



A note about *Triticum* in Oman

A. Al-Maskri¹, M. Nagieb^{1,2}, K. Hammer², A.A. Filatenko³, I. Khan¹ and A. Buerkert^{2,*}

¹Department of Agriculture, Sultan Qaboos University, Al Khod, Oman; ²Institute of Crop Science, University of Kassel, Steinstr., 19, D-37213 Witzenhausen, Germany; ³13 Linija, 12, KV 7, 199034 Sankt Petersburg, Russia; *Author for correspondence (e-mail: buerkert@wiz.uni-kassel.de; fax: + 49 5542 98-1228)

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Abstract

Little is known about the diversity of wheat (*Triticum* spp.) in Oman. Results of a survey conducted in two remote mountain oases of northern Oman indicate that there exists considerable morphological variation within and among the five traditional landraces of wheat cultivated. Within two of the landraces grown on irrigated terraces, sized between 2 and 100 m², two new botanical wheat varieties (*Triticum aestivum* var. *baladseetense* and var. *maqtaense*) were identified of which the agronomic properties, in particular tolerance to drought and heat, and the nutritional value require further investigation.

Introduction

The Arabian peninsula and Oman, situated at its eastern edge, have an ancient cultivation history of both bread wheat (*Triticum aestivum* L. s. l.) and durum wheat (*Triticum durum* Desf.; (Schwartz 1939; Guarino 1990)). However, given Oman's long geopolitical isolation, little is known about the morphological variation, genetic structure, the agronomic properties (such as tolerance against heat, drought and salinity) and quality characteristics of these traditional wheat landraces. Due to the aridity of its climate (from 30 to 300 mm annual precipitation compared to a potential evapotranspiration > 2000 mm) irrigation is necessary for crop growth all over in Oman except for the southernmost area which is characterized by a summer monsoon. This leads to only about 2% of Oman's total land surface, equivalent to 150,377 ha being cultivated (Anonymous 1995).

Commodity wise and technologically irrigated crop production in Oman is divided into two sectors. The first one is in the flat, northern Al-Batinah region where a modern, market-oriented agriculture on large land holdings focuses on the production of vegetables for human consumption, and on corn (*Zea mays* L.)

and alfalfa (*Medicago sativa* L.) for milk production. This system depends on furrow and sprinkler systems drawing subsurface water from pump wells. These are fed by aquifers originating in the Jabel Akhdar mountains (Figure 1).

The second sector, which is of interest for this study, consists of traditional, mainly subsistence-oriented oasis systems which date back over 3000 years and produce dates (*Phoenix dactylifera* L.), wheat, sorghum (*Sorghum bicolor* Moench s. l.), barley (*Hordeum vulgare* L. s. l.), alfalfa, lime (*Citrus aurantiifolia* (Christm. et Panz.) Swingle), garlic (*Allium sativum* L.), onion (*Allium cepa* L.) and banana (*Musa* spp.) in rotation systems on small terraces sized between 2 and 100 m². Located in mountain valleys of the North and Central Oman mountains, these systems rely on ancient spring or falaj irrigation infrastructure which tends to rapidly deteriorate as the economic pressure of a globalized food commodity market reached these villages with the advent of modern access roads.

The basic irrigation infrastructure of the falaj systems has been intensively investigated by several authors (Cost 1983; Dutton 1986; Norman et al. 1998; Omezzine and Lokman 1998; Wilkinson 1974, 1977).

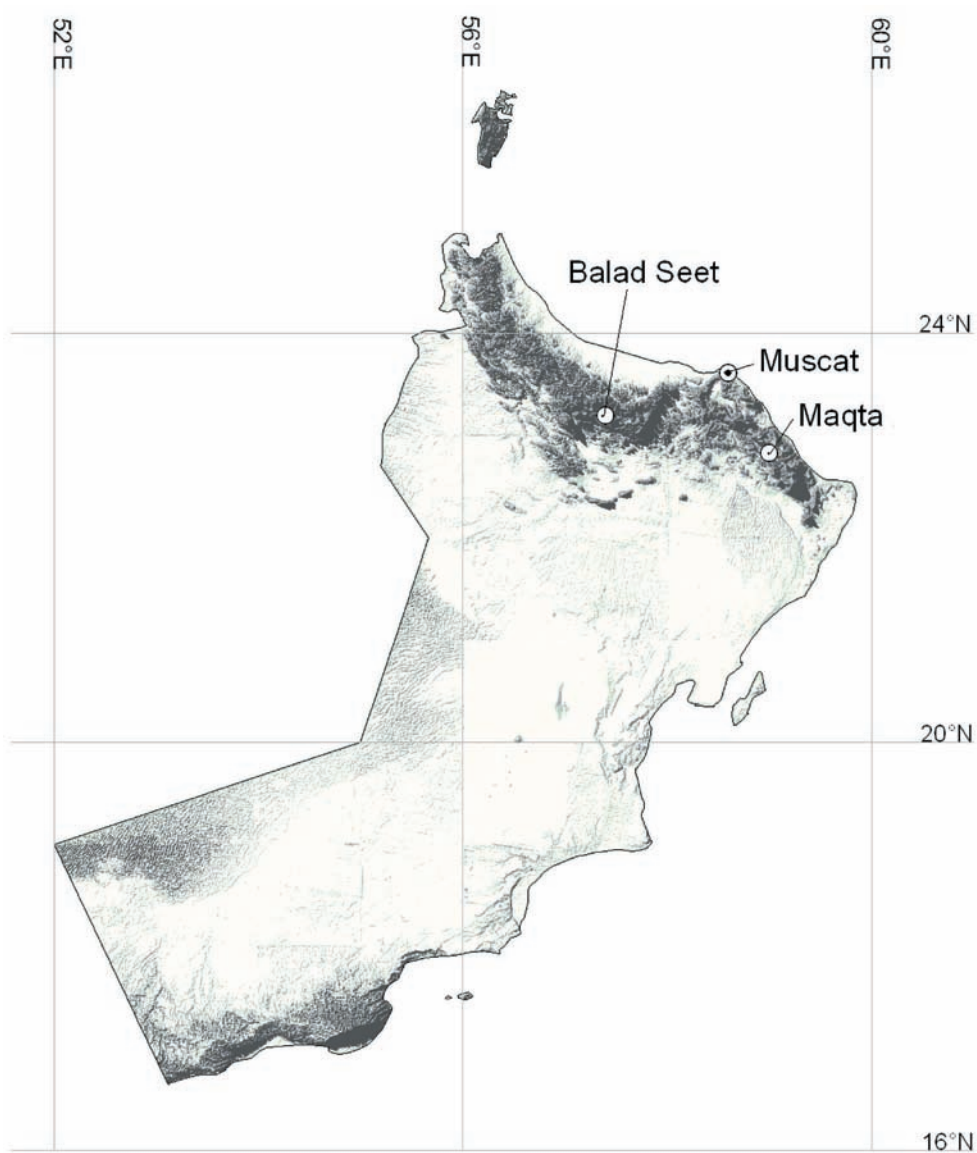


Figure 1. Map of Oman indicating the location of the two mountain oases of Balad Seet and Maqta where the wheat germplasm was collected.

The water use efficiency and nutrient cycling of traditional and introduced crop species in traditional mountain oases of Oman is one of the subjects of an ongoing interdisciplinary project on ‘Transformation Processes in Oasis systems of Oman’ conducted jointly by scientists from the German Universities of Tuebingen, Stuttgart and Kassel, the German Archeological Institute and Sultan Qaboos University in Oman.

First wheat collections by the Omani Ministry of

Agriculture differentiated a number of landraces (Sar-raya, Walidi, Cooley, Greda, Missani and Hamira) which were found to be increasingly replaced by higher-yielding modern varieties (Anonymous 2000). In 1996 the total area sown to Omani wheat typically growing from November to April (Akhtar 1981) in Interior, Sharquia, Dhahera, and Musandam was only about 238 ha compared to 1000 ha in 1988.

The purpose of this pilot study was to collect wheat seeds from farmers’ fields in two remote mountain

oases of Oman, to reproduce them under uniform conditions and to subsequently conduct a morphological characterization of their botanic structure.

Materials and methods

In spring 2001 a survey of wheat fields was conducted in the mountain oases of Balad Seet (23.19 °N, 57.39 °E; 996 m a.s.l.) in Wadi Bani Awf of the Northern Omani Jabal Akhdar mountain range and the village of Maqta (59.00 °E, 22.83 °N; 1250 m a.s.l.) in the Wadi Khabbah of the Al-Hajar Ash'sharqi range (Figure 1). In Balad Seet the farmers used the landraces Missani, Sarraya and Greda, whereas in Maqta only Missani and Walidi were found. Subsequently about 150 seeds from each landrace were taken to a growth chamber with a 14/10 h day/night cycle (475 $\mu\text{E m}^{-2} \text{s}^{-1}$) and 25/20 °C, sown in three replicates in pots filled to 0.15 m with a loamy soil, watered daily and supplied four times during the growing season with a nutrient solution (Wuxal Super 886 at 2 ml l⁻¹, Schering AG, Duesseldorf, Germany). At maturity all plant material was subjected to a thorough morphological characterization following Dorofeev et al. (1979), the so far last complete botanical monograph of *Triticum* with keys leading to infraspecific taxa.

Results

The morphological characterization revealed that the landraces were often mixtures of *T. aestivum* and *T. durum* comprising the following botanical varieties (Table 1)

1. *T. aestivum* var. *humboldtii* (Koern.) Mansf. (compact spikes), known from Europe and the New World
2. *T. aestivum* var. *insigne* (Kudr.) A. Filat. (compact spikes), known from Middle Asia, Mongolia and Afghanistan
3. *T. aestivum* var. *linaza* (Koern.) Mansf. (compact spikes), known from Chile and Mongolia
4. *T. durum* var. *africanum* Koern., known from the Mediterranean and Middle Asia
5. *T. durum* var. *melanopus* (Alef.) Koern., known from the Mediterranean and Middle Asia
6. *T. durum* var. *pseudaffine* (Haciz.) Schreib. (compact spikes) known from Cyprus and Turkey

7. *T. durum* var. *reichenbachii* Koern., known from the Mediterranean, Caucasus, Transcaucasus, Krim and Ukraine
8. *T. durum* var. *serengei* (Aschers. et Graebn.) Dorof. et A. Filat. (compact spikes), known from North Africa, Middle East and Asia minor

Two new botanical varieties (Figure 2) of *T. aestivum*, identified within the Walidi and Missani landraces need a formal description:

(a) *Triticum aestivum* var. *baladseetense* Hammer et A. Filat., var. nov.-A *T. aestivo* var. *pseudocicerinum* (Greb.) Mansf. glumis pubescentis differt. Typus: Peninsula arabica, varietas localis (Balad Seet), Reproductio Institutis Scientiae Plantarum Cultarum Witzenhausensis, herb. GAT 04.01.02.

Compact spikes, yellow with black awns, grains red, glumes pubescent.

(b) *Triticum aestivum* var. *maqtaense* A. Filat. et Hammer, var. nov.-A *T. aestivo* var. *icterinum* (Alef.) Mansf. glumis pubescentis differt. Typus: Peninsula arabica, varietas localis (Maqta), Reproductio Institutis Scientiae Plantarum Cultarum Witzenhausensis, herb. GAT 04.01.02.

Compact spikes, yellow with yellow awns, grains red, glumes pubescent.

The genetic structure of both varieties is currently being analyzed by micro-satellite techniques and compared to the germplasm contained in the wheat

Table 1. Morphological constituents of wheat landraces from Oman.

| Landrace | Morphological constituents |
|----------|--|
| Sarraya | <i>Triticum aestivum</i> var. <i>baladseetense</i> <i>Triticum durum</i> var. <i>pseudaffine</i> <i>Triticum durum</i> var. <i>reichenbachii</i> <i>Triticum durum</i> var. <i>serengei</i> |
| Walidi | <i>T. aestivum</i> var. <i>maqtaense</i> <i>T. durum</i> var. <i>africanum</i> |
| Cooley | <i>Triticum aestivum</i> var. <i>linaza</i> |
| Greda | <i>T. aestivum</i> var. <i>humboldtii</i> <i>T. aestivum</i> var. <i>insigne</i> <i>Triticum aestivum</i> var. <i>linaza</i> |
| Missani | <i>Triticum durum</i> var. <i>melanopus</i> <i>Triticum durum</i> var. <i>pseudaffine</i> <i>Triticum durum</i> var. <i>serengei</i> |

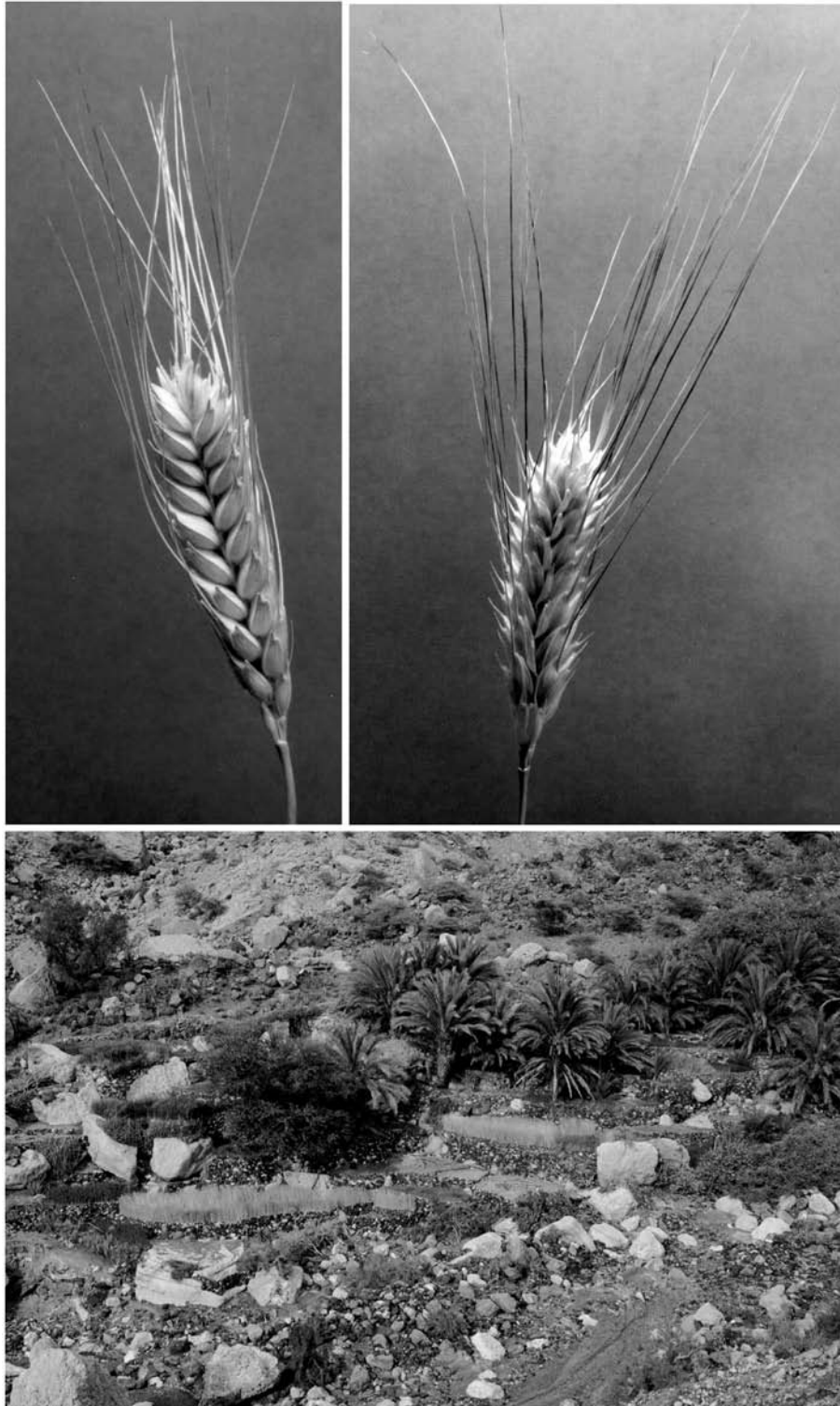


Figure 2. *Triticum aestivum* var. *baladseetense* (above left) and *Triticum aestivum* var. *maqtaense* (above right), two new botanical varieties of wheat identified in the Omani mountain oasis of Balad Seet and Maqta, respectively; typical farmer fields at Maqta (below).

gene bank at the International Maize and Wheat Improvement Centre (CIMMYT) in Mexico. Comparative analyses of the varieties' agronomic traits, grain quality characteristics and possible physiological adaptation to drought and heat, the most important environmental constraints in their habitat will follow. In the next months more systematic surveys in other remote Omani mountain oases with 'niche environments' (Figure 2) will be conducted to study the diversity of Omani wheats with respect to the documented germplasm of this crop.

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