Plant Species with Spontaneous Reproduction in Homegardens in Eastern Tyrol (Austria): Perception and management by women farmers

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Research

Abstract

Plant species in Alpine homegardens in Eastern Tyrol (Austria) are managed along a continuum that ranges from species which are planted or sown every year to species which are left to spontaneously reproduce in the gardens. The importance, management practices and the cultural context of spontaneously reproducing species was studied in 196 gardens in the years 1997/98 within an ethnobotanical inventory. Respondents do classify species with spontaneous reproduction in "not welcome", "tolerated" or "welcome" species. These categories are not mutually exclusive. Plants may be placed in one or more of them, because plants are managed differently by different gardeners. The first two categories have in common, that species have not been introduced actively by the gardener. They are soil borne or dispersed e.g., by wind or birds. "Not welcome" species are weeded as they germinate; "tolerated" species have a certain purpose, and therefore left to grow after harvest of the useful plant organ. From the total of 330 plant species with spontaneous reproduction found, 133 are "not welcome" and 26 plant species are "tolerated". In recent history, weeded species have always been used for fodder or as medicinal plants. Today only a few gardeners recognize these uses. Species classified to be "welcome" (230 species) were almost all actively brought into the garden once. Without active propagation these plant species reproduce spontaneously now. Women farmers estimate the "welcome" species and their contributions to the farmers' family, because of the diversity of their uses, the low labor input required for their management and as an opportunity to save money.

Introduction

The management of plant species in agriculture or horticulture does not exclusively involve sowing and planting as means to establish plant populations. Many species also emerge spontaneously. Generally, spontaneously emerging plants in agricultural and horticultural plots are undesired and subsumed under the concept of 'weeds' (e.g., Baker 1991). Such species are combated in many cases with labor- and money-intensive strategies (e.g., Aldrich & Kremer 1997, Rao 2000). Nevertheless, accounts from many parts of the world confirm that not all spontaneously emerging species in agricultural and horticultural plots are eliminated, but are used in a variety of ways, e.g., in Mexico (Bye 1993, Caballero & Mapes 1985, Rendón *et al*. 2001, Vieyra-Odilon & Vibrans 2001, Vogl *et al*. 2002); in Amazonia (Padoch & deJong 1991); in Zambia (Åfors 1994); in Bangladesh (Millat-e-Mustafa *et al*. 2000); in Laos (Kosaka *et al*. 2006); in Nepal (Daniggelis 2003) and in Spain (Catalonia) (Agelet *et al*. 2000).

Biologists who specialize in weed evolution (Baker 1991, De Wet & Harlan 1975, Harlan & De Wet 1965) see weeds as the intermediate stage in the evolution from wild to cultivated plants. This incipient interaction between people and weeds is one route towards domestication: farmers and gardeners tolerate, encourage or protect spontaneously emerging plants on their homesteads (cf. Anderson 1950, cf. Bye 1993). Such management is a labor- and

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money-saving strategy that increases the number of useful plant species (e.g., Datta & Banerjee 1978, Hanf 1998). A certain species may not be tolerated in one site, but be encouraged in another (Bye 1993). Selection criteria may involve robustness (Rendón *et al*. 2001) or being generally considered valuable (Millat-e-Mustafa *et al*. 2000).

One site, where intentionally (cultivated) and unintentionally (weeds) grown plants (Anderson 1939) frequently appear together, are farmers' home gardens. In alpine mountainous areas home gardens are a typical element of land-use (Bitterlich & Cernusca 1999, Jungmeier 1997) within the mosaic of agro-ecosystems managed by farmers (Vogl-Lukasser 2000). However, this kind of land-use is small in area, not market-oriented, and managed by women. It may be that these factors are responsible for the fact that home gardens have been neglected (IPGRI 2000) and that scientific research on farmers' home gardens - despite recent increased popularity of gardening - has not been realized, especially in temperate, arid and semi-arid zones (Huai & Hamilton 2009). This is true for Europe too, with only few exceptions (Agelet *et al*. 2000, Brun-Hool 1980, Thompson *et al*. 2003, Vogl & Vogl-Lukasser 2003, Vogl-Lukasser & Vogl 2002, 2004, 2005). Further, the study of species with spontaneous reproduction in home gardens, whether they are intentionally or unintentionally grown, seems to be nonexistent in Europe, despite the importance of these species for farmers.

This paper examines spontaneously germinating plants in the home gardens of women farmers in Eastern Tyrol, Austria. We describe the species composition, use and importance of these plants and discuss factors influencing the women's management decisions. We do believe that research on home gardens and on species with spontaneous reproduction do have important implication for maintaining the beloved diversified pattern of landscape elements in the Alps, for conservation and for the well being of the rural population and its visitors.

Study Area

The district of Lienz (Eastern Tyrol) is located in the Austrian part of the Eastern Alps with the Grossglockner (3,797 m) as its highest peak. The region stretches across 2,020 km^2 and is home to 49,000 inhabitants living in 33 villages. The study area includes the mountain range of the Hohe Tauern, which contains a national park.

The large altitudinal gradient from 600 m to almost 4,000 m above sea level gives rise to a narrow sequence of different natural and agricultural zones. At the lowest level, the natural vegetation consists of deciduous and mixed forests characterized by beech (*Fagus sylvatica* L.) and fir (*Abies alba* Mill.). However, these forests have only survived in small enclaves due to the great modifications by humans over a long period of time. Spruce (*Picea abies* (L.) H. Karst.) forests start at 1,000 m a.s.l., and extend to about 1,700 m a.s.l., to be replaced by open woods with larch (*Larix decidua* Mill.) and mountain pine (*Pinus mugo* Turra) at elevations of about 2,100 m a.s.l.. Above the treeline, dwarf shrubs form a transition to the high alpine grass formations and lichens at the upper limit of vegetation (Gärtner 2001). Annual precipitation in the district of Lienz (Eastern Tyrol) is 850 - 1150 mm and mean annual temperature is 4.8 - 6.9 C (Waschgler 1993).

The historical form of agriculture in Eastern Tyrol can be described as mountain cereal-grazing (Netting 1981). This subsistence system, with arable farming (e.g., cereals, field vegetables, fiber crops) and dairy cows as main components, existed until the 1970s. In the last three decades, cereals and fiber plants have almost completely disappeared due to unfavorable economic circumstances and their high labor requirement. These crops were replaced by meadows and pastures for cattle. Only home gardens and small vegetable plots still play an important role in subsistence for local people (Vogl-Lukasser 2000).

The farms surveyed were situated between 600 and 1,641 m a.s.l. The average area of agricultural land located near the homestead is seven hectares, and mainly consists of hay meadows. As one element of the homestead, forty-seven per cent of the surveyed farms have small plots (average size 0.01 hectares) of field vegetables (mainly potatoes, *Solanum tuberosum* L.) grown on moderate slopes. Special cultivations (e.g., orchards) are an average of 0.01 hectare in size. All farms surveyed do manage home gardens between twelve m^2 and 220 m^2 of size. In addition, most farmers own forests, as well as alpine meadows at 2,000 m a.s.l. and above, which are used as summer grazing grounds and for hay production. On average, each of the study households keeps twelve dairy cows, two pigs, twelve hens and 30 sheep. Fifty per cent of the farms studied are still managed on a full-time basis; the other 50% are part-time farms, i.e., managed by farmers that earn most of their income through off-farm labor (Vogl-Lukasser 2000).

Methods

This analysis of the spontaneously reproducing plant species in home gardens was part of a larger project on home gardens in Eastern Tyrol. In this project, 196 home gardens on farms in 12 villages in Eastern Tyrol were investigated as part of an ethnobotanical survey on home gardens from 1997 -1998 (e.g., Vogl & Vogl-Lukasser 2003, Vogl *et al*. 2004 Vogl-Lukasser 2000, Vogl-Lukasser & Vogl 2004, 2005). The villages were selected purposefully to represent all valleys and sub-regions that form part of the district of Lienz, ensuring that also less accessible areas were represented. In both years, on each of three dates spread over the vegetation period, all plant species occurring in the home gardens were recorded. During the surveys in the gardens, the female farmers, who

were responsible for garden management, were asked by means of structured interviews (cf. Bernard 1997) about each plant species (including species which were not welcomed) on its origin, management, use, name, etc. (see Vogl *et al*. 2004).

Whenever possible, a sterile or fertile plant voucher specimen was collected and added to the authors' collection which is deposited at the University of Agricultural Sciences, Vienna [Herbarium, Institut für Botanik, Universität für Bodenkultur, WHB]. It was not possible to collect voucher specimens of all spontaneously growing species for two reasons: Firstly, non-tolerated species are undesired, weeded and thus the occurring specimens are in most cases not mature plants in fruit or flower, but seedlings. Therefore, determination was carried out in the field by means of the seedlings. Nomenclature follows Fischer (1994) and Hanf (1990) (with a key for seedlings). Secondly, tolerated and welcomed species are used by gardeners, and in several cases, where they grew in very low abundance, the gardeners did not give permission to collect specimens.

In addition to the above mentioned structured interviews, semi-structured interviews were carried out with 26 elderly women who managed home gardens in the past, but no longer do so. They were asked to talk about the management of gardens during the last 70 years in Eastern Tyrol. One part of these interviews was dedicated to discovering present and past knowledge on the management of spontaneously reproducing plants in the gardens. From 2001-2002, five further in-depth interviews were carried out with five local experts from the sample of 196 gardeners to extend this topic and learn more about the management of some specific spontaneously reproducing plant species.

Results

Flora of the home gardens

In the 196 observed home gardens in Eastern-Tyrol, a total of 693 plant species was documented. According to the gardeners, these 693 species are a combination of plants

- 'that are planted or sown every year' (sources for the annually deliberately sown and/or planted species, of course all of these are welcomed, may be seeds and plantlets from retailers or neighbors, or own seeds.); and
- 'that come up on their own ('**dei kemmen olle Johr va selbo**').

The category of all species 'that come up on their own' (might be annual, biannual, perennial species and include domesticates or any other kind of categories used by scientists to classify plant species) is divided into plant species,

- that 'only grow' and do not reproduce in the gardens;
- that 'also reproduce' in the gardens (either vegetatively and/or generatively). Three hundred and thirty plant species were recorded in this category, called here 'spontaneously reproducing species'.

These 330 spontaneously reproducing species are managed by the respondents along a gradient (Table 1) according to the degree of 'welcomeness':

- 'not welcomed' (133 species);
- 'tolerated' (26 species);
- 'welcomed' (230 species).

These categories are not mutually exclusive. Plants may be placed in one or more of them, because plants are managed differently by different gardeners.

Spontaneously reproducing 'not welcomed' species

Most not welcomed plant species occur naturally in the gardens and have not been deliberately introduced (for exceptions see Table 4). Across all 196 home gardens studied, 133 species from 33 plant families were not welcomed plant species. The most important families are Asteraceae (15 species), Lamiaceae (twelve species), Brassicaceae and Caryophyllaceae (ten species). One hundred and six of these species are indigenous to central Europe, 20 are non-indigenous species (thereof 17 are naturalized). Seven species are of unknown origin. Of the 133 not welcomed plant species, 100 species are found exclusively in this category, i.e., 100 species are not welcomed by all the gardeners! The 33 species overlapping with other categories are probably due to differences in preferences and management practices of the gardeners.

The species distribution is highly variable. Only five of the 133 not welcomed species are found in more than 50% of the home gardens surveyed. The most frequent species (Table 2) are *Stellaria media* (L.) Vill. and *Taraxacum officinale* F.H. Wigg. Thirty-five species occur at a single location only. Between one and 28 not welcomed plant species are found in any one individual home garden.

Sixteen species of the group of not welcomed plant species have conservation status and can be found on the Austrian red list of endangered plants (as defined in Niklfeld & Schratt-Ehrendorfer 1999) (Table 3). Two of these species, *Vaccaria hispanica* (Mill.) Rauschert and *Asperula arvensis* L. (the species have the status 'near extinct' and 'extinct', respectively, in Austria!! see Table 3), must have either germinated from birds or birdseeds or been unintentionally introduced with plants/seeds bought from retailers. It is not proven that they spontaneously reproduce over a longer period of time, and it may be that they occur only in isolated instances in these gardens.

The local terms for not welcomed species are **Gross** (grass), **Woose** (turf), **Jotach** (from 'to weed') or **Unkraut**

Table 1. Qualitative and quantitative results on the occurrence of the 330 spontaneously reproducing plant species in female farmers' homegardens (n=196) in Eastern Tyrol, Austria.

Local classification	Not welcomed	Tolerated	Welcomed
Local description	**Mog I gor net** "I don't like them at all"	**Loss I holt stean** "I just let them be"	**Dei mechn olba wiedokemmen; Do pass I olba au, dass se wiedo selbo kemmen**. "They should always come back; I always watch to see if they come back by themselves"
Local term	**Gross**, **Woose**, **Jotach** "grass, turf, pulled-out weed"	**Do sogt man heint nimma Unkraut sondern Beikraut** "Nowadays, you no longer call it weed but **Beikraut***"	**Bluimin und Kräuto** "flowers and herbs"
Use	Not used	Sometimes used	Intensively used
Management	Weeded; sometimes knowledge of former use.	Tolerated until harvest of useful part, then weeded; sometimes not used but the knowledge that the species can be used is enough to allow the plant to grow, in some cases left until seeds are dispersed.	Protected: irrigated; supported with sticks; cutting back or weeding of surrounding vegetation; harvested or left until seed dispersal.
Possible origin of species	Natural occurrence (soil borne), introduced via wind or birds, etc.; or unintentionally introduced with plants from retailers	Natural occurrence (soil borne), introduced via wind or birds, etc.; or unintentionally introduced with plants from retailers	Once deliberately introduced by the gardeners
Number of species	133	26	230
Number of endangered species	16	No endangered species	54

*For the term **Beikraut** no English name is available; it is a non-discriminatory synonym for weeds.

(weed). These generic names are usually only used when the single species does not have any particular name in the local dialect. For 103 of the not welcomed plant species no specific names could be recorded (these species only occurred in single gardens). For 30 of the not welcomed plant species the gardeners have specific local names. For twelve of these species, different terms exist in the local dialects (at least more than one local name). Of the five most frequent not welcomed species four have more than one local name (Table 2).

Table 2. The 5 most frequent not welcomed species, i.e. species present in >50% of the 196 homegardens in Eastern Tyrol, Austria.

Family	Species	Local name	English name	Number of gardens
Caryophyllaceae	*Stellaria media* (L.) Vill.	**Kretscha**, **Kratscha**, **Hiadarme**, **Hiandoponze**, **Hiagepanze**	chickweed	155
Asteraceae	*Taraxacum officinale* F.H. Wigg.	**Maibluime**, **Lugnere**	dandelion	141
Apiaceae	*Aegopodium podagraria* L.	**Kralfiaße**, **Wossolaab**, **Ackermolch**, **Kitzalaab**, **Gaasfiaße**, **Huhnschritt**, **Hennprotzn**, **Schierling**, **Huhnfuiß**	round elder	135
Poaceae	*Poa annua* L.	**Fuißgross**, **Stöcklgross**, **Saugross**, **Sauwoose**, **Punzwoose**	annual meadow grass	121
Lamiaceae	*Lamium purpureum* L.	no local name, only German name (**Rote Taubnessel**)	red dead nettle	101

Table 3. The 16 not welcomed species in home gardens in Eastern Tyrol, Austria which can be found on the Austrian Red List of endangered ferns and flowering plants (Niklfeld & Schratt-Ehrendorfer 1999; 0 = extinct; 1 = near extinct; 2 = critically endangered; 3 = endangered; 4 = potentially endangered; r! = [endorsement to 1, 2, 3, or 4] regionally more strongly threatened; - r = not in the whole of Austria, but regionally endangered).

Family	Species	Number of gardens	Red List
Asteraceae	*Arctium lappa* L.	1	- r
Boraginaceae	*Anchusa arvensis* L.	1	3
Brassicaceae	*Sisymbrium strictissimum* L.	2	- r
Caryophyllaceae	*Cerastium glomeratum* Thuill.	4	- r
	Spergula arvensis L.	1	- r
	Vaccaria hispanica (Mill.) Rauschert	1	1 r!*
Chenopodiaceae	*Chenopodium bonus-henricus* L.	8	- r
	Chenopodium glaucum L.	6	- r
Crassulaceae	*Sedum album* L.	1	- r
Fumariaceae	*Fumaria officinalis* L.	4	- r
Geraniaceae	*Geranium pusillum* Burm. f. ex L.	21	- r
Lamiaceae	*Lamium amplexicaule* L.	3	- r
Rubiaceae	*Asperula arvensis* L.	1	0*
	Galium mollugo L.	3	- r
Scrophulariaceae	*Veronica agrestis* L.	16	- r
	Veronica polita Fr.	13	- r

**Vaccaria hispanica* (Mill.) Rauschert and *Asperula arvensis* L. must have either germinated from birdseeds or been introduced with plants/seeds from retailers.

In the study area, it was previously traditional and essential for subsistence that all of the 'weeded' plants were used as fodder (**Gross**) for goats, pigs and even for cows. According to the elder women the term 'weed' was not used at all in former times, but rather the term '**Gross**' (grass), emphasizing the former use as fodder. However, not only the weeded plants as a whole but also specific species of the category of not welcomed species were mentioned by elderly women as essential for subsistence. From the 133 not welcomed species, 41 species are traditional medicinal species and 15 traditional fodder plants. According to these elderly women who no longer manage a garden, the two very common species *Stellaria media* (L.) Vill. and *Aegopodium podagraria* L., for instance, used to be popular for feeding hens and pigs. During the study, however, only seven active gardeners reported that these species can be used as such, but even they hardly use the plants this way. None of the gardeners tolerate these species in the garden. Some active gardeners also reported uses for the species *Arctium lappa* L. (medicinal), *Geranium robertianum* L. (medicinal), *Potentilla anserina* L. (medicinal), *Vicia cracca* L. (fodder), *Vicia sepium* L. (fodder), *Lathyrus pratensis* L. (fodder) and *Chenopodium album* L. (food). These species are not tolerated and not used any more.

Gardening has experienced a revival and is currently practised very intensively in the region. Nevertheless, herbicides are not used at all: weeding is normally done by hand. The weeding process is sometimes called '**jäten**' (weeding) but most women describe the process as '**sauber machen**' (cleaning up the garden), '**richten**' (arranging the garden), '**schön machen**' (embellishing

Table 4. The seven species that have been deliberately introduced but then reclassified by the respondents as not welcomed species in home gardens in Eastern Tyrol, Austria.

Family	Species	Origin (Fischer 1994)
Apiaceae	*Pastinaca sativa* L.	indigenous (but introduced as a cultivar into the garden)
Asteraceae	*Chamomilla recutita* (L.) Rauschert	naturalised
	Solidago canadensis L.	naturalised
Boraginaceae	*Borago officinalis* L.	occasionally naturalised
Lamiaceae	*Satureja hortensis* L.	non-indigenous
Solanaceae	*Physalis alkekengi* L. var. *franchetii* (Mast.) Mak.	non-indigenous
Vitaceae	*Parthenocissus quinquefolia* (L.) Planch. emend. Rehd.	non-indigenous

the garden), '**dribagstonn**' (retouching the garden) or simply 'going into' the garden.

Management practices that facilitate or discourage the spread of not welcomed plants are well distinguished by the respondents. Watering only the welcomed species is a usual practice. Therefore watering by hand using a watering can is obligatory especially in springtime. Mulching is also practised to combat not welcomed species.

Nevertheless, the most important management practise to control not welcomed species is weeding. The weeding process is not always seen as an unpleasant obligation. Gardeners see weeding as cleaning the garden, and do so with pleasure especially when they have the opportunity to weed regularly. Women explain that they have enough time to keep the gardens 'weed-free' during the critical period in springtime. Only during summer, when there is plenty of other work on the farm, women sometimes complain that the garden is left unattended. At the same time, they report that not so much attention is required in summer since the welcomed species have already grown and therefore are competitive, so weeding ceases to be important.

An inverse correlation between the pleasure of weeding and the difficulty of removing not welcomed species is made by some of the gardeners: species which can be easily removed are popular and the work is seen to be easy and pleasant, while species which are difficult to remove are unpopular. These categories are closely related to the plants' life cycles. Women report that the species which can be removed easily are annual species which reproduce by seeds (e.g., *Galinsoga* sp., *Capsella bursa-pastoris* (L.) Medik., *Chenopodium album* L., *Galeopsis tetrahit* L.). Women pay close attention to ensure that these species are removed before seeds are dispersed.

Species which are difficult to remove are those which reproduce vegetatively. The women must ensure that no roots, runners or rhizomes remain in the ground (e.g., *Aegopodium podagraria* L., *Trifolium* sp., *Elymus repens* (L.) Bould).

Spontaneously reproducing 'tolerated species'

Twenty-three of the 26 tolerated plant species occur naturally in the gardens, i.e.,, have not been deliberately introduced. The three exceptions are *Myosotis sylvatica* Ehrh. ex Hoffm., *Bellis perennis* L. and *Viola tricolor* L. ssp. *tricolor* which occur both naturally and have been introduced by some gardeners bought from retailers. Nine tolerated species can also be found in the welcomed species category, and all 26 species that are tolerated by some gardeners are not welcomed by others (Table 5).

The tolerated species are non-crop plants with a potential for use (Table 5), though they are not always used.

Table 5. Twenty-six tolerated species, their management categories and uses in 196 home gardens in Eastern Tyrol, Austria.

Family/ Species	Management			Uses		
	Not welcomed	Tolerated	Welcomed	Primary	Secondary	Other
Asteraceae						
Taraxacum officinale F.H. Wigg.	141	2	0	Food	Medicinal	
Bellis perennis L.	23	2	14	Ornamental	Food	Medicinal
Conyza canadensis (L.) Cronq.	6	4	0	Ornamental		
Achillea millefolium L.	14	3	6	Medicinal	Beverage	
Boraginaceae						
Myosotis sylvatica Ehrh. ex Hoffm.	2	4	16	Ornamental		
Brassicaceae						
Capsella bursa-pastoris (L.) Medik.	81	1	0	Medicinal		
Caryophyllaceae						
Silene dioica (L.) Clairv.	5	3	0	Ornamental		
Silene latifolia Poir. ssp. *alba* (Mill.) Greuter *et* Burdet	1	3	0	Ornamental		
Chenopodiaceae						
Chenopodium bonus-henricus L.	8	1	0	Food	Fodder	

Lamiaceae						
Ajuga reptans L.	1	1	0	Ornamental		
Glechoma hederacea L.	20	2	0	Food	Medicinal	Fodder
Lamium album L.	28	1	0	Ornatmental	Medicinal	Food
Lamium maculatum L.	6	1	1	Ornamental	Food	
Mentha arvensis L.	5	1	1	Medicinal		
Mentha x *verticillata* L. s.str.	1	1	1	Medicinal		
Malvaceae						
Malva neglecta Wallr.	16	4	0	Medicinal	Food	Fodder
Onagraceae						
Epilobium angustifolium L.	2	1	0	Medicinal		
Epilobium ciliatum L.	4	1	0	Medicinal		
Epilobium montanum L.	11	3	0	Medicinal		
Papaveraceae						
Chelidonium majus L.	8	1	1	Medicinal		
Papaver rhoeas L.	4	4	2	Ornamental		
Plantaginaceae						
Plantago lanceolata L.	9	3	0	Medicinal		
Plantago major L.	38	1	0	Medicinal		
Urticaceae						
Urtica dioica L.	62	9	0	Medicinal	Food	e.g.
Violaceae						
Viola arvensis Murray ssp. *arvensis*	22	3	0	Ornamental	Medicinal	
Viola tricolor L. ssp. *tricolor*	3	2	9	Ornamental		

Sometimes the knowledge that the species can be used is enough to justify leaving the plant to grow, as is the case with the *Epilobium* species or *Lamium album* L.. Concerning management, unlike the not welcomed species, the tolerated species are allowed to grow and at least some plants of this group of species are left until reproduction is assured (e.g., seeds are dispersed). However they are never so intensively managed like the welcomed species. The useful parts are harvested continuously (e.g., *Glechoma hederacea* L.) or the useful parts are harvested at the same time when the plants are weeded (e.g., *Capsella bursa-pastoris* (L.) Medik.).

The most common tolerated species is *Urtica dioica* L. (9 gardeners). The other species are only tolerated by a few gardeners (1 to 4 gardeners) (Table 5). Stinging nettle is not only the most common tolerated species, but also the one species of which gardeners report the highest number and frequency of uses. Applications include food preparation (leafy vegetable, raw or cooked), tea preparations as beverage and curative (leaves and roots), medicinal uses for humans and animals (whole plant), shampoo (leaves, roots), fodder for cows and pigs (whole plant), fodder for breeding poultry (young leaves) and use as cleaning agent (whole plant). People also reported that they leave the plants growing because they are important fodder plants for caterpillars of endangered butterfly species.

Spontaneously reproducing 'welcomed species'

The majority of the 230 spontaneously reproducing welcomed plant species have been deliberately introduced in the garden at one time but at present reproduce spontaneously. Only those species which reproduced spontaneously during the two-year field survey and/or reproduce spontaneously according to the respondents have been included in this category. The total amount of welcomed species with spontaneous reproduction might rise if gardens were observed during a longer period of time. Exceptions are 26 species which may have been both deliberately introduced and/or emerged naturally (Table 6). Nine species can also be found in the two other categories (nine species are also treated by some gardeners as tolerated and seven species also as not welcomed) (Table 5).

Table 6. Welcomed species which have naturally emerged or have been deliberately introduced in 196 home gardens in Eastern Tyrol, Austria (9 species can also be found in two other categories; see Table 5).

Family/Species	Naturally emerged	Deliberately introduced
Asteraceae		
Artemisia vulgaris L.	1	4
Chamomilla recutita (L.) Rauschert	8	65
Helianthus annuus L.*	3	33
Leucanthemum ircutianum DC.	3	1
Leucanthemum vulgare (Lam.) DC.	4	8
Matricaria perforata Merat	3	0
Brassicaceae		
Rorippa sylvestris (L.) Besser	1	0
Cannabaceae		
Humulus lupulus L.	2	1
Crassulaceae		
Sedum acre L.	3	5
Sedum reflexum L.	1	1
Dryopteridaceae		
Cystopteris fragilis (L.) Bernh.	1	0
Athyrium distentifolium Tausch ex Opiz	1	0
Rosaceae		
Aruncus dioicus (Walt.) Fern.	1	7
Filipendula ulmaria (L.) Maxim.	1	0
Sambucaceae		
Sambucus nigra L.	6	4
Sambucus racemosa L.	3	0
Scrophulariaceae		
Verbascum thapsus L.	1	0

* *Helianthus annuus* L. may have been introduced through birdseed.

The original sources of deliberately introduced welcomed species – before they start to reproduce spontaneously - are commerce (e.g., *Cosmos bipinnatus* Cav., *Satureja hortensis* L.), neighbors or the previous gardener (e.g., *Calendula officinalis* L., *Dianthus barbatus* L.). A source for welcomed species is also surrounding nature (e.g., *Achillea clavenae* L., *Campanula cespitosa* Scop.). Changes in land-use, such as the abandonment of cereal fields and fallows, reforestation of scarps or drainage of grassland, caused women to transplant species from these habitats intentionally into gardens. Otherwise, these species would no longer prosper in their adjacencies (e.g., *Lilium bulbiferum* L. ssp. *bulbiferum*, *Primula elatior* ssp. *elatior* W.W. Sm. et Forrest, *Hypericum perforatum* L.). Also species which, according to the literature, are treated as weeds in other regions (e.g., *Chrysanthemum segetum* L., *Anthemis tinctoria* L.) are welcomed, mostly because of their attractive flowers, uncomplicated management and robust character.

The species distribution is highly variable. Only five of the 230 welcomed species are found in more than 50% of the home gardens surveyed (Table 7). These five species are left to spontaneously reproduce in between 13–56% of the gardens in which they occur, while in the rest where they are found they are intentionally planted every year or simply not left to reproduce spontaneously.

All welcomed species with spontaneous reproduction are intensively managed, although they are in most cases not crop plants. The management strategies range from protecting to encouraging and promoting, but the plants are never selected according to specific criteria or bred (by the gardeners) nor are the seeds or vegetative propagules harvested and replanted as is done with crop plants (i.e., domesticated species). Examples of management strategies include protecting natural seed dispersal by ensuring that seeds are ripe and dispersed before plants are cut or removed in autumn. Welcomed species may be encouraged by irrigating or supporting the plants with sticks. The surrounding vegetation may be weeded. Special focus is given to soil management, i.e., turning the soil (manual digging) is done in autumn only, to ensure undisturbed growth of welcomed species in springtime.

Traditionally, the gardens in Eastern Tyrol are well ordered. Crops are grown in beds in the middle of the garden, while species which 'come up on their own' are given space along the fence. However, the act of protecting seedlings and plants where they spontaneously emerge can sometimes result in disordered gardens with spontaneously reproducing plants growing also in the centre of the garden. Nevertheless, plants are not just protected where they occur, but occasionally get transplanted. Women distinguish between seedlings that can be transplanted (e.g., *Centaurea cyanus* L., *Digitalis purpurea* L.) and others which do not tolerate transplantation (e.g., *Papaver rhoeas* L.).

All welcomed plant species have benefits for the gardener. Almost all are medicinal plants, edibles (mostly spices) or attractive flowering plants and/or plants with uses in customs and religious events.

Table 7. The 13 most frequent species found in all 196 home gardens in Eastern Tyrol, Austria (intentionally sown/ planted or spontaneously reproducing welcomed species). The percentage of home gardens (n=196) in which they occur overall and the last column indicate if they are welcomed to reproduce spontaneously and the extent in percent of home gardens where they are allowed to reproduce spontaneously. 'No': all these plants are intentionally sown or planted every year or simply not left to reproduce spontaneously.

Family	Species	English name	In % of gardens in total	Welcomed / % of gardens
Asteraceae	*Lactuca sativa* L. var. *capitata* L.	head lettuce	99	No
Alliaceae	*Allium schoenoprasum* L. ssp. *schoenoprasum*	chive	96	Yes / 56%
Apiaceae	*Petroselinum crispum* (Mill.) Nym. ex A.W. Hill	parsley	78	No
Brassicaceae	*Brassica oleracea* L. var. *sabauda* L.	savoy cabbage	69	No
Brassicaceae	*Brassica oleracea* L. var. *gongylodes* L.	kohlrabi	67	No
Rosaceae	*Fragaria* x *ananassa* (Duch.) Guédès	strawberry	63	Yes / 19%
Apiaceae	*Daucus carota* L. ssp. *sativus* (Hoffm.) Arcang.	carrot	60	No
Asteraceae	*Calendula officinalis* L.	marigold	57	Yes / 24%
Brassicaceae	*Raphanus sativus* L. var. *sativus*	radish	57	No
Alliaceae	*Allium porrum* L.	leek	55	No
Brassicaceae	*Brassica oleracea* L. var. *botrytis* L.	cauliflower	55	No
Polemoniaceae	*Phlox paniculata* L.	phlox	55	Yes / 49%
Caryophyllaceae	*Dianthus barbatus* L.	sweet william	51	Yes / 13%

The most common welcomed species with spontaneous reproduction are chive, phlox and marigold (Table 7). Chive is the most popular spice in the gardens; it is used almost every day as a green condiment for soups and for many main dishes, including traditional ones. Chive was a feature of the traditional 'herbal gardens', which, according to elderly women, were not very diverse and contained almost exclusively spices and medicinal plants. Chive is reported to be grown in each of the 196 gardens. If a garden is turned over to the next generation's gardener, the chive plants in most cases remain in the garden. Today, gardeners say that if one has problems with growing chives, one has to look around in other gardens and ask for local grown chives, because the commercially available plants do not give a good harvest. If chive grows extremely well, the female farmer or the gardener is locally called '**koa nutze Bäurin**' which among other things means that she is not very hard-working in the garden. The reason is that, in the respondents' opinion, chive prospers and reproduces much better without care.

Phlox and marigold are also reported as traditional species which have been handed down from one generation to the next by letting them reproduce spontaneously in the gardens. Phlox is reported to be uncomplicated to grow. The flowers are long-lasting, not only *in-situ* but also as cut flowers: bouquets of phlox are used to adorn churches and chapels for traditional festivities. Apart from that, the odor which the plant gives of is said to refresh a room.

Marigold is the welcomed species of which gardeners report the highest number and frequency of uses. Applications include medicinal use for humans and animals (flowers), food preparation (coloring soups and butter), tea preparation as beverage (petals), and cut flowers for bouquets and herb bunches. There are two particular traditional uses for herb bunches in Eastern Tyrol: one is Assumption Day, August 15th, where these receive church blessing; the other is ritual fumigation of the farm houses at year end (see Christanell *et al*. 2010). Marigold is also used to decorate the hats of musicians on traditional religious celebrations, to garnish meals, or as garden ornamental. People also mention that they leave the plants growing because they are important food plants for bees. Not only medicinal plants, plants with uses in customs or attractive flowering plants but also species with unspectacular appearance (e.g., inconspicuous flowers) and with no "practical use" (such as *Silene alba* (Mill.) E.H.L. Krause, *Adonis aestivalis* L.) are sometimes welcomed. For some women, the knowledge that the species is endangered (e.g., *Agrostemma githago* L., *Adonis aestivalis* L., *Gentiana verna* L., *Eryngium alpinum* L.) or does not grow anymore in the surrounding habitats (e.g., *Primula farinosa* L.) is sufficient to encourage and protect them. Some of these species are on the Austrian red list of endangered ferns and flowering plants (Niklfeld & Schratt-Ehrendorfer 1999, Table 8).

Table 8. Fifty-four welcomed species found in 196 home gardens in Eastern Tyrol, Austria which can be found on the Austrian Red List of endangered ferns and flowering plants (Niklfeld & Schratt-Ehrendorfer 1999; 0 = extinct; 1 = near extinct; 2 = critically endangered; 3 = endangered; 4 = potentially endangered; r = [endorsement to 1, 2, 3, or 4] regionally more strongly threatened; - r = not in the whole of Austria, but regionally endangered).The final column indicates if respondents reported knowledge of the species' endangered status.

Family / Species	Red List	Use	Endangered Status known
Amaryllidaceae			
Galanthus nivalis L.	- r	Ornamental	X
Leucojum vernum L.	- r	Ornamental	
Apiaceae			
Carum carvi L.	- r	Medicinal, Food	X
Eryngium alpinum L.	3	Ornamental	X
Eryngium planum L.	1	Ornamental	
Asteraceae			
Achillea ptarmica L.	3	Traditional	
Antennaria dioica (L.) Gaertn. var. *dioica*	- r	Ornamental, Medicinal	X
Anthemis tinctoria L.	- r	Ornamental	
Aster amellus L.	- r	Ornamental	
Centaurea cyanus L.	3	Ornamental	X
Centaurea montana L.	- r	Ornamental	
Leontopodium alpinum Cass. ssp. *alpinum*	- r	Ornamental, Medicinal	X
Onopordum acanthium L.	- r	Ornamental	
Boraginaceae			
Omphalodes verna Moench	4	Ornamental	
Campanulaceae			
Campanula cervicaria L.	3 r	Ornamental	X
Campanula cespitosa Scop.	- r	Ornamental	X
Campanula glomerata L.	3	Ornamental	X
Campanula latifolia L.	3	Ornamental	
Caryophyllaceae			
Agrostemma githago L.	1	Ornamental	X
Dianthus barbatus L.	- r	Ornamental, Traditional	
Dianthus deltoides L.	- r	Ornamental	X
Lychnis viscaria L. ssp. *viscaria*	- r	Ornamental	X
Sagina subulata (Sw.) C. Presl	2	Ornamental	
Silene conica L.	1	Ornamental	
Silene noctiflora L.	- r	Ornamental	
Vaccaria hispanica (Mill.) Rauschert	1 r	Ornamental	
Chenopodiaceae			
Chenopodium bonus-henricus L.	- r	Food, Fodder	X
Crassulaceae			
Sedum telephium L.	3	Ornamental	
Dryopteridaceae			
Polystichum aculeatum (Sw.) Schott	- r	Ornamental	

Family / Species	Red List	Use	Endangered Status known
Euphorbiaceae			
Euphorbia polychroma A. Kern.	3 r	Combat pest, Ornamental	
Gentianaceae			
Gentiana asclepiadea L.	- r	Ornamental	
Gentiana lutea L.	4	Medicinal	X
Gentiana verna L.	- r	Ornamental	X
Hyacinthaceae			
Muscari botryoides (L.) Mill.	3 r	Ornamental	
Iridaceae			
Iris pseudacorus L.	- r	Ornamental	X
Iris sibirica L.	2	Ornamental	X
Lamiaceae			
Leonurus cardiaca L.	- r	Medicinal, Fodder	
Marrubium vulgare L.	1	Medicinal	
Nepeta cataria L.	3	Medicinal	
Liliaceae			
Lilium bulbiferum L. ssp. *bulbiferum*	3	Ornamental, Traditional	X
Lilium bulbiferum L. ssp. *croceum* (Chaix) Nyman	3	Ornamental	X
Malvaceae			
Malva alcea L.	3 r	Medicinal, Ornamental	
Malva moschata L.	3	Medicinal, Ornamental	
Myrsinaceae			
Lysimachia punctata L.	- r	Ornamental	
Primulaceae			
Primula elatior ssp. *elatior* W.W.Sm. et Forrest	- r	Medicinal	X
Primula farinosa L.	- r	Ornamental	X
Primula veris L. ssp. *veris*	- r	Medicinal, Ornamental	X
Primula vulgaris Huds.	- r	Ornamental	
Ranunculaceae			
Adonis aestivalis L.	3 r	Ornamental	X
Aquilegia vulgaris L.	- r	Ornamental	
Consolida regalis Gray	- r	Ornamental	
Helleborus niger L.	- r	Ornamental, Medicinal	
Scrophulariaceae			
Verbascum phlomoides L.	- r	Medicinal	X
Veronicaceae			
Veronica teucrium L.	3 r	Ornamental	

Discussion and Conclusion

In temperate Eastern Tyrol home gardens, as elsewhere (e.g., Bye 1993, Harlan & De Wet 1975), gardeners manage wild, weedy and domesticated plant species along a gradient from not welcomed, tolerated to welcomed plant species. Gardeners tolerate, encourage or protect plant species that reproduce spontaneously in their home gardens in Eastern Tyrol primarily if they have a use or if they are somehow valuable to them, a phenomenon also seen

for wild plants in Bangladesh home gardens (Millat-e-Mustafa *et al*. 2000). However, the uses and subsequently the categorisation of all species depend on the personal preferences of the gardener and are highly variable between gardens, demonstrating a previously remarked idiosyncratic attitude towards certain species ranging from high appreciation to complete rejection on the part of the gardeners (Harlan & De Wet 1965).

Furthermore, personal perceptions may change over time (Bye 1993) and the interactions of Eastern Tyrol gardeners with spontaneously reproducing plants are multifaceted and answer not only to personal interests but also to cultural, social and economical trends.

In previous times for instance, when people kept many animals and were much more dependent upon farming for their subsistence, they were dependent on using all the weeded plants as fodder. From agro-ecosystems, emerging species which are eliminated, may be used in a variety of ways, e.g., as fodder weeds (Åfors 1994, Agelet *et al*. 2000, Bye 1993, Caballero & Mapes 1985, Kosaka *et al*. 2006, Millat-e-Mustafa *et al*. 2000, Padoch & de-Jong 1991, Rendón *et al*. 2001, Vieyra-Odilon & Vibrans 2001). Now that the farmers in Eastern Tyrol are less dependent on farming for meeting every household's needs for survival, they tolerate or welcome only some species that connect them with their heritage, their religion, their family, their landscape but no longer use all the "not welcomed" species, for example as fodder.

People incorporate introduced 'alien' plants (bought from retailers or given by neighbors or other gardeners), which were not used in the area before (Casas *et al*. 2001) and these species are now spontaneously reproducing. This might indicate that gardeners nowadays have many more chances to approach new species together with the knowledge of how to use them. It also indicates increased mobility. Some species with traditional uses are no longer used, but their past uses are still known and valued, and therefore they are tolerated or welcomed in the garden. Growing plants with a 'potential use' might indicate either a desire to be connected with a traditional lifestyle or a proactive strategy to adapt to potential insecurity in the economy.

The management of spontaneously reproducing species is a labor- and money-saving strategy, a means to raise a high diversity of useful, well adapted plant species with different uses that might also contribute to household income when sold on markets, as observed by several authors (e.g., De Wet & Harlan 1975, Rendón *et al*. 2001, Vieyra-Odilon & Vibrans 2001). Gardeners in Eastern Tyrol appreciate spontaneously reproducing welcomed species for economic reasons, such as the diversity of uses or potential uses, because they are easy to handle, no intensive labor is needed for management, nor are they vulnerable to pests or diseases. However the species are not just chosen for reasons of economic utility and the labor is not just about economic utility either. The not welcomed species are for instance combated with labor intensive methods like weeding by hand (Aldrich & Kremer 1997, Rao 2000) and garden work as a whole can not at all be seen as a labor-saving strategy. Nevertheless, the gardeners like the labor because it is a labor of love, an aesthetic act - particularly when we consider the alternative words that women use for weeding (arranging, embellishing, retouching), which makes someone think of hairdressing or interior decorating.

Another aspect to consider is that many welcomed or tolerated species serve purposes specific to the person or family which have uses beyond the economic potential of plants. Some spontaneously reproducing species are maintained in the garden because they were handed down from the previous generation. Welcoming plants that are handed down, for example chives, indicates an emotional attachment or a sense of heritage for the new gardener, a significance that goes beyond the economic potential of the plant. In other words, chives that have been grown by one's mother or grandmother taste better in one's soup, not only because they may be a better adapted variety, but also because they make "one feel a connection with previous generations".

Other species are incorporated in the garden because they are endangered in the wild and are now allowed to spontaneous reproduce in the garden, a phenomenon also reported, e.g., in Anatolia (Ertuğ 2003). Growing endangered species suggests a concern for Alpine heritage and a sense of place that is not motivated only by objective measurement of the plant's utility. These values have an important implication for conservation.

Women do not only incorporate wild, endangered species, but also create a habitat for the survival of unintentionally emerging plant species ("weeds"), which can be found on the Austrian Red List of endangered species. Conservation efforts should recognize that gardens not only in Eastern Tyrol but in many countries of the world (IPGRI 2000, Nazarea 1998) are living gene banks where not only local crop varieties, landraces and obsolete cultivars (Vogl-Lukasser & Vogl 2002, Vogl-Lukasser *et al*. 2009) but also rare and endangered plant species are preserved.

'Plants that come up on their own' are often overlooked in studies of agricultural systems and home gardening. Nevertheless, the significance of spontaneously reproducing plants has been noted in agro-ecosystems (Shiva 2000) such as agroforestry fields (Padoch & deJong 1991), meadows and hedgerows (Pardo-de-Santayana *et al*. 2005), maize fields (Vieyra-Odilon & Vibrans 2001) or pastures (Ertuğ 2003).

The examples presented in this paper help to explain the fluidity of the categories used here and by other authors.

This fluidity, with perceptions affected by economic, historical, ecological, aesthetic and social factors, demonstrates the embeddedness of home gardening in the concerns and lifestyles of the gardeners, and also indicates the complexity and performative nature of gardening. In species such as marigold and chives, economic and social significance are virtually inseparable, while the simple knowledge that some species have been useful in the past can confer sufficient social meaning - even history - to justify placing a species in the tolerated or welcomed category. When these species are rare and endangered, this practice takes on ecological significance beyond the confines of the household. Hence, the consignment of all spontaneously reproducing plants to the category 'weed', as opposed to the category 'crop' is both an overly dichotomous categorization of plants themselves, and an underestimation of the multivalent significance of East Tyrolean gardens and the impressive skill, knowledge and devotion of their gardeners.

We contend that the full importance of home gardening cannot be appreciated without considering the time, attention and meaning that gardeners dedicate to spontaneously reproducing plants. The gardeners are constantly recognizing, assigning meaning to and managing hundreds of different spontaneously emerging species.

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