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REGULAR ARTICLE

Wheat landraces from Oman: A botanical analysis

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Abstract

The wheat landraces of Oman are chacterized. Their main constituents are *Triticum aestivum* L. ssp. *aestivum*, *T. aestivum* ssp. *hadropyrum* (Flaksb.) Tzvel., *T. compactum* Host, *T. aethiopicum* Jakubz.ssp. *aethiopicum*, *T. aethiopicum* ssp. *vavilovianum* Jakubz. et A. Filat. and *T. dicoccon* Schrank. The classification of the landraces was performed using the morphological method developed by Dorofeev, Filatenko et al. (1979), considering species, subspecies, convarieties and a great number of botanical varieties. Single landraces contained up to three different species ("Sareeaa") and up to 17 different botanical varieties ("Missani"). *T. aethiopicum* var. *hajirense* A. Filat. et K. Hammer is newly described. Keys for the determination of important Omani wheat races are proposed. 15 wheat landraces of Oman are characterized morphologically. A detailed list describing origin, local names, and infraspecific taxa of the material is provided. Transformation processes of the oasis settlements lead to a replacement of the traditional agricultural systems and the landraces are threatened by genetic erosion. Additional measures are necessary to increase the possibilities for on-farm conservation of the valuable material of landraces.

Key words: Wheat, Landraces, *Triticum* sp., Oman, Morphological characterization, Botanical classification

Introduction

Oman on the Arabian Peninsula at the cross-roads of inter-regional exchange including also cultivated plants (Gebauer et al., 2007; Hammer et al., 2007) is still rich in landraces of various crops. For a long time Oman was a closed country with first possibilities for botanical exploration, especially in the last century. Older reports about wheats are very limited (Schwarz, 1939; Mandeville, 1977). The presence of different wheat species was not clear. Only some reports from neighbouring Yemen (Flaksberger, 1935; Vavilov, 1931, 1964) allowed some conclusions. A note about wheat in Oman opened the way for new activities (Akhtar, 1981; Chapman, 1985). In the late 1980s Oman was included in worldwide activities for the collection of plant genetic resources (Guarino, 1990) and the first information about the still existing cultivation of *Triticum dicoccon* appeared. At the beginning of the new millennium a program was started for exploring and collecting the wheat landraces of Oman reporting about wheat landraces from Hajir Mountains and describing new botanical varieties of hexaploid wheats (Al-Maskri et al., 2003). Hammer et al. (2004a) also found *T. dicoccon* subsp. *asiaticum* Vav. in Al Hamra, Misfat Abreen in the same Hajir Mountains.

Wheat (*Triticum* L.) is one of the most important staple foods in the world and its importance becomes even more acute as the global population increases. Thus, its characterization and application in breeding programs is very crucial. The wealth of the Omani landraces has been stressed in the last years (Filatenko et al., 2008).

The importance of landraces as an important basis for present and future breeding was recognized relatively late (von Proskowetz, 1890). Their possible loss by the introduction and spread of new highly productive varieties has been stressed also by Bauer (1914), Tschermack (1915) and Schindler (1918). Their preservation in genebanks was proposed, but it was not until the development of the "plant gentic resources movement" (Pistorius, 1997) that their value was adequately appreciated. Zeven (1998) provided the necessary definitions and classifications for

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landraces. He also questioned the on-farm activities, as they have been done formerly, for the maintaining of landraces (Zeven, 1996). Landraces are commonly genetically heterogeneous, developed through traditional agriculture over thousands of years by local farmers (Brush, 1999; Hammer and Diederichsen, 2009). Landraces have remained variable over long times, because eco-geographical structures are largely adaptive. Wheat farming in Oman is dependent on irrigation except for a small area in northern Oman which depends on rainfall.

Material and Methods

Exploration and collecting missions have been organized in Oman (Al Maskri et al., 2003; Al Khanjari et al., 2005). Samples have been transferred to the experimental fields of the University of Kassel in Witzenhausen where the characterization and evaluation of the material took place.

The description of agronomically important and useful characteristics is an important prerequisite for effective and efficient use of germplasm collections in future breeding programs.

The checklist-method has been used for a species survey (Hammer et al., 2004b, 2009).

For the characterization of the material, diversity studies have been carried out. Following the modern approach, a molecular evaluation was performed using microsatellites (Al Khanjari et al., 2005, 2007 a and b).

After a preliminary morphological characterization in 2002/ 2003 (Al Maskri et al., 2003; Hammer et al., 2004a), the classification and identification of the germplasm material was determined in 2010 (A. Filatenko). The basis for this work was the classical approach of Dorofeev, Filatenko et al. (1979) which allowed not only the determination of the species (for species designation we followed Hammer et al. (2011)), but also the infraspecific categories (a translation of the monograph is in preparation – Knüpffer et al., 2004). The methodology was developed in the Vavilov Insitute, St. Petersburg and proved to be useful for an exact classification of the material, for getting information towards its diversity and for following the process of genetic erosion (Bürkert et al., 2006), particularly in cases of monitoring landraces in certain areas (Hammer et al., 1996).

A map of Oman is presented in Figure 1, a photo of variable landrace is shown in Figure 2, and the main collecting areas are presented in Table 1.

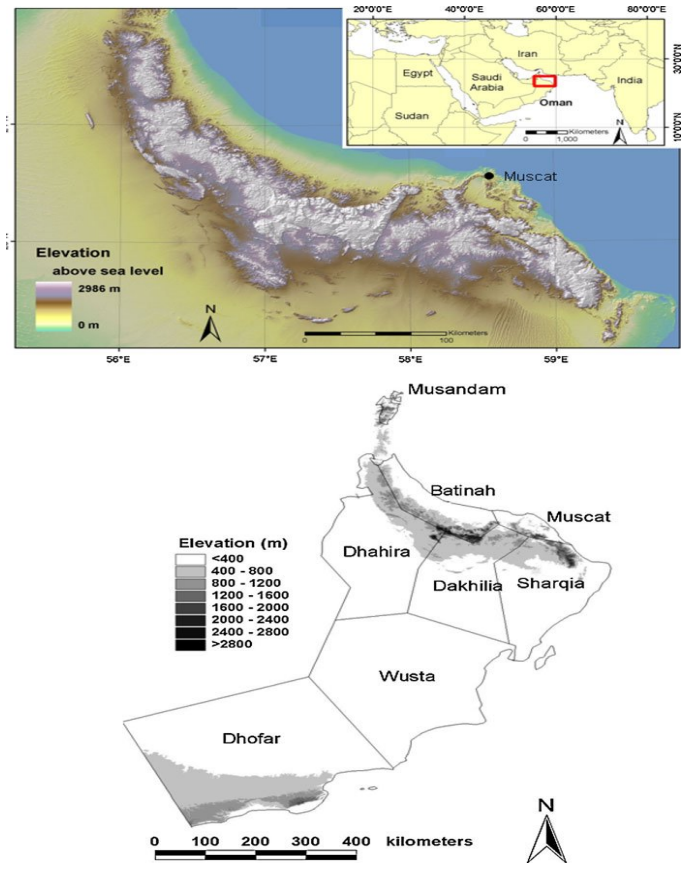

Figure 1. Map of Oman showing the Hajar Mountains where most of the newly discovered botanical wheat varieties were found (above) and the country's different districts where the wheat germplasm survey was conducted (below)

Figure 2. Typical spikes of the landrace „Walidi“ from Baladseet (Biladsayt) (left),. *T. compactum* var. *maqtaense* (A. Filat. et K. Hammer) A. Filat. (Walidi) (right).

Table 1. Summary of the collection areas (point range).

District	Altitude	Latitude	Longitude
Dhahira	300m - 700m	56°30 - 56°37	23 °41 - 23 °18
Batinah	400m - 800m	56°29 - 57°37	23°59 - 23°11
Dakhilia	300m - 900m	57°04 - 57°12	22°48 - 23°06
Sharquia	300m - 1500m	59°09 - 58°45	22°59 - 23°47
Musandam	50m - 400m	55°57 - 56°18	26°04 - 24°24

Results and Discussion

Many botanical varieties of cultivated wheat have been observed and collected in Oman. The results of the classification are shown in Appendix 1. A short discussion arranged by species is provided in the following. Wild-growing species of wheat and *T. monococcum* L. have not been found in Oman.

Hexaploid wheats

Triticum compactum Host

The finding of a wide distribution of *T. compactum* in Oman is especially interesting. In the neighbouring countries this species is very rare (Iran), or not found at all (Ethiopia).

It is ecologically a typical mountain wheat, which includes, according to Vavilov (1935), moisture-loving forms with a low temperature requirement in the period of ripening and tolerance against decreasing temperature in spring, which are not demanding with respect to soil and cultivation conditions.

Three groups of varieties are distinguished within *T. compactum*. These were: convar. *compactum*, convar. *rigidicompactum* (Kudr.) A. Filat. and convar. *inflatum* (Vav. et Kob.) A. Filat. The latter one was not found in Oman (see Al Khanjari, 2005, 2007b, 2008).

Plants and spikes of *T. compactum* are of delicate structure, glumes usually thinly coriaceous, with a transverse depression at the base. Caryopses loosely enclosed by lemma and palea and easy to thresh. Convar. *compactum* is distributed throughout the whole Old World. In the 20th century it was particularly cultivated in Siberia, Russian Far East, Yakutia, Mongolia and China but never common.

T. compactum is not associated with any particular distribution area, but, according to Vavilov (1964), it represents relicts to a considerable degree. Two botanical varieties belong to convar. *compactum*, namely, var. *balatseetense* (K. Hammer et A. Filat.) A. Filat., var. *maqtaense* (A. Filat. et K. Hammer) A. Filat.

Spikes of this group are awned, half-awned; less often awnless, glumes rigid, more often half-rigid; caryopses closely enclosed in lemma and

palea, but are usually easy-to-thresh, less often threshing is difficult.

Geographical distribution

Mountain and foothill zones of Middle and South-West Asia, Transcaucasia, Mongolia, Oman.

Four botanical varieties belong to convar. *rigidicompactum*: var. *muticilinaza* Kudr., var. *linaza* Koern., var. *sedabense* A. Filat. et K. Hammer, var. *omanense* A. Filat et K. Hammer.

Spikes of this group are awned, semi-awned or sometimes awnless, glumes rigid or usually semi-rigid; caryopses closely enclosed by lemma and palea, usually easy or sometimes difficult to thresh.

Generally, convar. *rigidicompactum* is characterised by a distinct polymorphism and represented by a considerable number of varieties.

***Triticum aestivum* L.**

From the typical common wheat in Oman *T. aestivum* subsp. *aestivum* (European wheat) and *T. aestivum* subsp. ***hadropyrum*** (Asiatic wheat) convar. ***semirigidum*** A. Filat. et Dorof. are present.

Spikes of convar. *semirigidum* awned or awnless, semi-robust; glumes less coarse than those of convar. *rigidum*, with less distinct venation, caryopses not so firmly enclosed by palea and lemma, not falling, but easy to thresh.

Geographical distribution. *T. aestivum* convar. *semirigidum* has a very wide geographical distribution: West Asia, India, China, Mediterranean, Lower Volga, Transcaucasia and Arabian Peninsula (Oman).

Out of the 59 described varieties (Dorofeev, Filatenko et al., 1979) of convar. s*emirigidum,* 12 were collected in Oman (only subconvar. *semirigidum*), one of them is a new variety (bold face): var. *barbarossa* (Alef.) Mansf., var. *graecum* (Koern.) Mansf., var. *hostianum* (Clem.) Mansf., var. ***ibraense*** K. Hammer et A. Filat., var. *insigne* (Kudr.) A. Filat., var. *leucospermum* (Koern.) Mansf., var. *meridionale* (Koern.) Mansf., var. *pseudoerythrospermum* (Kudr.) A. Filat., var. *pseudohostianum* (Flaksb.) Mansf., var. *pseudoleucospermum* (Kob.) Mansf., var. *pseudopyrothrix* (Kob.) Mansf., var. *pulchrum* (Kudr.) A. Filat.

Subsp. *aestivum* – European subspecies is present with 7 varieties in Oman; the altitudinal distribution ranged **between** 50 - 1500 m above sea level.

Plants and spikes of this group are of delicate structure, glumes usually thinly coriaceous, very various in shape, with a transverse depression at the base. Caryopses loosely enclosed by lemma and palea, easy to thresh, many forms with easily shedding grains exist, the degree of enclosure of the caryopsis by the lemma and palea is determined by the amount of convexity of the lower half of the glume and not by the coarse texture of the glume as in subsp. *hadropyrum*.

Geographical distribution. Throughout the range of *T. aestivum.*

Out of the 38 listed varieties of subsp. *aestivum* (Dorofeev, Filatenko et al., 1979), 3 were found in Oman: var. *aestivum*, var. *anglicum* (Aschers. et Graebn.) A. Filat., var. *lutescens* (Alef.) Mansf. and 3 have been newly discovered by us: var. *arabicum* K. Hammer et A.. Filat., var. *pseudosoharicum* K. Hammer et A. Filat., var. *soharicum* K. Hammer et A. Filat.

The botanical diversity of hexaploid wheat species is poorer than in the main center of their origin –Southwest Asia (Turkestan, Afghanistan, East Iran, Northwest India). But, the botanical composition of the hexaploid wheats and the newly found varieties are good indications of the long-time evolution in the territories of Oman.

Tetraploid wheats

***Triticum dicoccon* Schrank**

Full description about the hulled tetraploid *T. dicoccon* is available in Hammer et al. (2004a). *T. dicoccon* from Oman is intermediate between Asiatic (ssp. *asiaticum* Vav.) and Ethiopian (ssp. *abyssinicum* Vav.) races. It has not yet been included in molecular studies (Zhang et al., 2006; Teklu et al., 2007). In recent years it has become very rare. A last sample of aged seeds with no germinability has been found by the authors in 2006 in an Omani seed store (Gebauer et al. 2007).

The tetraploid naked wheats of Oman are also very interesting; they are very similar to Ethiopian tetraploids and belong to ***T. aethiopicum*** Jakubz. Earlier, this species was considered endemic to Ethiopia and Yemen. New material was also found in Egypt recently (Gowayed, 2009). The history and evolution of this species have to be revised on the basis of the new findings (Sinskaja, 1969; see also Filatenko et al., 2003).

Vavilov (1931) first distinguished the Ethiopian naked tetraploid wheats as separate subspecies within the species *T. durum* and *T. turgidum.* Percival (1921) had previously included the Ethiopian wheat in *T. dicoccon* on the basis of their similar number of vascular bundles in the coleoptile. Later Vavilov (1964) emphasised the peculiarity of the Ethiopian tetraploid naked wheats (presence of violet-seeded forms, and on the basis of the number of vascular bundles in the coleoptile). Ethiopian wheat is similar to *T.*

aestivum in the characters of the spike, the diversity of the glumes, the presence of awnless, semi-awned and inflated forms and the scabridity of the leaf blades. Some of its dense-spiked forms resemble compact forms of *T. aestivum/T.compactum*. The resemblance to the tetraploid *T. carthlicum* Nevski is shown in the development of awns on the glumes, the thin spike rachis (not as thin, however, as that of *T. carthlicum*) and the rugose (wrinkled) dorsal side of the caryopsis. The presence of forms with a well-developed glume keel, with two clearly distinct rows on the lateral side of the spike and with a solid culm show that the Ethiopian wheats as close to *T. durum* Desf. On the basis of the latter resemblance, as well as on their tetraploid nature, Vavilov (1931) referred them to *T. durum* subsp. *abyssinicum* Vav. (see Hanelt and IPK, 2001) and emphasised, in so doing, their clear distinction from the common types of *T. durum* and *T. aestivum.*

Turgidoid Ethiopian wheats, previously assigned to *T. turgidum* subsp. *abyssinicum* Vav., resemble *T. turgidum* L. in characters of the the glume (shorter than lemma; inflated) and the caryopsis (gibbous). However, Vavilov (1931) noted that the Mediterranean *T. turgidum* was sharply distinct from the turgidoid Ethiopian wheats and pointed out the greater ecological and morphological similarities of all groups of Ethiopian wheats. Vavilov considered the presence of characters of *T. aestivum*, *T. durum* and *T. turgidum* in *T. aethiopicum* as a feature of the primitiveness of their cultivation, although it may be very ancient.

Flaksberger (1939) confirmed the repeated statements by Vavilov of the need to distinguish the Ethiopian wheat as an independent species. Moreover, he considered this wheat to have a complex of characters providing arguments for raising it to species rank as *T. abyssinicum* (a later homonym). In 1947 Jakubziner renamed this species - *T. aethiopicum* (Dorofeev, Filatenko et al., 1979).

This species was divided by A. Filatenko into three subspecies: 1) subsp. *aethiopicum* (shows similarity to *T. aestivum* and *T. carthlicum*); 2) subsp. *vavilovianum* Jakubz. et A. Filat. (has characters of *T. durum*); 3) subsp. *turgidoides* A. Filat. (see Dorofeev et al., 1979). We have discovered in Oman only the varieties of *T. aethiopicum* subsp. *aethiopicum* and subsp.

vavilovianum. Subsp. *turgidoides* is very rare as a crop in Ethiopia now. S. Cleuziou and L. Costantini (1980) indicate the prehistoric finding of *T. turgidum* in Oman. But it could be rather *T. aethiopicum* subsp. *turgidoides,* somewhat similar in grain shape to *T. turgidum.* Moreover, in Oman there were never good conditions for the cultivation of *T. turgidum.*

T. aethiopicum Jakubz. **subsp. *aethiopicum***.

Spikes are typically 6–12 cm long, lax (D about 17), mostly spindle-shaped, oval in cross-section, awned or awnless. Glumes smooth (shiny or with a slight wax bloom) or pubescent, with an awn (up to 7 cm long) or with acute keel tooth. Awns thin, long, slightly divergent, almost parallel to the spike rachis. Caryopsis narrow, elongated, slightly rugose (wrinkled), more or less flat on the ventral side, usually violet, less often red and rarely white. In Ethiopia cultivated at 2400–3000 m.

For the first time the var. *rarissimum* (Vav.) A. Filat. was found in Wadi Bani Khalid in the Sharqia province of Oman at 300-1500 m. Later on, additional races were collected: var. *pseudorarum* (Vav.) A. Filat., var. *uncinatum* (Perciv.) A. Filat., var. *amharicum* (Perciv.) A. Filat.

The majority of tetraploid naked wheats of Oman belong to *T. aethiopicum* subsp. v*avilovianum.*

T. aethiopicum subsp. **vavilovianum** Jakubz. et A. Filat. – Vavilov's subspecies (description after Dorofeev et al., 1979)

Spikes are medium sized to short (5–9 cm long), moderately dense (D=30–40) or dense (D=40–59), elongated, cylindrical or sometimes pyramidal. Glumes glabrous (shiny or with wax bloom) or pubescent, of various shapes and sizes, delicate or rather coarse in consistency; keel clearly distinct, but comparatively narrow, reaching the base of glume, base without transverse depression and not longitudinally wrinkled. Keel tooth acute, short to awn-like (up to 7 cm long). Caryopses short, orbicular, quite often with hump on dorsal side, white, red or violet. Tuft sparse (stems 2–3), with a small number of subsidiary spikes. Plants quite short. Culm thin, flexible, solid or with a small hollow. Sheath slightly pubescent. Leaf blades scabrous.

Subsp. *vavilovianum* is divided into two convarieties.

Key for the determination of the convarieties of *T. aethiopicum* subsp. *vavilovianum* Jakubz. et A. Filat. (key translated from Dorofeev, Filatenko et al. 1979)

1. Spikes cylindrical, 5–9 cm long, dense (D=30–40) convar. ***vavilovianum*** A. Filat.

\+ Spikes narrowed towards the apex, up to 5 cm long, dense (D>40) convar. ***compactum*** (Vav.) A. Filat.

The most part of varieties in Oman belongs to convar. *vavilovianum*, less to convar. *compactum.*

Convar. *vavilovianum* – group of dense-spiked varieties.

Out of the 34 described varieties of convar. *vavilovianum,* 11 were discovered in Oman: var. *bialbum* (Vav.) A. Filat., var. *bicolor* (Chiov.) A. Filat., var. *comitans* (Vav.) A. Filat., var. *densimenelikii* (Vav.) A. Filat., var. *mahsanense* A. Filat. et K. Hammer (Filatenko et al. 2010), var. *pilosinigrum* (Vav.) A. Filat. (Al Khanjari et al. 2008), var. *pseudorubripubescens* (Vav.) A. Filat.var. *pseudotomentosum* (Perciv.) A. Filat., *var. tchetchericum* (Vav.) A. Filat., var. *tomentosum* (Perciv.) A. Filat. var. *hajirense* A. Filat. et K. Hammer is described below.

Key for the determination of varieties of convar. *vavilovianum* A. Filat. of Oman.

Glumes						Awns		Variety
white	white with black margin	red	red with black margin	black on background		same as glumes	black	
				white	red			
Spikes awned								
Spikes glabrous								
Caryopses red								
+	–	–	–	–	–	+	–	*densimenelikii*
–	–	–	–	+	–	–	+	*bicolor*
Caryopses white								
+	–	–	–	–	–	+	–	*bialbum*
Spikes pubescent								
Caryopses red								
+	–	–	–	–	–	+	–	*tchertchericum*
+	–	–	–	–	–	–	+	*comitans*
–	–	+	–	–	–	–	+	*pseudorubripubescens*
–	–	–	–	–	+	–	+	*pilosinigrum*
–	–	–	–	+	–	–	+	*mahsanense*
Caryopses white								
+	–	–	–	–	–	+	–	*tomentosum*
+	–	–	–	–	–	–	+	*pseudotomentosum*
Spikes half-awned (Spikes pubescent)								
Caryopses white								
–	–	–	+	–	–	–	+	*hajirense*

T. aethiopicum convar. *vavilovianum* var. *hajirense* A. Filat. et K. Hammer, **var. nova**

– Spica rubra marginibus glumarum nigris.

Typus: Peninsula Arabica, Oman, cultivar localis Sareeaa, exped. № 270-3b, districtus Musandam, prope pagus Lkasab, a supra mare 300 m. 2001, leg. S. Alkhanjari and K. Hammer. Herbarium:GAT

Convar. **compactum** A. Filat. – group of extremely dense-spiked varieties.

Out of the 19 described varieties of convar. *compactum*, 3 were discovered in Oman: var.

pseudoarabicum (Vav.) A. Filat., var. *nubicum* (Vav.) A. Filat., var. *ptolomaeum* (Vav.) A. Filat.

Key for the determination of the varieties of *T. aethiopicum* convar. *compactum* (Vav.) A.Filat. in Oman

Glumes						Awns		Variety
white	white with black margin	red	red with black margin	black on background		same as glumes	black	
				white	red			
Spikes glabrous								
Caryopses red								
+	–	–	–	–	–	+	–	*ptolomaeum*
Spikes pubescent								
Caryopses red								
+	–	–	–	–	–	–	+	*pseudoarabicum*
Caryopses white								
+	–	–	–	–	–	–	+	*nubicum*

Among tetraploid accessions some were similar to *T. durum* Desf. (Al Maskri et al., 2003; Al Khanjari et al., 2005). But these forms have a spike more soft and tender, than that of *T. durum,* the culm filling is weak or intermediate in upper internode as with *T. aethiopicum*. Some former determinations could not be confirmed by a new classification done in 2010.

The rich and unique naked hexaploid and tetraploid wheats of Oman testify that wheat is not a casual and recent component of cultural flora of this country, but has an old history of cultivation. Ancient traces of agriculture are found in Arabia in the 3rd millenium BC. The oases of Oman were, at that time, early settlements where early farmers cultivated date palms and sowed distichous and polystichous barley, wheat, sorghum and jujube (Cleuziou and Costantini, 1980). Oman was the important staging post on crossing trade routes which connected Mesopotamia, Persia, the Indus valley and Africa (Shnirelman, 1989).

A wide variation was observed in Dahirah region where cultivated fields were large in size. Batinah region is the second largest in size and number of the fields. Although Batinah is known to have many fields, most fields have been affected by salinity. Sharqia region is spread over a large area but there are few landraces. Farmers in the area cultivate a special type of wheat locally called "Walidi". The Dakhilia region is the smallest region in size with small fields as well. Important landraces and their morphological constituents are shown in Table 2; where a large level of variation can be seen within this region.

In total 29.49% of the local landraces (as expressed by their botanical varieties) have not been reported elsewhere in the world.

Table 2. Important landraces from Oman and their constituents (species and botanical varieties).

Landrace	Species	Botanical varieties
„Missani"	*T. aestivum*	var. *aestivum*, var. *anglicum*, var. *arabicum*, var. var, *barbarossa,* var. *hostianum,* var. *oblivense*, var.var. *pseudohostianum,* var. *soharicum*.
	T.aethiopicum	var. *amharicum*, var. *comitans*, var. *densimenelikii*, *var. mahsanense*, var. *pseudorarum*, var. *pseudorubropubescens*
„Buwaidha"	*T. aestivum*	var. *ptolomaeum,* var. *tchertchericum,* var. *uncinatum,* var. *soharicum*
	T.aethiopicum	var. *comitans*, var. *densimenelikii*, var. *uncinatum*
„Sareeaa"	*T. aestivum*	var. *graecum*, var. *ibraense*, var. *pseudoerythroleucon*
	T. compactum	var. *baladseetense*, var. *sedabense*
	T.aethiopicum	var. *densimenelikii*
„Malki"	*T.aethiopicum*	var. *pseudorarum*

Table 2. Contd..

Landrace	Species	Botanical varieties
„"Sareeaa" – „Bulwaidha alwadi"	*T. aethiopicum*	var. *densimenelikii*
„Cooley"	*T. aestivum*	var. *insigne*, var. *ibraense*, var. *lutesecens,* var var. *pseudohostianum,* var. *leucospermum,* var. *meridionale*, var. *hostianum*
	T. compactum	var. *baladseetense*, var. *muticilinaza*, var. *omanense*, var. *linaza*
„Walidi"	*T. aestivum*	var. var. *aestivum*, var. *hostianum*, var. *leucospermum,* var. *pseudoleucospermum*, var. *pulchrum*, var. *soharicum*
	T. compactum	var. var. *baladseetense*, var. *densimenelikii*, vv var. *maqtaense*, var. *muticilinaza*
„Hamira"	*T. aestivum*	var. var.*aestivum*, var. *hostianum*, var. *ibraense*, var. var. *pseudoerythrospermum*, var. *pseudohostianum*, var. *pseudovelutinum*, var. *soharicum*
	T. compactum	var. var. *baladseetense*
„Greda"	*T. aestivum*	var.var. *graecum*
„Shalut"	*T. aestivum*	var. var.*aestivum*, var.*hostianum,* var. *var.pseudoerythrospermum*, var. *soharicum,* var.var.*pseudopyrothrix*, var. *pseudodovelutinum* var. var. *pulchrum*
	T. compactum	var.var. *muticilinaza*
„Shawie"	T. aestivum	var. var. *soharicum*
„Khatie"	*T. aestivum*	var. var. *hostianum*
„Grada"	*T. aestivum*	var.var. *hostianum*,var. *ibraenese*, var. *pseudovelutinum,* var. var. *leucospermum*, var. *pulchrum*
„"Musfsikha"	*T. aestivum*	var. var. *hostianum*

Conclusions

Various morphological variations in wheat landraces were found in Oman. Most of the fields were mixed with other cereal crops. Approximately 90% of the wheat fields which where visited contained *Avena sativa* L., and approximately 10-20% contained *Hordeum vulgare* L. These findings confirm earlier reports by Al-Maskri et al. (2003). But a steep decline in the presence of wheat landraces, as already observed by Anon. (2000), has to be confirmed. The speed of transformation processes in the agriculture of oasis settlements of Oman is extremely high (Buerkert et al., 2007; Buerkert and Schlecht, 2010; Gebauer et al., 2010). Many of the small terraces (from 2 to 100 m^2; Al-Maskri et al., 2003) have been abandoned. Programs for on-farm conservation of wheat and other genetic resources are urgently needed.

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Appendix 1. Botanical classification of Oman wheat (A.A.Filatenko, Gatersleben, 2010)

OMTRI	Probe N	Species	subspecies	convar.	subconvar.	varieties	Cultivar localis	Location	Region	District
21	180-4	*T. aestivum* L.	*aestivum*			*soharicum*K.Hammer et A. Filat.	Missani	Al Gum	Sur	Sharquia
22	180-4	*T. aestivum*	*aestivum*			*arabicum* K.Hammer et A. Filat.	Missani	Al Gum	Sur	Sharquia
31	104-1	*T. aethiopicum* Jakubz.	*aethiopicum*			*pseudorarum, pseudorubripubescens*	Missani	Wadi Sermi Khabura	Khabura	Batinah
32	104-2	*T. aethiopicum*	*aethiopicum*			*pseudorarum* (Vav.)A. Filat.	Missani	Wadi Sermi Khabura	Khabura	
33	104-4	*T. aethiopicum*	*aethiopicum*			*uncinatum* (Perciv.)A.Filat.	Buwaidha	Wadi Sermi Khabura	Khabura	Batinah
34	104-5	*T. aethiopicum*	*aethiopicum*			*uncinatum* (Perciv.)A.Filat.	Missani	Wadi Sermi Khabura	Khabura	Batinah
35	104-6-1	*T. aethiopicum*	*vavilovianum*Jakubz. et A.Filat.	*vavilovianum* A.Filat.		*comitans* (Vav.)A.Filat.	Missani	Wadi Sermi Khabura	Khabura	Batinah
36	104-6-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Wadi Sermi Khabura	Khabura	Batinah
37	106-1	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Al Zam	Rustaq	Batinah
38	106-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Al Zam	Rustaq	Batinah
39	106-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa	Al Zam	Rustaq	Batinah
40	107-1	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Al Mahsan	Wadi Bani Kharus	Batinah
41	107-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Al Mahsan	Wadi Bani Kharus	Batinah
42	107-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Al Mahsan	Wadi Bani Kharus	Batinah
43	107-5	*T. aethiopicum*	*aethiopicum*			*uncinatum* (Perciv.)A.Filat.	Missani	Al Mahsan	Wadi Bani Kharus	Batinah
44	109-5	*T. aethiopicum*	*aethiopicum*			*pseudorarum* (Vav.)A. Filat.	Missani	Wadi Hibi - Al Hajal	Sohar	Batinah
45	109-6	*T. aethiopicum*	*aethiopicum*			*amharicum* (Perciv.)A.Filat.	Missani	Wadi Hibi - Al Hajal	Sohar	Batinah
45-1	109-6	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Wadi Hibi - Al Hajal	Sohar	Batinah
46	111-3	*T. aestivum*	*hadropyrum* (Flaksb.) Tzvel.	*semirigidum* A.Filat.et Dorof.	*semirigidum* A.Flat. et Dorof.	*hostianum* (Clem.)Mansf.	Missani	Wadi Ahan	Sohar	Batinah
47	111-5	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*tchertchericum, comitans*	Missani	Wadi Ahan	Sohar	Batinah
48	112-10	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*tchertchericum* (Vav.)A.Filat.	Missani	Wadi Ahan	Sohar	Batinah
49	112-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*tchertchericum, comitans*	Buwaidha	Wadi Ahan	Sohar	Batinah
50	113-4-1	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Wadi Ahan	Sohar	Batinah
51	113-4-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Wadi Ahan	Sohar	Batinah
52	113-4-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Wadi Ahan	Sohar	Batinah

53	120-1	*T. aethiopicum*	*aethiopicum*			*pseudorarum* (Vav.)A. Filat.	Malki	Al Raky	Wadi Bani Khalid	Sharquia
54	120-6-2	*T. aethiopicum*	*aethiopicum*			*pseudorarum* (Vav.)A. Filat.	Malki	Al Raky	Wadi Bani Khalid	Sharquia
55	**120-9**	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*mahsanense* A. Filat. et K. Hammer	Missani	Al Raky	Wadi Bani Khalid	Sharquia
56	126-7	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Buwaidha alwadi	Salma	Dhang	Dhahira
57	127-4	*T. aestivum*	*aestivum*			*aestivum*	Missani	Falaj Sudairen	Yanqul	Dhahira
58	128-1-1	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa	Bahla	Bahla	Dakhilia
59	131-1	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa	Gemat Barut	Bahla	Dakhilia
60	131-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa	Gemat Barut	Bahla	Dakhilia
61	132-1-1	*T. aethiopicum*	*vavilovianum*	*compactum (Vav.) A.Filat.*		*ptolomaeum* (Vav.)A.Filat.	Missani	Seent Jabl Kuor	Bahla	Dakhilia
62	132-1-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Missani	Seent Jabl Kuor	Bahla	Dakhilia
63	132-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa	Seent Jabl Kuor	Bahla	Dakhilia
64	132-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa-Buwaidha alwadi	Seent Jabl Kuor	Bahla	Dakhilia
65	138-1	*T. aethiopicum*	*aethiopicum*			*amharicum* (Perciv.)A.Filat.	Missani	Al Raky	Wadi Bani Khalid	Sharquia
66	138-2	*T. aethiopicum*	*aethiopicum*			*amharicum* (Perciv.)A.Filat.	Missani	Al Raky	Wadi Bani Khalid	Sharquia
67	138-4	*T. aethiopicum*	*aethiopicum*			*amharicum* (Perciv.)A.Filat.	Missani	Al Raky	Wadi Bani Khalid	Sharquia
68	140-12-1	*T. aestivum*	*aestivum*			*anglicum (*Aschers. Et Graebn.)A.Filat.	Missani	Falaj Sudairen	Yanqul	Dhahira
69	140-13-1	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Sareeaa	Falaj Sudairen	Yanqul	Dhahira
70	140-13-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Missani - Buwauidha	Falaj Sudairen	Yanqul	Dhahira
71	140-25	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Missani	Falaj Sudairen	Yanqul	Dhahira
72	150-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Sareeaa	Wadi Ahan	Ibri	Dhahira
73	150-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Sareeaa	Wadi Ahan	Ibri	Dhahira
74	150-4	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*balatseetense (Hm. et Filat.) A. Filat.*	Sareeaa	Wadi Ahan	Ibri	Dhahira
75	190-5	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans, pseudorubripubescens*	Missani Arabic	Kasab	Kasab	Musandam
75-1	190-5	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*barbarossa* (Alef.)Mansf.	Missani Arabic	Kasab	Kasab	Musandam
76	190-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Kasab	Kasab	Musandam
77	190-4	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Kasab	Kasab	Musandam
78	190-6	*T. aethiopicum*	*aethiopicum*			*amharicum* (Perciv.)A.Filat.	Missani	Kasab	Kasab	Musandam
79-1	190-7	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudohostianum, hostianum*	Missani Arabic	Qaa	Kasab	Musandam
79	190-7	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani Arabic	Qaa	Kasab	Musandam
80	190-8	*T. aestivum*	*aestivum*			*oblivense* (Greb.) A. Filat.	Missani	Ras Auqab	Kasab	Musandam

81	270-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*comitans* (Vav.)A.Filat.	Missani	Lima	Lima	Musandam
82-1	270-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudohostianum* (Flaksb.) Mansf.	Missani	Lima	Lima	Musandam
82	270-2	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*tchertchericum* (Vav.)A. Filat.	Missani	Lima	Lima	Musandam
87	107-4	*T. compactum* Host		*rigidicompactum*(Kudr.) Dorof. et A.Filat.	*rigidicompactum* A.Filat. et Dorof.	*muticilinaza* Kudr.	Cooley	Al Mahsan	Wadi Bani Kharus	Batinah
88	109-1	*T. compactum*		*compactum*		*baladseetense(Hm. et A. Filat.) Filat.*	Cooley	Wadi Hibi - Al Hajal	Sohar	Batinah
89	109-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Walidi	Wadi Hibi - Al Hajal	Sohar	Batinah
89-1	109-2-6	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum (*Koern.) Mansf.	Walidi	Wadi Hibi - Al Hajal	Sohar	Batinah
90	109-3	*T.aestivum*	*aestivum*			*soharicum*K.Hammer et A. Filat.	Hamira	Wadi Hibi - Al Hajal	Sohar	Batinah
91	109-10	*T.aestivum*	*aestivum*			*soharicum*K.Hammer et A. Filat.	Walidi	Wadi Hibi - Al Hajal	Sohar	Batinah
92	111-1	*T.aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*graecum* (Koern.) Mansf.	Greda	Wadi Ahan	Sohar	Batinah
93	111-4	*T.aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Walidi	Wadi Ahan	Sohar	Batinah
94	111-6	*T. compactum*				*linaza* Koern.	Cooley	Wadi Ahan	Sohar	Batinah
95	111-7	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum (*Koern.) Mansf.	Cooley	Wadi Ahan	Sohar	Batinah
96	111-8-1	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Shalut	Wadi Ahan	Sohar	Batinah
97	111-8-2	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Shalut	Wadi Ahan	Sohar	Batinah
98	111-9	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Wadi Ahan	Sohar	Batinah
99	111-10(112-11)	*T. compactum*		*compactum*		*baladseetense (Hm. et Filat.)A. Filat.*	Hamira	Wadi Ahan	Sohar	Batinah
100	112-1	*T. compactum*		*compactum*		*maqtaense* A. Filat. et Hammer	Walidi	Wadi Ahan	Sohar	Batinah
101	113-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Wadi Ahan	Sohar	Batinah
102	113-10	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoerythrospermum (Kudr.) A.Filat.*	Cooley	Wadi Ahan	Sohar	Batinah
103	113-11	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum (Kudr.)* A. Filat.	Walidi	Wadi Ahan	Sohar	Batinah
104	113-12	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum (Kudr.)* A. Filat.	Walidi	Wadi Ahan	Sohar	Batinah
105	113-5	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.)Mansf.	Missani	Wadi Ahan	Sohar	Batinah
106	113-6	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.)Mansf.	Hamira	Wadi Ahan	Sohar	Batinah
107	113-7	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.)Mansf.	Hamira	Wadi Ahan	Sohar	Batinah
108	115-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense A. Filat. et K.Hammer*	Cooley	Buairedha	Ibri	Dhahira
109	115-2	*T. aestivum*	*aestivum*			*lutescens* (Alef.) Mansf.	Cooley	Buairedha	Ibri	Dhahira
110	115-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Buairedha	Ibri	Dhahira
111	115-5	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Buairedha	Ibri	Dhahira
112	115-6	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Buairedha	Ibri	Dhahira

113	115-7	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudohostianum* (Flaksb.) Mansf.	Hamira	Buairedha	Ibri	Dhahira
114	120-11	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoerythrospermum (Kudr.) A.Filat.*	Shuaira	Al Raky	Wadi Bani Khalid	Sharquia
115	120-12	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
116	120-13-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum (*Koern.) Mansf.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
117	120-13-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* (compactoid)	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
118	120-6-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.)Mansf.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
119	120-7-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense K. Hammer et A. Filat.*	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
120	120-7-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
121	120-(120-5-1)	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
122	120-4(120-5-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum* (Kudr.) A. Filat.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
123	120-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum (*Clem.)Mansf.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
124-1	120-(120-4-1)	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum (*Koern.) Mansf.	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
124	120-2-3	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense K. Hammer et A. Filat.*	Walidi	Al Raky	Wadi Bani Khalid	Sharquia
125	**121-(120-4-2)**	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense (Filat. et Hm.) A. Filat.*	Sareeaa	Sedab	Taeen	Sharquia
126	121-2(121-1)	*T. compactum*		*compactum*	*compactum*	*balatseetense (Filat. et Hm.) A. Filat.*	Walidi	Sedab	Taeen	Sharquia
127	121-3	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Sedab	Taeen	Sharquia
128	121-4	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Sedab	Taeen	Sharquia
128-1	121-4,5	*T. aestivum*	*aestivum*			*aestivum*	Walidi	Sedab	Taeen	Sharquia
129	121-5	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Sedab	Taeen	Sharquia
130	122-1	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Sedab	Taeen	Sharquia
131	126-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Salma	Dhank	Dhahira
132	126-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Salma	Dhank	Dhahira
133	126-3	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Sareeaa	Salma	Dhank	Dhahira
134	126-6	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Walidi	Salma	Dhank	Dhahira
135	127-1-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Falaj Sudairen	Yanqul	Dhahira
136	127-1-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
137	127-2-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira

138	127-2-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
139	127-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
141	127-6	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Falaj Sudairen	Yanqul	Dhahira
142	128-10-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Bahla	Bahla	Dakhilia
143	128-10-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Bahla	Bahla	Dakhilia
144	128-10-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Bahla	Bahla	Dakhilia
145	128-11	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Bahla	Bahla	Dakhilia
146	128-1-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Bahla	Bahla	Dakhilia
147	128-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Bahla	Bahla	Dakhilia
147-1	128-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Bahla	Bahla	Dakhilia
148	128-2-2	*T. aestivum*	*aestivum*			*aestivum*	Shalut	Bahla	Bahla	Dakhilia
149	**100-1**	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*omanense A. Filat. et K. Hammer*	Cooley	Iraqi	Ibri	Dhahira
150	100-1-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*omanense A. Filat. et K. Hammer*	Cooley	Iraqi	Ibri	Dhahira
151	100-1-2	*T. aestivum*	*aestivum*			*soharicum(4), pseudohostianum(2)*	Cooley	Iraqi	Ibri	Dhahira
152	100-1-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*meridionale* (Koern.) Mansf.	Cooley	Iraqi	Ibri	Dhahira
153	100-1-6	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Iraqi	Ibri	Dhahira
155	100-3	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Cooley	Iraqi	Ibri	Dhahira
158	**100-7**	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Iraqi	Ibri	Dhahira
158	100-7	*T. compactum*		*compactum*		*baladseetense (Hm. et Filat.) A. Filat.*	Hamira	Iraqi	Ibri	Dhahira
160	100-9	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*omanense* A. Filat. et K. Hammer	Cooley	Iraqi	Ibri	Dhahira
161	100-6-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Iraqi	Ibri	Dhahira
162	100-6-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Iraqi	Ibri	Dhahira
163	101-1	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Khader Makattim	Khabura	Batinah
164	101-2	*T. compactum*		*compactum*		*baladseetense* K. Hammer et A. Filat.	Hamira	Khader Makattim	Khabura	Batinah
165	101-3	*T. compactum*		*compactum*		*baladseetense* K. Hammer et A. Filat.	Hamira	Khader Makattim	Khabura	Batinah
166	101-4	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Khader Makattim	Khabura	Batinah
167	101-5	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Khader Makattim	Khabura	Batinah
168	128-3	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Cooley	Bahla	Bahla	Dakhilia
169	128-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudovelutinum* (Kob.)Mansf.	Cooley	Bahla	Bahla	Dakhilia
170	128-5	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.) Mansf., *pseudoerythrospermum*	Cooley	Bahla	Bahla	Dakhilia

171	128-6	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Shawie	Bahla	Bahla	Dakhilia
172	128-7	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Bahla	Bahla	Dakhilia
173	128-8	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Bahla	Bahla	Dakhilia
174	131-2-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Qemat Barut	Qemat Barut	Qemat Barut
174-1	131-2-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Qemat Barut	Qemat Barut	Qemat Barut
175	131-2-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Qemat Barut	Bahla	Dakhilia
176	131-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum* (Kudr.) A. Filat.	Shuaira	Qemat Barut	Bahla	Dakhilia
177	131-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum*	Cooley	Qemat Barut	Bahla	Dakhilia
178	131-5-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Shuaira	Qemat Barut	Bahla	Dakhilia
179	131-5-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	***ibraense*** K.Hammer et A.Filat.	Shuaira	Qemat Barut	Bahla	Dakhilia
180	131-6	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum*	Cooley	Qemat Barut	Bahla	Dakhilia
181	135-1	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.)A. Filat.*	Walidi	Maqta	Taeen	Sharquia
182	135-2	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
183	135-3	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
184	135-4	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
185	135-5	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
186	136-1	*T. compactum*		*compactum*	*compactum*	*baladseetense(Hm. et Filat.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
187	136-2	*T. compactum*		*compactum*	*compactum*	*baladseetense (Hm. et Filat.)A. Filat.*	Walidi	Maqta	Taeen	Sharquia
188	137-1	*T. compactum*		*compactum*	*compactum*	*maqtaense (Filat.. et Hm.) A. Filat*	Walidi	Maqta	Taeen	Sharquia
189	137-2-1	*T. compactum*		*compactum*	*compactum*	*maqtaense (Filat. et Hm.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
190	137-2-2	*T. compactum*		*compactum*	*compactum*	*maqtaense (Filat. et Hm.) A. Filat.*	Walidi	Maqta	Taeen	Sharquia
191	138-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.)Mansf.	Khati	Al Raky	Wadi Bani Khalid	Sharquia
192	140-10	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum (Kudr.)* A. Filat.	Shuaira	Falaj Sudairen	Yanqul	Dhahira
193	140-11	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum (Kudr.)* A. Filat.	Cooley	Falaj Sudairen	Yanqul	Dhahira
194	140-1-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum (Koern.) Mansf.*	Cooley	Falaj Sudairen	Yanqul	Dhahira
194c	140-1-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Falaj Sudairen	Yanqul	Dhahira
195	140-1-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense A. Filat. et K. Hammer*	Cooley	Falaj Sudairen	Yanqul	Dhahira
196	140-12-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudopyrothrix,pseudovelutinum*	Shuaira	Falaj Sudairen	Yanqul	Dhahira
197	140-14	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum (Clem.)Mansf.*	Shuaira	Falaj Sudairen	Yanqul	Dhahira
198	140-15-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Grade	Falaj Sudairen	Yanqul	Dhahira
199	140-15-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Grade	Falaj Sudairen	Yanqul	Dhahira

200	140-6(140-13)	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*densimenelikii* (Vav.)A.Filat.	Cooley	Falaj Sudairen	Yanqul	Dhahira
201	140-17	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum*(Clem.) Mansf.	Shalut	Falaj Sudairen	Yanqul	Dhahira
202	140-19	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoerythrospermum*(Kudr.) A.Filat.	Shalut	Falaj Sudairen	Yanqul	Dhahira
203	140-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*omanense A. Filat. et K. Hammer*	Cooley	Falaj Sudairen	Yanqul	Dhahira
204	140-21	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum*(Clem.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
205	140-22-1	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Shuaira	Falaj Sudairen	Yanqul	Dhahira
207	140-23	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudovelutinum* (Kob.)Mansf.	Grade	Falaj Sudairen	Yanqul	Dhahira
208	140-24	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum* (Kudr.) A. Filat.	Grade	Falaj Sudairen	Yanqul	Dhahira
209	140-26-1	*T. aestivum*	*aestivum*			*aestivum*	Hamira	Falaj Sudairen	Yanqul	Dhahira
210	140-26-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoerythrospermum* (Kudr.) A.Filat.	Hamira	Falaj Sudairen	Yanqul	Dhahira
212	140-4-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
213	140-4-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense A. Filat. et K. Hammer*	Cooley	Falaj Sudairen	Yanqul	Dhahira
214	140-5	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
215	140-7	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
216	140-8	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
217	140-9-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Falaj Sudairen	Yanqul	Dhahira
218	140-9-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Falaj Sudairen	Yanqul	Dhahira
219	150-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*insigne* (Kudr.) A.Filat.	Cooley	Wadi Ahan	Ibri	Dhahira
220	150-5	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Wadi Ahan	Ibri	Dhahira
221	150-6	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza Kudr*.	Cooley	Wadi Ahan	Ibri	Dhahira
222	143	*T. compactum*		*compactum*		*baladseetense* K. Hammer et A. Filat.	Walidi	Hadas	Taeen	Sharquia
223	102-1	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Khader Makattim	Khabura	Batinah
224	102-2	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Khader Makattim	Khabura	Batinah
225	102-3	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Khader Makattim	Khabura	Batinah
226	103-1	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Al Khad	Khabura	Batinah
227	103-2	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Al Khad	Khabura	Batinah
228	103-3	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Hamira	Al Khad	Khabura	Batinah
229	103-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Hamira	Al Khad	Khabura	Batinah
230	180-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudohostianum* (Flaksb.) Mansf.	Missani	Al Gum	Sur	Sharquia
231	180-3	*T. aethiopicum*	*vavilovianum*	*vavilovianum*		*tchertchericum* (Vav.)A.Filat.	Missani	Al Gum	Sur	Sharquia
232	116-1	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Ibri	Ibri	Dhahira

233	116-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Ibri	Ibri	Dhahira
234	116-3	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Cooley	Ibri	Ibri	Dhahira
235	116-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoerythrospermum* (Kudr.) A.Filat.	Sareeaa	Ibri	Ibri	Dhahira
236	117-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Walidi big size	Al Drize	Ibri	Dhahira
237	117-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Walidi big size with awns	Al Drize	Ibri	Dhahira
238	118-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Al Drize	Ibri	Dhahira
239	118-2	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Sareeaa	Al Drize	Ibri	Dhahira
240	119-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*sedabense* A.Filat. et K. Hammer	Cooley	Yanqul	Yanqul	Dhahira
241	119-3-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudoleucospermum* (Kob.) Mansf.	Cooley	Yanqul	Yanqul	Dhahira
242	119-3-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Yanqul	Yanqul	Dhahira
243	119-3-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Shuaira	Yanqul	Yanqul	Dhahira
244	119-3-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Shuaira	Yanqul	Yanqul	Batinah
245	123-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Greda	Al Hajiar	Wadi Bani Kharus	Batinah
246	123-2	*T. compactum*		*rigidicompactum*	*rigidicompactum*	*muticilinaza* Kudr.	Shuaira	Al Hajiar	Wadi Bani Kharus	Batinah
247	123-3-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pseudovelutinum* (Kob.)Mansf.	Hamira	Al Hajiar	Wadi Bani Kharus	Batinah
248	123-3-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum, ibraense*	Shuaira	Al Hajiar	Wadi Bani Kharus	Batinah
249	123-4	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*graecum (*Koern.) Mansf.	Sareeaa	Al Hajiar	Wadi Bani Kharus	Batinah
250	123-5-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum (*Clem.) Mansf.	Cooley	Al Hajiar	Wadi Bani Kharus	Batinah
251	123-5-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.) Mansf.	Greda	Al Hajiar	Wadi Bani Kharus	Batinah
252	124-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum, pseudoerythrospermum*	Walidi	Dhank	Dhank	Dhahira
253	124-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*hostianum* (Clem.) Mansf.	Mufsikha	Dhank	Dhank	Dhahira
254	124-3	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*pulchrum (*Kudr.) A. Filat.	Shuaira	Dhank	Dhank	Dhahira
255	124-4-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Dhank	Dhank	Dhahira
256	124-4-2	*T. aestivum*	*aestivum*			*soharicum* K. Hammer et A.Filat.	Cooley	Dhank	Dhank	Dhahira
257	124-5-1	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*ibraense* K.Hammer et A.Filat.	Cooley	Dhank	Dhank	Dhahira
258	124-5-2	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*leucospermum* (Koern.) Mansf.	Cooley	Dhank	Dhank	Dhahira
259		*T. compactum*		*compactum*		*maqtaense* (Filat. et Hm.) A. Filat.	?			
260	J.Gebauer	*T. aestivum*	*hadropyrum*	*semirigidum*	*semirigidum*	*graecum* (Koern.) Mansf.		Jabal Al Akhbar		