabrous to totally hairy.

Internodes hairiness, except for one specimen (TARI 78831), all the materials studied showed glabrous internodes.

Leaf blade and sheath indumentums, the upper surface showed different degree of hairiness, the lower surface was almost hairy among the materials studied, inner part of the sheaths was glabrous.

Table 1. The quanitative characters examined among 50 accessions belonging to the genus *Secale* in Iran. Abbreviations are as: Char. = Characters; N. = Number of individuals examined; Mea. = Mean; Med. = Median; Std. = Standard deviation; Var. = Variance; Min. = Minimum; Max. = Maximum; Q1 & Q3 = First and Third Quarters; Pl.hg. = Plant high in cm; N.st.n. = Number of nodes per the highest stem; Fl.lf. = Flag leaf in cm; L. = Length; W. = Width; Sht. = Sheath in cm; Ind. = Internode in cm; Spk. = Spike in mm; Gl. = Glumes in mm; Aw. = Awn in mm; Lm. = Lemma in mm; Brs. = Bristle in mm; Crp. = Caryopsis in mm; Anthr. = Anther in mm.

Char.	N.	Mea.	Med.	Std.	Var.	Min.	Max.	Q1	Q3
Pl.hg.	415	124.79	126	16.89	285.39	43.00	187.5	116.5	135.5
N.st.n.	415	4.04	4	0.52	0.28	2.00	5.00	4.00	4.00
Fl.lf.:									
L.	415	9.01	8.60	3.31	10.98	2.30	23	6.60	10.80
W.	415	0.637	0.60	0.195	3.826	0.30	2.50	5.00	7.00
L./W.	415	14.21	14.00	3.55	12.60	3.72	28.14	11.71	16.25
L.Sht.	415	22.45	22.45	3.12	9.75	12.70	32.60	20.20	24.30
Lf.lf.:									
L.	415	17.40	17.30	4.57	20.96	5.20	33.00	14.2	20.10
W.	415	1.01	1.00	0.20	4.38	0.50	1.80	0.90	1.20
L./W.	415	17.40	16.70	4.55	20.78	5.78	34.44	14.38	19.60
L.Sht.	415	17.95	17.90	2.42	5.9	6.70	28.30	16.50	19.90
L.Ind.	415	33.26	34.00	5.72	32.72	12.20	49.70	29.80	37.00
L.Spk.1	415	15.50	15.50	2.49	6.23	9.50	22.90	13.50	17.00
L.Spk.2	166	11.06	11.05	3.14	99.10	37.00	200	89.5	132.25
Gl.:									
L.	166	9.22	9.00	1.31	1.72	6.20	13.00	8.17	10.00
W.	166	1.43	1.50	0.24	5.83	0.80	2.10	1.20	1.60
L./W.	166	6.57	6.25	1.12	1.27	4.33	10.00	5.71	7.28
L.Gl.Aw.	166	1.56	1.50	0.61	0.37	0.30	3.20	1.10	2.00
Lm.:									
L.	166	16.49	16.10	2.26	5.13	10.20	25.00	15.00	18.00
W.	166	4.40	4.50	0.50	0.25	2.50	5.60	4.00	4.80
L./W.	166	3.77	3.75	0.57	0.33	2.16	7.14	3.47	4.08
L.Lm.Aw.	166	35.25	34.50	12.93	167.29	3.00	100.00	26.75	42.05
L.Brs.	166	0.86	0.90	0.19	3.78	0.40	1.60	0.70	1.00
Pl.:									
L.	166	13.96	14	1.61	2.60	5.50	17.50	13.00	15.00
W.	166	4.38	4.5	0.54	0.29	2.90	6.00	4.00	4.80
L./W.	166	3.29	3.19	1.04	1.09	1.97	15.80	3.00	3.40
Crp.:									
L.	1170	8.85	8.90	0.82	0.68	6.00	11.50	8.30	9.40
W.	1170	2.58	2.60	0.30	9.88	1.20	7.00	2.40	2.80
L./W.	1170	3.45	3.40	0.44	0.19	1.14	7.50	3.17	3.68
L. Anthr.	90	8.15	8.00	1.61	2.61	4.50	13.50	7.00	9.00

Glumes features, glumes were usually equal or some times unequal with a leathery tissue and characterized as linear-lanceolate or subulate, keeled with one nerve and tapering toward a short awn, no hairs were seen on the inner part of the glumes.

Lemma, showed five nerves on the back, tough keeled and ciliated keel margin, it was without hairs along the margin or inner parts and a long awn.

Caryopsis, was observed as elliptic or fusiform, more or less hairy at apex.

2-Quantitative observations:

Plant high, observations made on 415 individuals belonging to 40 accessions are presented in Table 1. The minimum length was 43 cm and the maximum 187.5 cm.

Number of stem nodes, varied from 2-5 in this study (Table 1).

Flag leaf, was measured among 415 individuals (Table 1). Flag leaf length varied from 2.3 cm to 23; its width ranged from 0.7 - 2.5 cm. Length/width ratio of the flag leaf changed from 3.27 to 28.14. Flag leaf sheath showed a length between minimum 12.7 cm to maximum 23.6 cm.

The leaf beneath the flag leaf, was examined in 415 individuals (Table 1). The minimum and maximum length were 5.2 cm and 33 cm respectively. The width of this leaf varied from 0.5 cm to 1.8 cm. Length/width ratio showed a range from 5.78 to 34.44. The length sheath varied from 28.3 to 67 cm.

Internodes length, measurements (Table 1) among 415 individuals showed a minimum of 12.2 to a maximum of 49.27 cm.

Number of culms, a wide range of variation from 1- 42 culms in one plant was observed among the accessions (Table 1), no specific number corresponding to a particular accession was observed.

Spike length, measurements based on two groups of individuals: 415 individuals and 166 individuals are presented in Table 1.

Glumes, variables were examined among 166 individuals (Table 1) and a range of: glumes length from 6.2–13 mm, glumes width from 0.8–2.1 mm, and the ratio of glumes Length/width 4.33–10 were observed. Glumes awn showed a length between 0.3–3.2 mm.

Lemma, the observations of this study on 166 individuals (Table 1) showed that different variables of lemma range as: length 10.2–25 mm, width 2.5–5.6 mm, and length/width ratio 2.15–7.14. Lemma awn length varied from 3–100 mm. Length of bristles on lemma keel was between 0.4–1.6 mm.

Palea's, observations obtained from 166 individuals (Table 1) showed that its dimensions are as: length 5.5–17.5 mm, width 2.9–6 mm, and length/width ratio 1.97-15.8.

Caryopsis, variables were studied on a total number of 1170 fruits (Table 1) belonging to 39 accessions (30 caryopsis from each accession, unpublished data). The minimum caryopsis length was 6 and the maximum 11.5 mm. The minimum caryopsis width was 1.2 mm and the maximum 7 mm. Length/width ratio varied from 1.14–7.5. The results of this study showed that the caryopsis belonging to *S. strictum* are thinner than those of *S. cereale*. Despite apparently interesting and variable, however the hairiness of caryopsis apex showed a homogeneous variability among the accessions studied.

Anther length, this character was examined on a total number of 90 individuals belonging to 18 accessions (five individuals from each) (Table 1).

Discussion and taxonomic conclusion

The results of this study and also our unpublished observations made on the accessions showed that the morphological characters are mostly of low infra generic taxonomic value among the materials studied. Some characters such as length of lemma awn appeared very variable even in one individual

(unpublished data of the authors). Mostly the variability of the characters was not consistent with any taxonomic distinction among the accessions (based on unpublished data of the authors). Fredriksen & Petersen (1997) examining 14 morphological characters on 43 herbarium specimens from a wide range of geographical distribution and using PCA analysis in *Secale*, argued that regarding the very limited correlation between the chosen characters, separating the postulated taxa based on the any chosen character or combination of characters unambiguously is difficult.

Based on the results of this study the following conclusions and comments can be made about the morphological characters examined in this study:

Duration, can be used as a diagnostic character to split the genus *Secale* into three groups: annual, biennial and perennial, which are in accordance with the relevant literature.

Spike form, has been used by Parsa (1950) in circumscribing *S. cereale* from *S. montanum*, nevertheless regarding the variability of this character among the identified herbarium materials it became clear that this character is of no diagnostic value.

The rachis fragility, has been considered as a diagnostic character (Fredriksen & Petersen 1998). The results of this study showed that this character has a spectrum of variation from totally fragile to totally tough even in one population of *S. cereale*, which already assumed to be completely tough in this taxon by some workers (Boissier 1879, Maire 1955, Bor 1968 & 1970, Heathcote 1980, Nasir & Ali 1982).

Epidermal features, showed that the presence/absence of hairs on the base of spike and node and also amount of wax on different parts of plants are of no taxonomic value in separating taxa belonging to *Secale*; this study showed that the hairy epidermis of stem and leaves in *S. strictum* subsp. *strictum* var. *ciliatiglume* is a diagnostic character to say the latter from var. *strictum* which only posses *glabrous* stem and leaves.

General caryopsis form, *S. strictum* appeared to have thinner and longer caryopsis than *S. cereale*. The hairiness of caryopsis apex showed to be a variable feature and hence of no diagnostic value.

Plant height, Rozhevits & Shishkin (1985) in the Flora of USSR used this character to split *S. vavilovii* Grossh. from *S. anatolicum* and *S. kuprjanovii*. However, comparing the observations made on the accessions grown in the same conditions with the specimens collected from the field, it can be concluded that this is a phenoplastic character and can be affected by the growing conditions.

Length and width of flag leaf and the leaf beneath it, are used mostly as descriptive characters in the literature (Bor 1968 & 1970, Nasir & Ali 1982, Rozhevits & Shishkin 1985, Tan 1985), which are in accordance with the results of this study.

Internode length, has not been considered as a taxonomic character as is the case in this study.

Spike length, although used by Tan (1985) in order to separate two taxa: *S. cereale* var. *cereale* and var. *vavilovii*, but the results of this study showed no taxonomic importance for it.

Number of spikelets, appeared to be of no diagnostic value in this taxon.

Number of florets in the spikelets, showed significant splitting value among the populations studied. Some populations showed merely two florets in their spiklets, the latters were identified as belonging to *S. strictum* s. l. taxonomically and some possessing two to three florets, which were classified in the range of *S. cereale* s. l. Parsa (1950).

Glumes awn length, which was examined among 39 populations and all the herbarium specimens (see materials and methods), showed a similar variability among all the

materials studied. Despite Bor (1970), who described *S. anatolicum* Boiss. and *S. ciliatiglume* (Boiss.) Grossh. as two awnless taxa, this study showed no diagnostic value for it.

Lemma length, showed to be highly variable not only among all the populations studied but also in one individual, therefore of no taxonomic value in the genus *Secale*.

Length of bristles on lemma keel, although has been used by Fredriksen & Petersen (1998) as a taxonomic feature but it is not in accordance with the results of this study.

Anther length, appeared as a non-diagnostic character in this study.

Based on the results of this study it can be concluded that morphological features superimpose a cline of variation among the populations and taxa in the genus *Secale*. This can be led by high gene flow and hybridisation among the cultivated and wild taxa belonging to the genus (Khush & *al.* 1961, Stutz 1972, Fredriksen & Petersen 1997). In addition, the presence of a low gene flow among the taxa closely related to the genus e.g., *Aegilops*, *Agropyron*, *Hordeum*, *Pseudoroegneria*, *Thinopyrum* and *Triticum* and *Secale* (see Wang 1986 & 1988, and Petersen 1991 a & b) has raised the variability in *Secale* and caused taxonomic confusion among the taxa belonging to it.

Based on the results of this study regarding the taxa mentioned in the range of flora of Iran the following taxonomic conclusions can be made: -Regarding Fredriksen & Petersen's monograph for the genus *Secale* (Fredriksen & Petersen 1998) it can be concluded that *S. montanum* Guss. mentioned by Boissier (1879) and Parsa (1950) as having two subsp.: *anatolicum* and *ciliatiglum* in Iran and Bor (1970) who following the general description of *S. montanum* s. l., recognised three species: *S. montanum*, *S. anatolicum* and *S. ciliatiglume* for the sam range of variability in Iran, the description of the all above taxa (Boissier 1879, Parsa 1950 and Bor 1970) are more or less identical to that of *S. strictum* (C. Presl) C. Presl. The latter was described first in the genus *Triticum* (Presl 1820) and later transferred by the same author to *Secale* (Precl 1826). Following the nomenclature rules it is obvious that *S. strictum* (C. Presl) C. Presl takes the priority over *S. montanum* Guss. (Guss. 1825). Accordingly, two varieties *ciliatiglume* and *anatolicum* described by Boissier (1844) in *S. monatum* are accepted as new combinations in *S. strictum*, as treated by Fredriksen & Petersen (1998).

-*S. cereale* L., the results of this study showed that it is a common species in Iran, growing as a weed in the wheat areas. Boissier (1879) and Bor (1970) in their accounts on the genus in Iran described *S. cereale* as having fragile spike rachis while Parsa (1950) mentioned tough rachis for it. Both the descriptions are in accordance with Fredriksen & Petersen (1998) in part who described *S. cereale* as possessing: "Rachis tough or partly fragile, rarely totally fragile". In addition, Bor (1970) reported *S. segetale* (Zhuk.) Roshev. and *S. afghanicum* (Vavilov) Roshev. as two similar species to *S. cereale* for Iran. This study showed that six accessions from the materials studied have spikes that are fragile in the terminal 1/3 part. Although, these could be determined as *S. segetale*, however regarding the whole features indicate that except for being fragile in terminal 1/3 part of spike they are fairly in the range of *S. cereale*, therefore following Fredriksen & Petersen (1998) these populations were determined as *S. cereale* subsp. *ancesterale* Zhuk. Neither of our examined herbarium specimens nor populations showed totally fragile spikes that is the diagnostic character of *S. afghanicum*.

Thus, we accept two species for the genus *Secale* in Iran: *Secale cereale* L. with two subsps. *cereale* and *ancesterale* Zhuk. and *S.*

strictum (C. Presl) C. Presl including subsp. *strictum* var. *strictum* and subsp. *strictum* var. *ciliatiglume* (Boiss.) Fred. & G. Petersen.

Taxonomy

Secale L. Sp. Pl.: 84 (1753)

Plants annual, biennial or perennial, usually the lower-most leaves with a hairy blade, otherwise glabrous, sometimes blades and nodes with a waxy coat, sheaths and auricles glabrous or with soft and short hairs, ligules small and membranous. Spikes terminal, rachis densely hairy with white hairs on the margins and only one spikelet on each node, rachis from easily disarticulated to totally tough. Spikelets usually contain two hermaphrodite florets rarely with a third hermaphrodite or sterile one. Glumes equal or unequal, narrow with a leathery texture and a nerve on the dorsal surface, with or without awn, 6.2-13 mm long. Lemma leathery, 5 nerved, gradually tapering to an awn with 3-100 mm length, keeled with a ciliated raw of curved bristles along the margin of keel. Palea membranous and double keeled. Pistil hairy with a bifid stigma. Lodicules two, cuneate, membranous and ciliate. Caryopsis free from lemma and palea, narrow and fusiform, sometimes oblong, hairy at apex. Chromosome number: 2n = 14, B chromosome was observed as well.

Key to the *Secale* species in Iran

1- Plants annual or rarely biennial, rachis totally tough to partly fragile in the terminal 1/3 part of the spike ***S. cereale*** s. lat.

- Plants biennial or perennial, rachis totally fragile ***S. strictum*** s. lat.

***S. cereale* L.**, Sp. Pl.: 84 (1753).

Plants annual or rarely biennial, with culms 43-187.5 cm long, nodes glabrous. Spikes terminal, erect or curved at the apex, rachis totally tough or fragile in the terminal 1/3 part, 2.5-22.9 cm long. Glumes awn-less or with a short awn at most 3.2 mm long. Lemma has an awn 10.5-100 mm long, lemma keel ciliated with a raw of strongly developed bristles, 0.4-1.6 mm long. Anthers 5-9 mm long. Caryopsis oblong, hairy at apex and yellow.

Key to the subspecies of *S. cereale*

1.Plants cultivated, rachis totally tough *S. cereale* subsp. *cereale*.

-Plants wild, rachis fragile in the terminal 1/3 part *S. cereale* subsp. *ancesterale*

S. cereale* L. subsp. *cereale

Plants cultivated or growing as a weed along or in the wheat and barley fields (Figs. 1 & 2).

Distribution. Cultivated all around the world, particularly in the Mediterranean areas.

Specimens seen. **Azarbayjan**: 2 km to Kaleibar from Ahar, 1670 m, Rahiminejad 14700 HIU. Ahar, 1450m, Rahiminejad 14705 HIU. Ahar to Kaleibar, Shindareh, 1430 m, Rahiminejad 14706HIU. Zanjir-Bolagh, 15 km to Ahar, 1410, Rahiminejad 14710 HIU. Tabriz to Ahar, 1570, Rahiminejad 14716 HIU. 70 km to Ardabil from Meshkin-Shahr, Rahiminejad, Dehghan, Saiedi & Sharifi 14671 HIU. 35 km to Kaleibar from Ahar, 1715m, Rahiminejad, Dehghan, Saiedi & Sharifi 14658 HIU. 15 km from Chaldoran to Khoy, 1856 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14659 HIU. On the road side of Maku- Khoy, before Gharazyaaddin, 1065 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14660 HIU. 15 km to Syahcheshmeh, in the protected area, 1950 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14661 HIU. 3 km to Maku from Bazargan, 1355 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14664 HIU. 50 km to Keshmesh-tapeh from Chaldoran, 1833 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14655 HIU. Kordestan: 60 km to Sanandaj from Kermanshah, 1680 m, Rahiminejad 14702

Fig. 1: *Secale cereale* L. subsp. *cereale*: 1. the general habit of plant, 2. one spike (a without a third floret, b with a third floret), 3. node, 4. ligule.

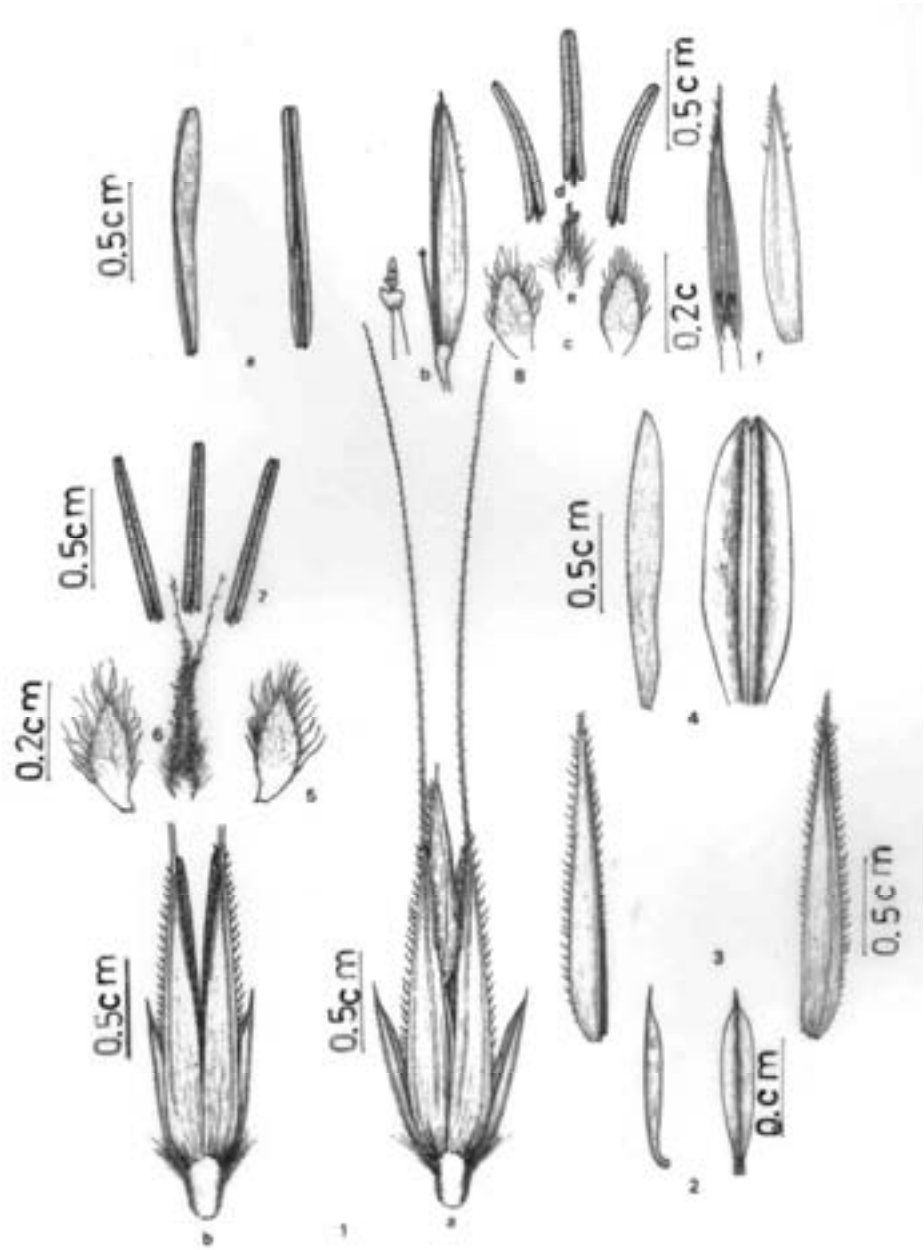

Fig. 2: *Secale cereale* L. subsp. *cereale*: 1. one spikelet (a with a third floret, b without a third floret), 2. Glume, 3. lemma (the lower one), 4. palea (the upper one), 5. lodicule, 6. pistil, 7. anther, 8. the general shape of the third floret a palea, b floret, c lodicule, d anther, e pistil and anther, and f lemma.

HIU. 10 km to Saghez from Sanandaj, 1419 m, Rahiminejad 14704 HIU. Divandareh to Saghez, Jenian, 1770 m, Rahiminejad 14708 HIU. 10 km to Saghez from Bookan, 1450 m, Rahiminejad 14711 HIU. 65 km to Saghez from Sanandaj, 1880 m, Rahiminejad 14714 HIU. 55 km to Sanandaj from Kamyaran, 1550 m, Rahiminejad 14717 HIU. 25 km to Divandareh from Sanandaj, 2100 m, 14715 HIU. 65 km to Sanandaj from Kamyaran, 1680 m, Rahiminejad 14719 HIU. **Kermanshah**: Harsin to Noorabad, 1520 m, Rahiminejad 14723 HIU. Kakavand area, 1770 m, Rahiminejad 14724 HIU. **Lorestan**: 40 km to Aligoodarz from Khomein, 1940 m, Rahiminejad 14712 HIU. Dorood, 1650 m, Rahiminejad 14721 HIU. **Bakhtyari**: Shamsabad, 1940 m, Rahiminejad 14709 HIU. Bazoft (Eskandari), after Chenar-rood to Daran 2200 m, Rahiminejad 14715 HIU. Bazoft, Dashtak, 1940 m, Rahiminejad 14729 HIU. Vardanjan 20 km to Shahreh-Kord, Hosseini 14724 HIU. Boroojen, Faradonbeh, Zamani 14723 HIU. **Isfahan**: 20 km Semirom to Hanna, Rahiminejad 14726 HIU. Daran to Aligoodarz, 2450 m, Rahiminejad 14727HIU. 10 km to Daran from Najafabad, 2280 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14673 HIU. **Markazi**: Malayer to Arak, 1840 m, Rahiminejad 14718 HIU. **Tehran**: Karaj, 1600 m, Moosavi 23516 TARI. Firoozkooh, TARI 14728. **Zanjan**: south of Soltaniyeh, 1800 m, Pabot 27932 TARI. South-East of Zanjan, Bor 21462 IRAN. **Mazandaran**: North of Kandovan, 2180 m, Pabot 2180 TARI. Sari to Behshahr, sea level, Saiedi & Hoseini, 13942 HIU. Behshahr to Galogah, 03 m, Sahebi & Dehghan 13943 HIU. **Khorasan**: Ghoochan to Mashhad, 1230 m, Saiedi & Hoseini 14680 HIU. Mashhad to Neishaboor, 1240 m, Saiedi & Hoseini 14685 HIU. Sabzehvar to Shahrood, 1100 m, Saiedi & Hoseini 14683 HIU. Azad-shahr to Bojnoord, 1950 m, Saiedi & Hoseini 14682 HIU.

***S. cereale* L. subsp. *ancesterale* Zhuk.** Trudy Prikl. Bot. 19, 2: 54 (1928).

Syn.: *S. segetale* (Zhuk.) Roshev., Trudy Bot. Inst. Akad. Nauk SSSR, ser. 1, Fl. Sist. Vyss. Rast. 6: 143 (1947).

Plants growing usually as wild or weed.

Distribution. Restricted mainly to a narrow area from Turkey in the West to the area around Lake Balkhash in the East (Frederiksen & Petersen 1998).

Specimens seen. Azarbayjan: Maragheh, Khezreloo, 1290 m, Rahiminejad 14713 HIU. Ahar, 1450 m, Rahiminejad 14720 HIU. Oroomieh, Solook, 2200 m, Sabeti 5059 TARI. Tabriz to Sahand, between Basmenj and Vayghan, 2100 m, Assadi 73983 TARI. Haris, high lands over looking Alan and Aghoosh, Ekoozdaghi, around Aieebolagh cheshmeh, 2325-2375 m, Olfat & Fathi 411 TARI. **Kordestan**: South of Sanandaj, 1650 m, Fatahi & Khaledian 427 TARI. Khanboneh, 1750 m, Fatahi 1457 TARI. North of Kerend-gharb, Barband, Zayedeh mountain, 1570-1980 m, Hamzeie & Hatami 1334 TARI.Between Sanandaj and Kamyaran, Nashoor valley, 1770-2200 m, Assadi 75173 TARI. Marivan to Saghez, 30 km to Saghez, 1500 m, Termeh 21468 IRAN. Marivan to Saghez, 50 km to Saghez, 1700 m, Termeh 21465/1 IRAN. Kamyaran to Marivan, Cheshmidar village, 1770 m, Rahiminejad, Dehghan, Saiedi & Sharifi, 14669 HIU. **Kermanshah**: Kerend mountains, at the beginning of Dalahoo road, 1700-2000 m, Assadi 60808 TARI. **Hamadan**: Asadabad, South and West of Gharavol-khaneh mountain, 2100-2500 m, Mozafarian 64659 TUH. **Isfahan**: Golpaygan, Sharifian 13445 TUH. **Bakhtyari**: Shamsabad, 1940 m, Rahiminejad 14407 HIU. **Tehran**: Homand-Absard, 1950 m, Moosavi 22787 TARI; Pabot 30838 & 30839 & 75173 TARI. Tondar, 34 km north east of Karaj, 2000 m, Amin & Bazargan 19324 TARI. **Khorasan**: Neyshaboor to Sabzevar, Saiedi and Hoseini 14684 HIU.

***S. strictum* (C. presl) C. Presl,** Fl. Sicul., praefatio: 46 (1826).
Syn.: *Triticum strictum* C. Presl, Cyper. et Gramin. Sicul.: 48 (1820). *S. montanum* Guss., Index sem. Hort. boccad. (1825). *S. montanum* var. *anatolicum* (Boiss.) Boiss. Fl. Or. 5: 670 (1884).
Plants biennial or perennial with culms 60-100 (150) cm, sheaths with or without hairs. Spikes erect and terminal, rachis totally fragile and easily disarticulated. Spikelets have two fertile florets. Glumes awn-less or with an awn at most 6 mm long. Lemma awn 4-50 mm long, lemma keel with strongly developed bristles 0.7-1.3 mm long. Anthers 5-10 mm long.

This species has two subspecies from which *S. strictum* subsp. *strictum* with two varieties occurs in Iran.

S. strictum* subsp. *strictum
Plants growing mainly as wild in dry mountainous oak woodland areas, along roadsides or as a weed in or along the edges of fields. This taxon grows naturally from Spain in the West to Caspian Sea in the east (Fredriksen & Petersen 1998).

Key to the varieties of *S. strictum* subsp. *strictum* in Iran
1. Culms, leaf blades and sheaths glabrous or covered with a mixture of scattered short and long hairs
S. strictum subsp. ***strictum*** var. ***strictum***
- Culms, leaf blades and sheaths densely covered with short hairs
S. strictum subsp. ***strictum*** var. ***ciliatiglume*** (Bioss.) Fred. & G. Petersen

S. strictum* (C. Presl) C. Presl subsp. *strictum* var. *strictum
Plants perennial, growing as wild in dry mountainous areas, specially in northern and western parts of Iran (Figs. 3 & 4).

Specimens seen. **Azarbayjan**: Maku, Boralan, 900 m, Seyami 6904 TARI. Oroomieh, Targavar, Pasan valley, 1520-1600 m, TARI 7229 and Ghasemloo, 1600 m, Sabeti 7091 TARI. 35 km to Ahar from Kaleibar, 1716 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14658 HIU. Khalkhal, 1600 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14676 HIU. Maku, Booralan-Damgheshlagh, Rahiminejad, Dehghan, Saiedi & Sharifi 14666 HIU. **Kordestan**: Sanandaj-Saghez, Sabeti 2146/1 & 2146/3 & 2146/4 IRAN. North-West of Kordestan, Pabot 21463/1 & 21463/2 IRAN. **Hamadan**: Kaboodrahang, Ghohrood, Sarajoogh, Kooheh-syah, 2000-2240 m, Mozafarian 26095 & 64644 TARI. 40 km to Hamadan from Malayer, 1940 m, Rahiminejad, Dehghan, Saiedi & Sharifi 14667 HIU. **Lorestan**: 47 km to the South-east of Khorramabad, 1850 m, Pabot 27935 TARI. 45 km on the road of Khorramabad to Nojian and Keshvar, 1850 m, Raunemark & Lazari 26095 TARI. **Bakhtyari**: Farsan, Babaheydar, Sefid-daneh, 2300 m, Ghahreman & Mozafarian 20045 TUH. **Mazandaran**: Kandavan, 2600 m, Gauba & Sabeti 21458/1 & 21458/2 IRAN. Albourz, Kandavan area, southern slopes, 2700-2900 m, Wendebo & Cobham 13450 TARI. Karaj to Chaloos, near Nesa, 2120 m, Assadi, Pakravan, Aminian & Nikchehreh 76581 TARI. Chaloos road, southern slopes of Kandavan, 2600 m, Ghahreman & Mozafarian 9783 TUH. **Golestan**: Gorgan, 1750 m, Wendelbo & Forooghi 12613 TARI. Almeh forest, 1680 m, Forooghi 7105 TARI.

***S. strictum* (C. presl) C. Presl subsp. *strictum* var. *ciliatiglume* (Boiss.) Fred. & G. Petersen,** Nord. J. Bot., 18 (4): 409 (1998).

Syn.: *Secale montanum* Guss. var. *ciliatiglume* Boiss., Fl Or. 5: 670 (1884).

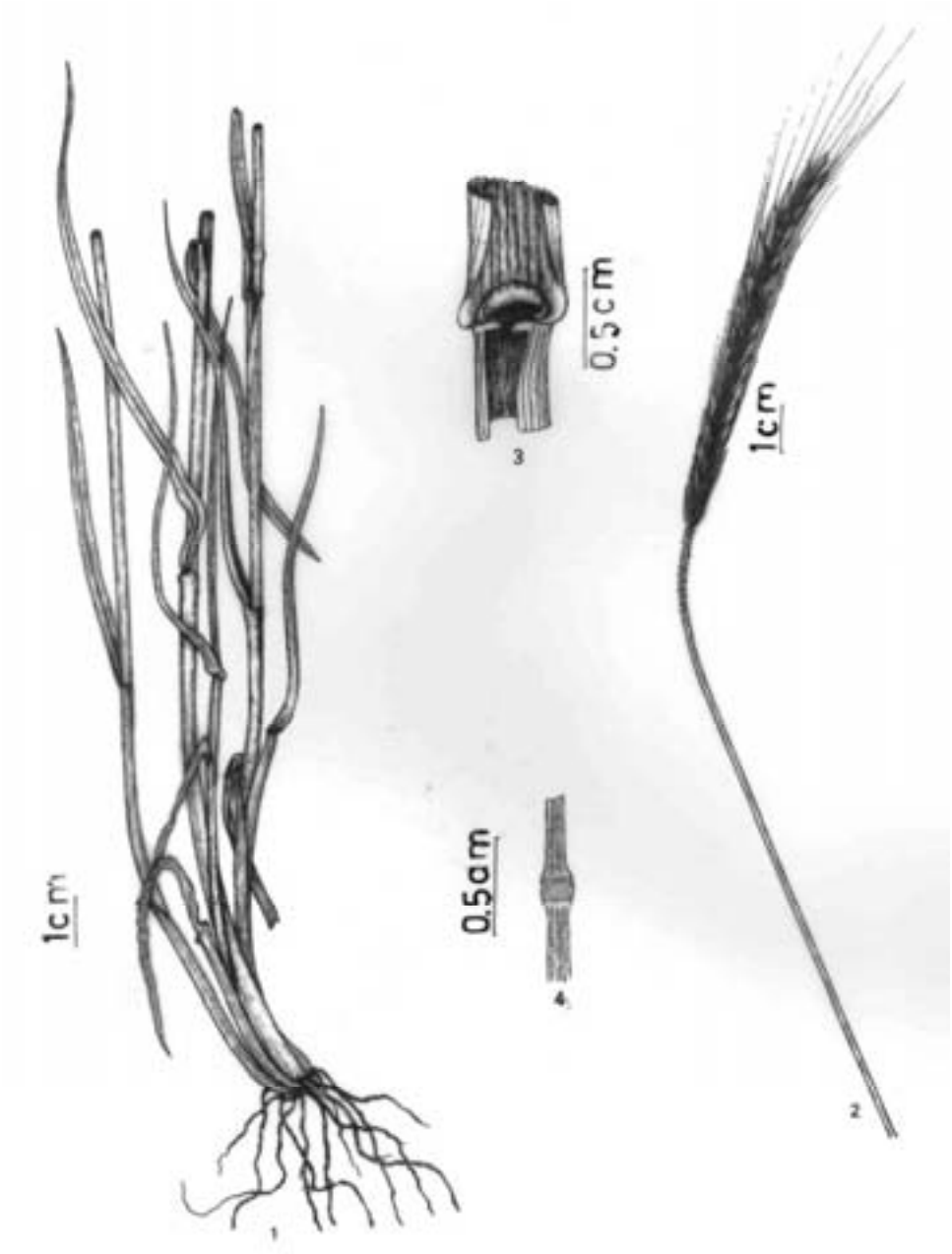

Fig. 3: *Secale strictum* (C. Presl) C. Presl subsp. *strictum* var. *strictum*: 1. the general habit of plant, 2. one spike, 3. auricle, 4. node.

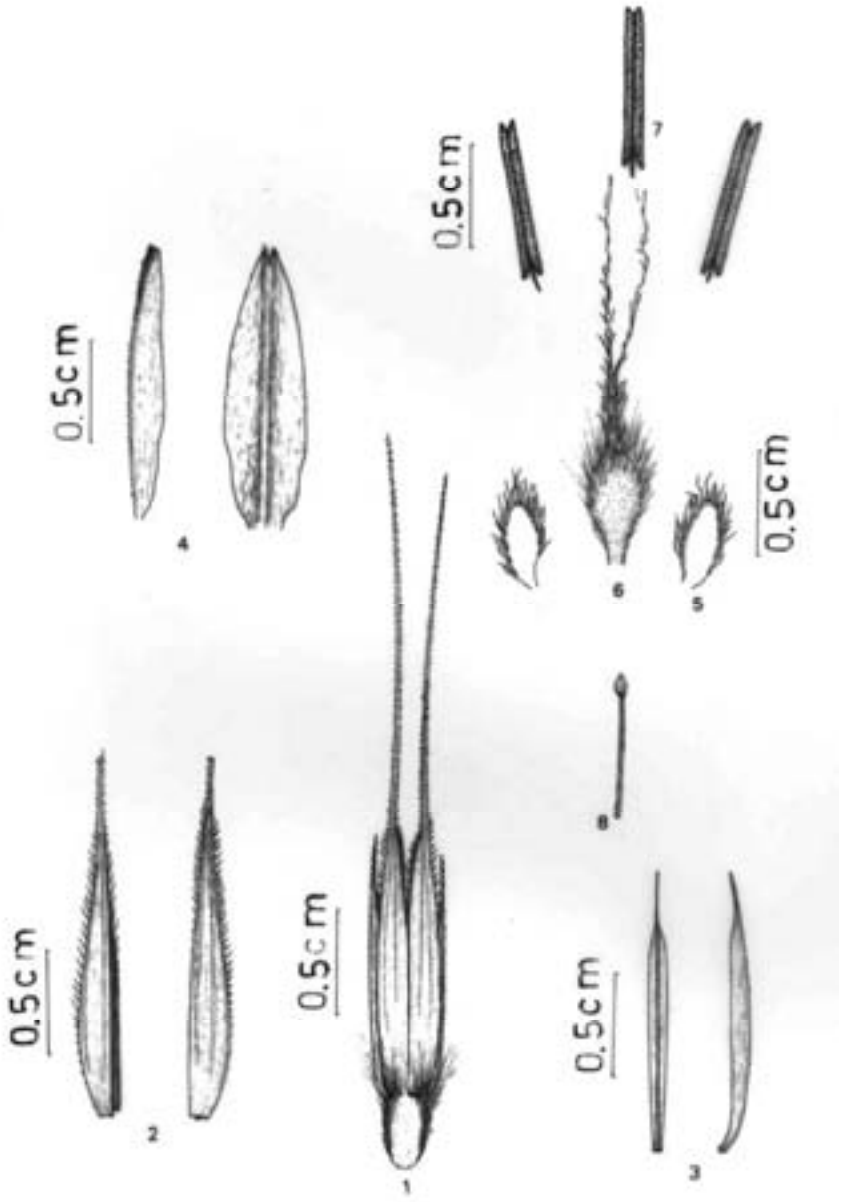

Fig. 4: *Secale strictum* (C. Presl) C. Presl subsp. *strictum* var. *strictum*: 1. one spikelet, 2. glume, 3. lemma, 4. palea, 5. lodicule, 6. pistil, 7. anther, 8. an appendix between two florets in the spikelet.

Plants perennial, growing as wild on dry and stony slopes.

Genaral distribution: Restricted to eastern Turkey, southern Armenia and North-West of Iran (Fredriksen & Petersen 1998).

Specimens seen. **Kordestan**: between Sanandaj and Divandareh, before Zaghpass, 2200 m, Assadi 78831 TARI. Marivan toward Baneh, 12 km before Chenareh, 1370 m, Ranjbar HBAU 5295.

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