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Source: Willdenowia, 30(1) : 105-113

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: https://doi.org/10.3372/wi.30.30109

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RÜDIGER WITTIG, YINGZHONG XIE, THOMAS RAUS & HILDEMAR SCHOLZ

Addenda ad Floram Ningxiaensem – Supplement to the flora of the Autonomous Region Ningxia, China

Abstract

Wittig, R., Xie, Y., Raus, Th. & Scholz, H.: Addenda ad Floram Ningxiaensem – Supplement to the flora of the Autonomous Region Ningxia, China. – Willdenowia 30: 105-113. 2000. – ISSN 0511-9618.

New records of eleven angiosperm taxa are given for the Autonomous Region of Ningxia, China. Eight taxa, viz. *Bromus carinatus, B. hordeaceus* subsp. *pseudothominei, Carduus acanthoides, Cynodon dactylon, Festuca arundinacea* subsp. *orientalis, Senecio vulgaris, Stellaria pallida* and *Tripleurospermum perforatum,* are new to the flora of Ningxia. The spontaneous occurrence of *Melilotus officinalis* is reported for the first time from Ningxia. *Poa annua,* which is given in the 'Flora Sinensis in Area Tan-Yang' for Ningxa but not included in the 'Flora Ningxiaensis', is confirmed for Ningxia. *Polygonum aviculare* subsp. *rectum* is the first report of an infraspecific taxon of this polymorphic species for Ningxia. Of these eleven taxa *Festuca arundinacea* subsp. *orientalis, Bromus carinatus, B. hordeaceus* subsp. *pseudothominei, Polygonum aviculare* subsp. *rectum* and *Tripleurospermum perforatum* were found exclusively in *Lolium perenne* lawns, indicating their introduction with lawn seeds. *Cynodon dactylon* was found at down-trodden parts of *Lolium perenne* lawns but also as a garden weed. *Melilotus officinalis* was found in ruderal sites, *Poa annua, Senecio vulgaris* and *Stellaria pallida* were found only in watered ornamental gardens.

Introduction

'Flora Ningxiaensis', the standard reference flora of the Autonomous Region Ningxia (Ma & Liu 1986, 1988), identifies 1492 phanerogamic species. Of this total, 126 are found only as cultivated plants; the remaining 1366 are either wild species or cultivated species that regularly escape from cultivation. In July 1999 the first two authors of this paper made a botanical excursion to China with stopovers in the towns of Yinchuan, Guyuan, Xiji and Yanchi, a visit to the Yunwushan Nature Preserve ("cloud forest") and a short stay at the Shahu ("sand sea") recreation area. During this excursion the authors collected nine species and one subspecies not mentioned in the 'Flora Ningxiaensis'. These were found in watered lawns, parks and gardens, at ruderal sites and less frequently at segetal sites. In addition, one species hitherto classified exclusively as a cultivated plant in the flora of Ningxia was also found on ruderal sites. A short report on the occurrence of these 11 taxa is provided in this paper. First, a brief characterization of the area of investigation is given.

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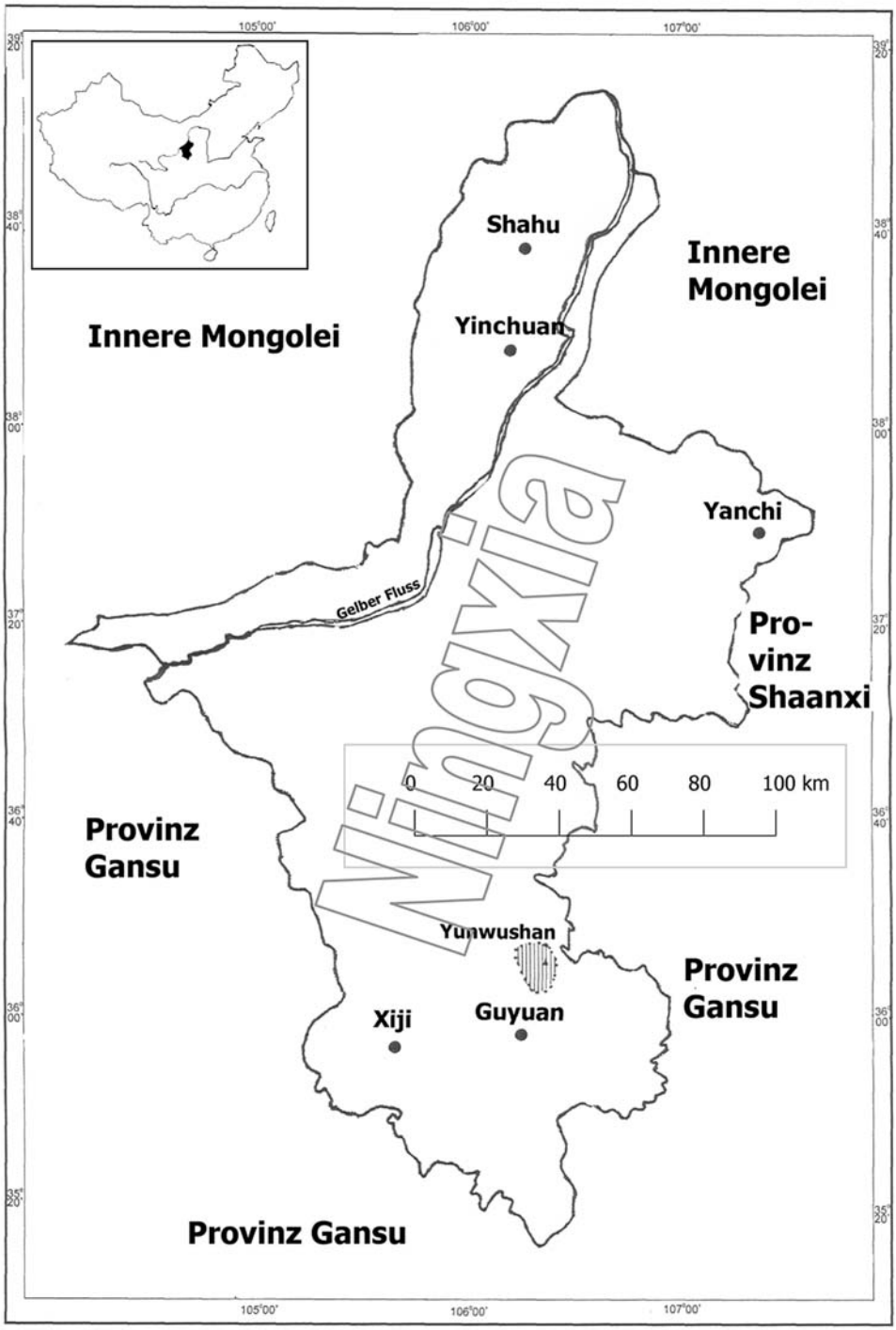


Fig. 1. Map of the Autonomous Region of Ningxia with the collecting localities mentioned in the text.

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Area of investigation

The Autonomous Region of Ningxia is located along the upper reaches of the Yellow River (Fig. 1) in N Central China. It covers an area of 66 400 km^2; its maximal extension is from 104°17' to 107°39'E and from 35°14' to 39°N.

To the west and south, the area adjoins the Mongolian highlands. The southern part is geographically part of the Chinese loess plateau. Across large areas, the entire autonomous region is part of the Chinese temperate steppes, which connect with the neighbouring arid deserts in the north and west over semi-arid plant communities. The Yinchuan Plain on the Yellow River is very heavily irrigated, however, to permit intensive farming (rice, wheat, sugar beets and maize). For this reason, relicts of natural or semi-natural vegetation can no longer be found even in small areas. Toward the south, the water balance is distinctly improved as the altitude increases in steps up to the Liupan Mountains, where various scrub communities are able to survive. In the alpine zone of the Liupan Mountains, more than 2000 m above sea level and not included in our investigation, semi-natural (secondary) deciduous summergreen forests and mixed deciduous-coniferous forests are the dominant types of vegetation.

Between the Yinchuan Plain in the north and the Liupan Mountains in the south, the landscape in the central part of Ningxia is characterized by ridges of loess hills with narrow valleys and small basins; locally fields of inland dunes are a typical feature. Steppe formations constitute the characteristic vegetation of this region. For centuries grazing (sheep, goats and cattle) has coexisted with farming (wheat, millet).

New records for the flora of Ningxia

Of the 11 species (Table 1) not listed or listed only as cultivated plants in the standard reference flora (Ma & Liu 1986, 1988), two are reported (albeit with no indication of the location) in the four-volume 'Flora Sinensis in Area Tan-Yang', which goes far beyond the Autonomous Region of Ningxia. This flora was published in the years 1988 to 1996 (Yu & al. 1988, Hsu & al. 1993, Hsu & Wang 1996a, b) as the result of a joint project involving numerous botanists working for three Chinese institutes (Officium Basis Modernae Agriculturae Ningxia, Scriminum Administrationis Animalis Domestici & Rustici Ningxia, Institutum Botanicum Boreali-Occidentali Shaanxi). Five of the species belong to the *Poaceae,* three to the *Asteraceae,* one each belongs to the *Brassicaceae, Caryophyllaceae, Fabaceae* and *Polygonaceae*. The taxa are listed in alphabetical order; short comments on their geographical distribution and their occurrence in Ningxia are provided. Three of the species are "world weeds", bound at all locations to human habitats (cf. Holm

Table 1. The taxa and their recorded occurrences in Ningxia.

Taxon	Locality				
	Guyuan	Xiji	Yunwushan	Yinchuan	Shahu
Bromus carinatus	.	.	.	●	.
Bromus hordeaceus subsp. *pseudothominei*	.	.	.	●	.
Carduus acanthoides	●	●	●	.	.
Cynodon dactylon	.	.	.	●	●
Festuca arundinacea subsp. *orientalis*	.	.	.	●	.
Melilotus officinalis	●	.	.	.	.
Poa annua	●	●	.	●	.
Polygonum aviculare subsp. *rectum*	●	●	●	●	●
Senecio vulgaris	●	●	.	.	.
Stellaria pallida	.	●	.	.	.
Tripleurospermum perforatum	.	.	.	●	.

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& al. 1997). The abbreviation "Fl. Sin." indicates that the species has been mentioned in the volumes of 'Flora Reipublicae Popularis Sinicae' published to date. Specimens of all newly discovered species were collected and deposited in the herbaria of the Botanic Garden and Botanical Museum Berlin-Dahlem (B) or the Senckenberg Research Institute in Frankfurt am Main (FR).

Bromus carinatus Hook. & Arn., *Poaceae*
Scattered in sown and regularly watered *Lolium perenne* lawns in front of public buildings in Yinchuan, especially in front of the Congress Center, 17.7.1999, *Wittig* (B, det. H. Scholz); (see Table 2, relevés no. 6, 8, 12).

Extremely laterally flattened spicules are characteristic of species in *Bromus* sect. *Ceratochloa* (P. Beauv.) Griseb., to which *B. carinatus* belongs. This multiform hexaploid (2n = 56) species (Pavlick 1955) is native to the Pacific states in the USA. During the last few decades, partly as a result of its cultivation for animal feed, this species has been spread widely along roads and paths, on embankments and in ruderal pasture communities in several parts of the northern hemisphere (e.g. in Europe). Two noticeable features of *B. carinatus* from China, which are probably attributable to regular mowing, are the relatively low length of the culms (below 50 cm instead of 1 m) and the narrow panicle. *B. carinatus* can be distinguished from its tropical relative, *B. catharticus,* which thrives in warm climates, by its narrower lemma with fewer veins (7-9 instead of 9-13) and longer awn. The plants are biennials or annuals; *B. carinatus* var. *hookerianus* (Thurb.) Shear is a perennial.

Bromus hordeaceus subsp. ***pseudothominei*** (P. M. Sm.) H. Scholz, *Poaceae*
Found at scattered locations in regularly watered *Lolium perenne* lawns in front of public buildings in Yinchuan, especially in front of the Congress Center, 17.7.1999, *Wittig* (B, det. H. Scholz); (see Table 2, relevés no. 11, 12, 15).

Originally described as a nothospecies (*Bromus* ×*pseudothominei* P. M. Sm.; *B. hordeaceus* L. subsp. *hordeaceus* × *B. lepidus* Holmb.), this subspecies is now generally classified as of non-hybrid origin (most recently by Acedo & Llamas 1999, as *B. pseudothominei*). Its small spicules and husk fruits are viewed as examples of "adaptation" to match the size of seeds of cultivated European grasses with small fruits, such as *Lolium* spp. and *Festuca* spp. (Smith 1968, Scholz 1970). In these populations, *B. hordeaceus* subsp. *pseudothominei* occurs as a weed and overall achieves a broad dissemination. The specimens collected in Ningxia have hairy spicules. For North America Pavlick (1995) described the characteristics of *B. hordeaceus* subsp. *hordeaceus*, which is not native to North America, and *B. hordeaceus* subsp. *pseudothominei* (both tetraploid, 2n = 28), and provided the following key to separate then:

– Lemma 6.5-8 mm long, usually bare, with broad or narrow, frequently angled skin-like edges; caryopsis usually as long as the palea . . . . . subsp. *pseudothominei*
– Lemma 8-11 mm long, usually with long or short hairs, with narrow blunt-angled edges; caryopsis shorter than the palea . . . . . subsp. *hordeaceus*

Carduus acanthoides (incl. *C. merxmuelleri* Kazmi), *Asteraceae* – [Fl. Sin. 78(1): 158]
Found frequently among the ruderal vegetation at the Guyuan Railway Station together with various species of *Melilotus* and *Artemisia*, 13.7.1999, *Wittig* (B, det. Th. Raus); found also in Xiji and in (overgrazed?) steppe pastures in and around the Yunwushan Nature Preserve.

Carduus crispus was previously considered the sole representative of this genus in Ningxia (Ma & Liu 1988: 304). The piercing thorns (to 4 mm long) on the edges of the leaves identify the plants from Guyuan as *C. acanthoides*. The weak, woolly, cobweb-like indumentum of the involucrum and the scattered, multicellular hairs on the upper surface of the leaves correspond well with the reference material from central Europe. Kazmi (1964: 367 & 519, Meusel & Schubert 1971: 175, fig. 33) recognise the E Asian populations of *C. acanthoides* (s.l.) as a separate species, *C. merxmuelleri,* on the basis of indumental and involucral features, which, however, ap-

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Table 2. Inventory of *Lolium perenne* lawns in Yinchuan (Ningxia, China). * = reference specimen deposited in the Berlin-Dahlem herbarium (B).

No. of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total coverage %	100	100	95	100	75	90	90	100	75	98	80	80	80	85	95
Lolium perenne L.	5	5	4	5	4	5	5	5	4	5	4	4	4	4	3
Festuca arundinacea subsp. *orientalis* (Hackel) Tzvelev*	1	+	2	+	2	1	+	1	2	2	1	1	.	+	+
Plantago major L.*	+	1	+	+	+	+	+	+	+	.	+	+	+	+	+
Melilotus dentatus (Waldst. & Kit) Pers.*	1	+	2	+	+	+	+	+	+	+	1	1	.	+	.
Elymus dahuricus Griseb.*	.	.	.	.	.	.	+	1	.	.	+	+	.	1	+
Artemisia sp.*	.	.	.	.	+	+	+	.	.	+	+	.	.	.	.
Bromus carinatus Hook & Arn.*	.	.	.	.	.	+	.	+	.	.	.	+	.	.	.
Lepidium apetalum Willd.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	
Bromus hordeaceus subsp. *pseudothominei* H. Scholz*	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+
Medicago lupulina L.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.
Cynodon dactylon Pers.*	.	.	.	.	.	.	.	.	.	.	.	.	.	2	3
Vicia sativa L.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Tripleurospermum perforatum (Mérat) Lainz*	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Convolvulus arvensis L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Eragrostis sp.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Calystegia hederacea Wall. & Roxb.*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Polygonum aviculare subsp. *rectum* Chrtek*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.

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pear too weak to substantiate a discontinuity to *C. acanthoides* (s. str.). Further studies must be performed to ascertain whether at least an infraspecific status is appropriate for the E Asian populations.

Cynodon dactylon (L.) Pers., *Poaceae*
Found scattered at down-trodden parts of *Lolium perenne* lawns (Table 2: relevés no. 14, 15) in the company of *Polygonum aviculare, Plantago major* and *Lepidium apetalum,* 17.7.1999, *Wittig* (B, confirm. H. Scholz). Also seen in watered gardens in the Shahu ("sand sea") recreation area.

This perennial with rhizomes and epigean creeping shoots and a finger-like arrangement of the spikes at the culm end similar to many species of *Digitaria,* includes multiform, diploid (2n = 18) and tetraploid (2n = 36) infraspecific taxa (De Wet & Harlan 1970). *C. dactylon* is found in all tropical and subtropical countries. The northernmost populations outside these areas are the frost-resistant *C. dactylon* var. *septentrionalis* (Asch. & Graebn.) Grossh. (according to Cvelev 1976 often characterized by a larger length-width ratio of the leaf lamina; perhaps a subspecies). *C. dactylon* is employed as a soil strengthener and for the creation of durable lawns. However, it is also a feared weed in plantations and field cultures, owing to its high competitiveness.

Festuca arundinacea subsp. ***orientalis*** (Hackel) Tzelev, *Poaceae*
Found very frequently in sown, intensely watered *Lolium perenne* lawns in front of public buildings and hotels, as well as in parks, in Yinchuan, 15.7.1999, *Wittig* (B, confirm. H. Scholz) (Table 2, relevés no. 1-12, 14, 15).

On the basis of the available material, the newly found *Festuca arundinacea* Schreb. from China most likely represents *F. arundinacea* subsp. *orientalis*. With awns to 2 mm long on the upper lemma and the smooth sheaths of the lower leaf shoots, the plants correspond well with the characteristics listed by Cvelev (1976) in the identification key for *F. arundinacea* subsp. *arundinacea*. Representing links in the tetraploid to decaploid *F. arundinacea* complex (2n = 28-70), these two subspecies (hexaploid, 2n = 42) occur in geographically separated areas in W Eurasia, where they are both native: *F. arundinacea* subsp. *orientalis* is found in the continental eastern part of this region, while *F. arundinacea* subsp. *arundinacea* tends to be found more in the western part influenced by the Atlantic. One of the ancestral species is presumably the diploid (2n = 14) *F. pratensis* Huds. (Jauhar 1933), which is known only in anthropogenic meadows and pastures and never grows genuinely in the wild. In temperate climates *F. arundinacea* has been widely disseminated through agriculture and has undergone many different changes, which make its taxonomy difficult (cf., e.g., Aiken & Darbyshire 1990).

Melilotus officinalis Poll., *Fabaceae* – [Fl. Sin. 42(2): 300]
Found in ruderal vegetation at Guyuan Railway Station as well as on the grounds of a filling station on the Guyuan-Xiji road, 13.7.1999, *Wittig* (B).

This species is listed exclusively as a plant cultivated for animal feed by the standard reference floras of Ningxia (Ma & Liu 1986: 345, Hsu & al. 1993: 402), spontaneous occurrences are not mentioned. At the two localities where specimens of *M. officinalis* were collected, it had not been cultivated but was growing together with *M. albus, M. dentatus, Artemisia* spp., *Agropypron desertorum, Carduus acanthoides, Setaria viridis, Chenopodium album*, other *Chenopodium* spp. and other ruderal species, thus in spontaneous populations strongly reminiscent of European sweet clover communities (Echio-Melilotetum Tüxen 47 = Melilotetum albo-officinalis Sissingh 50; Oberdorfer 1983: 258-261). No conclusions can be drawn about the degree of naturalization on the basis of these individual findings.

Poa annua L., *Poaceae* [Holm & al. 1997: 585]
Weed found in flower tubs and raised flowerbeds, relatively common in Xiji, 12.7.1999, *Wittig* (B, confirm. H. Scholz), also found in individual cases in watered gardens; found scattered at corresponding locations in Guyuan and (very rarely) in Yinchuan.

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This species was not mentioned by Ma & Liu (1988: 413). Yu & al. (1988: 42) described it as "on the whole widespread" in Ningxia, a statement that does not coincide with our observations. It is significant in this context that *Poa annua* has been known in neighbouring Mongolia only since the late 1970s (Hilbig & Schamsran 1980). This easy-to-identify, usually short-lived ruderal (and segetal) species is considered indigenous to Europe and parts of W Asia. It is believed to be an allotetraploid (2n = 28) derivative from the crossing of the diploids *P. supina* Schrad. and *P. infirma* Kunth. However, analysis of the karyotypes fails to substantiate this hypothesis. As a result, origins and lineage of *P. annua,* a species today virtually ubiquitous, remain unclear.

Polygonum aviculare subsp. ***rectum*** Chrtek (*P. heterophyllum* Lindm., nom. illeg.), *Polygonacae* – [Fl. Sin. 25(1): 7; Holm & al. 1997: 596]
Found at roadsides in Xiji; in wheat fields near Yanchi (all B, det. H. Scholz); in the company of *Cynodon dactylon, Plantago major* and *Lepidium apetalum* at down-trodden parts of *Lolium perenne* lawns in Yinchuan, 12.7.1999 (Table 2, relevé no. 14), also in Guyuan, Shahu and Yunwushan, *Wittig* (all B, det. H. Scholz).

Polygonum aviculare L. is a common ruderal plant ("trampled plant") in Ningxia; it is often found in human settlements and occurs regularly in cultivated fields. The specimens collected in park lawns in Yinchuan and fields in Yanchi proved to belong to subsp. *rectum*. Characteristic features of this subspecies are the more or less grey-greenish pointed leaves and the deeply partitioned perigon, which is shorter than the fruit (the latter up to 2.5 mm long). In contrast, in *P. aviculare* subsp. *aviculare* at least the lower leaves are blunt-tipped and the perigon is usually longer than the fruit, which is up to 3 mm long. Although the Chinese reference works do not distinguish subspecies of *P. aviculare,* they do cite synonyms for the two subspecies.

According to Wisskirchen & Haeupler (1998: 379, additional references at that location), "*P. aviculare* (s.l.) appears to be an anthropogenic weed in cultivations". The species encompasses morphologically indistinguishable tetraploids (2n = 40) and hexaploids (2n = 60), which are indigenous to Europe.

Senecio vulgaris L., *Asteraceae* [Holm & al. 1997: 749]
Rare in flower tubs and watered ornamental gardens in Xiji, 12.7.1999, *Wittig* (B, confirm. Th. Raus); usually in the company of *Chenopodium album, Ch. glaucum, Sonchus oleraceus, Poa annua* and *Capsella bursa-pastoris;* very rare at corresponding locations in Guyuan.

In view of the fact that this species was previously not known in Ningxia and found by us to be very rare, it is of some interest that *Senecio vulgaris* is a common weed in irrigated fields in neighbouring Mongolia (Hilbig 1982) and one of the most aggressive segetal species found outside rice fields in Japan (Kasahara 1954: 79, 1982: 287). Upon further inquiry, however, we found that Hultén & Fries (1986: 924, map 1848) did in fact note a large 'white area' in China for the distribution of this assimilated ruderal plant, which is today found on all continents. Since its introduction to China in 1915, this species has evidently not been able to spread widely from the location where it first entered the country and established itself, namely at the Forestry Botanical Garden at Tsingtau (Qing Dao) on the Shandong peninsula. The plants collected in Xiji have no ray flowers and only a sparse woolly indumentum. They thus represent the phylogenetically young ruderal biotype of this species (*S. vulgaris* var. *vulgaris;* 2n = 40) capable of producing several generations per year. This biotype has probably evolved in W Asia via ligulate winter annual forms with pronounced seed dormancy and frequently denser indumentum (*S. vulgaris* var. *denticulatus* (O. F. Müll.) Hyl. ≡ *S. vulgaris* subsp. *denticulatus* (O. F. Müll.) P. D. Sell) by a doubling of the chromosome set (Kadereit 1984, Comes & al. 1997) from *S. vernalis* Waldst. & Kit. (2n = 20).

Stellaria pallida (Dum.) Crépin, *Caryophyllaceae*
Very rarely in heavily watered flower tubs and gardens in Xiji, 17.7.1999, *Wittig* (B, det. H. Scholz); it is invariably found in plant communities with *Poa annua*.

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This species can be distinguished from *Stellaria media* (L.) Vil., under which name it was first noted and collected in Xiji, by the absence of petals, shorter (i.e. only 2-3 instead of 3.5 mm long) and narrower sepals, smaller (0.5-0.8 instead of 0.8 to 1.3 mm diam.) seeds (Chater & Heywood 1993: 162) and its flowering cycle. In the part of Europe where it is indigenous, this fragile plant with faded green leaves and a precariously short lifespan can be found in spring or early summer mainly in dry, sandy, ruderal ornamental lawns. The diploid *S. pallida* (2n = 23) is considered, perhaps unjustifiably, to be one of the ancestral species of the hardier *S. media*, a species that germinates and flowers all year round (2n = 40, 44).

Tripleurospermum perforatum (Mérat) Laínz (*T. inodorum* (L.) Sch. Bip.), *Asteraceae* [Fl. Sin. 76(1): 53]
Very rare in *Lolium perenne* lawns in Yinchuan, *Wittig* (B, confirm. Th. Raus); (see Table 2, relevé no. 13).

The area in Ningxia where this species occurs as an adventitious plant is disjunct from the E Asiatic subarea (NE China, Korea, Japan) of this species. The nomenclature used here for this weed, which is presumably derived from *T. maritimum* (L.) W. D. J. Koch, of N Europe, is based on the rejection of the illegitimate name *Matricaria inodora* L. by Rauschert (1974). However, this view is still a matter of controversy (Wisskirchen & Haeupler 1998: 530).

摘要：本文首次论述了 *Bromus carinatus*、*B. hordeaceus* subsp. *pseudothominei*、*Carduus acanthoides*、*Cynodon dactylon*、*Festuca arundinacea* subsp. *orientalis*、*Senecio vulgaris*、*Stellaria pallida*、*Tripleurospermum perforatum* 等八种植物在中国宁夏的新分布。文中同时首次报道了 *Melilotus officinalis* 在中国宁夏的野生分布，并确定在该地区广泛分布的 *Polygonum aviculare* 为该种系中的亚种 *Polygonum aviculare* subsp. *rectum*。对《宁夏植物志》中不包含的另外一个种 *Poa annua*（《中国滩羊区植物志》中有宁夏分布的记录），在宁夏多处发现，并对其特征进行了相关描述。研究结果表明，*Festuca arundinacea* subsp. *orientalis*、*Bromus carinatus*、*B. hordeaceus* subsp. *pseudothominei*、*Polygonum aviculare* subsp. *rectum* 及 *Tripleurospermum perforatum* 只分布于 *Lolium perenne* 人工草坪中。因此，它们极有可能是随草坪草种一起新定居的植物种。*Cynodon dactylon* 集中分布于 *Lolium perenne* 草坪中极度践踏的地段，但作为杂草在花园中也有零星分布。*Melilotus officinalis* 多在路旁分布。*Poa annua*、*Senecio vulgaris* 及 *Stellaria pallida* 则只在具有灌溉条件的草地和花园中出现。

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