

## Annex II

### Forage and range germplasm collection in Dhofar, Oman

(November 8-18, 2001)

*By Ahmed E. Osman*

As part of ICARDA-Arabian Peninsula Regional Program (APRP) activity with the Sultanate of Oman a collection mission for rangeland germplasm was organized in Dhofar Province in the period November 8 to 18, 2001. A similar mission was supported by ICARDA-APRP in 1998 for the Sohar region in Oman. The germplasm materials collected then are being evaluated within the collaborative program between the Sultanate and ICARDA-APRP, for their forage value and water use efficiency, with the objective of replacing the 'water-hungry' exotic forages in the Sultanate. Participants in the mission were Ali Shehade (ICARDA-GRU, Aleppo); Ahmed Osman (ICARDA-APRP, Dubai); Saleem Nadaf, Salih Al Hinahi and Safa'a Al Farisi (Research & Extension Ministry of Agriculture, Rumais, Oman). From Salalah (Range and Forest group) participated: Saeed Bin Masoud Al Omari (local coordinator), Ahmed Awad Bakeir, Mohamed Bin Mahad Al Awaaid, Salem Bin Mosalam Geid, Ahmed Suhail Al Marhoun, Msalam Ali Hardan and Ahmed Mosalam Al Amri.

#### Itinerary

##### **November 8**

Ali Shehade who arrived the day before from Aleppo Syria joined me on the ride from Dubai to Oman by car, arriving Novotel Seeb Hotel in the afternoon (close to Seeb International Airport and not too far from Rumais Research Station).

##### **November 9**

Met Saleem Nadaf and Salih Al Hinahi from Rumais at Seeb Airport and flew to Salalah. The other participant (Safa'a Al Farisi) took another flight late in the day.

##### **November 10**

A short meeting was held at the Agricultural Directorate with Eng. Mosalam Ahmed Bin Suhail Tabouk Assistant DG, Agricultural Directorate. The participants from Salalah: Saeed Bin Masoud Al Omari (local coordinator), Mohamed Bin Ali Al Awaaid and Ahmed Awad Bakir (Eastern region); Ahmed Bin Gamaan Al Marhoun (Central region); Mosalam Bin Faraj Ali Hardan and Ahmed Mosalam Al Amri (Western region) joined the meeting. The meeting discussed and agreed on the general plan for the field visits. The group of participants then moved to the Range and Forestry Building where the details of the mission were reviewed. Maps, Flora of Dhofar and Herbarium were checked. Field tools, pressing boards, old news papers, GPS, Campus, bags, tags scissors were prepared. For the purpose of this mission the Directorate provided two to three pickups everyday for the field trips.

##### **November 11**

Accompanied by the range and forest staff: Saeed Bin Masoud Al Omari (local coordinator), Mohamed Bin Ali Al Awaaid and Ahmed Awad Bakir we drove east of Salalah for about 40

km in the direction of Taqah (29 km) before turning north to our first stop at Wadi Dirban. The site is characterized by a permanent spring and crowded with camels and cattle. The pasture has been grazed to the ground and it was clear that the animals were relying on hand feeding. Sogot (*Anogeissus dhofarica*) and sidr (*Ziziphus spina-christi*), which are the most dominant tree species, are showing clear demarcation of the grazing line. Camels unable to reach for the high branches of the trees have turned into grazers on what ever they find on the ground (Figure 1). Nevertheless the site is showing a wide diversity of species especially the trees. The grasses that are mostly annuals (*Al aali Themeda quadrivalis* and *Al shipzaph Apluda mutica*) have been grazed to the ground.



**Figure 1.** Grazing line on trees created by camel browsing and (in the insert picture), a Camel unable to reach for branches is reaching for what ever it can find on the ground.

The pasture was in great need for reducing the stocking rate (currently 2 to 3 times its carrying capacity) in order for it to recover. Enclosure at Tawi Ateir our next stop (few km from Wadi Dirban site) is showing excellent recovery of *Themeda quadrivalis* and *Apluda mutica* both are highly palatable. At Tawi Ateir enclosure we noticed beside the annual grasses, the presence of a palatable perennial grass ‘zadrut’ *Dichanthium aristatum*. The enclosure also contained several trees of ‘thour’ *Acacia senegal*, which were planted.

We stopped at the office of the governor of Tawi Ateir who expressed concerns over the range degradation and he is looking forward to see the government plan for reducing the current camel numbers by purchasing the excess animals from herders. We then traveled east on Jebal Samhan for our next stop at 1255m altitudes. The area is also degraded but the stunted shrubs ‘Tashgout’ *Euphorbia balsamiphora* is dominating the seen. The local people use this tree for producing gum ‘Elka’ by squeezing the juice ‘milklike’

from the branches. Present also was 'Halqoum' *Solanum incanum* which is considered an indicator of overgrazing. Another non-palatable tree, which was noticed here and later on encountered in other locations in Dhofar, was 'Sheraz' *Dodonaea angustifolia*.

At a lower elevation (1014m) we came across a good stand of 'Qarat' *Acacia nilotica* subspecies *indica*. We also noted an interesting climber plant, which is destroying other shrubs by climbing and smothering them. It is known locally as 'Itra' *Cissus quadrangularis* (Figure 2) Apart from heavy grazing those weedy species 'Itra' and 'Sheraz' are becoming a threat on the range, which need a quick action like what has been taken for Mesquite *Acacia juliflora* (*Prosopis juliflora*). The species was introduced by the municipality but turned into a very serious weed, which had to be destroyed following a decree from H.H., the Sultan late 2000. The fight against Mesquite is still progressing. The two more stops on the range before sunset: at Karhanut (longitude: E 54 38 12, latitude: N 17 06 49) and Wadi Hashir (longitude: E 54 36 33 and latitude: N 17 03 12) confirmed the previous seen of overstocking. The noticeable *Acacia* species 'talh' *Acacia geradi*, 'geirat' *Acacia nilotica* subspecies *indica* seems have already contributed their share of the animal feed judging by the camel grazing line on them.



*Figure 2. Several unwanted species are now spreading on the range 'Itra' Cissus quadrangularis is the most serious one climbing and smothering Acacia species.*

## November 12

Accompanied by: Saeed Bin Masoud Al Omari and the two staff from the central region (Salem Bin Mosalam Geid, Ahmed Suhail Al Marhoun) we traveled north of the Salalah on the road to Muscat, turning left before Heiritti to visit an enclosure at Hajif about 18 km north of Salalah. Rainfall is about 200 mm, yet perennial grasses 'dafeid' *Dyschoriste dalyi* and 'kazareit' *Dactyloctenium scindicum* and 'zadrouit' *Dichanthium aristatum* were able to flourish and produce seeds under the protection from grazing inside the enclosure.

### **November 13**

Visiting the western region for two days (13&14) we were accompanied by Saeed Bin Masoud Al Omari, Msalam Ali Hardan and Ahmed Mosalam Al Amri. Our first stop was Shahab Isaeib (Geishan Mountains) altitude 1065m, with low rainfall (less than 100mm). The characteristic species noted was 'airoub' *Dracaena serrulata*, which was heavily browsed on by camels. The tree produces fibrous leaves similar to sisal, which was popular in the past for rope making by local inhabitants. The other tree species 'saab' *Acacia etbaica* is scattered on the slope. Perennial grasses were surviving on water harvesting by the roadside: These include 'zadrut' *Dichanthium micranthum*, ahier' *Loudetia flavida* and 'kazareit' *Dactyloctenium scindicum*. We stopped on our way at a veterinary center belonging to the Ministry of Agriculture. A man in his fifties told that in the old days the whole area around there was covered by trees, but he added due to the increased camels number are all gone. Our second stop was Anatokh (longitude:E 53 20 07; latitude: N 16 46 12, 18 and Altitude of 850 m). A new road is being constructed (30 km) linking the main highway to the coastal town of Rakhut. The area is enjoying a relatively high rainfall 300 mm, but more importantly low animal population probably due to the rough terrain. Here the most dominant trees are 'Sogot (*Anogeissus dhofarica*), 'khair' (*Ormocarpum dhofarense*) which our local companions described as very palatable to all livestock. Well represented also was 'aayloub' *Belepharis dhofarense*, 'khofout' *Belepharispermum hirtum* and 'thour' the gum Arabic tree *Acacia senegal*. Our last stop before sunset was to examine an enclosure at Ambroof, 12 km from the coastal town of Anatokh. The grasses of *Apluda mutica* and *Themeda quadrivalis* were up to two meters high. The only tree species was 'qatait' *Ficus sycomorus*. It is interesting to note that these enclosures are opened every year for local people to harvest the forage. This is done at the end of the season after taken plant measurements and after seed collection. By so doing a good relation is maintained with the herders. Our night stay was at a guesthouse provided by the governor of Rakhut.

### **November 14**

Back to the main road we continued west towards the Yemen boarder, then into a narrow road towards the coastal town of Dalkut. Our stop before Dalkut was Wadi Saiq (longitude E 53 13 06 and latitude N 16 45 03). Rainfall was not more than 150 but the area supports many tree species: 'qarad' *Gerwia bicolor*; 'shebhait' *Premna resinosa*; 'thour' *Acacia senegal* and *A. laeta*. At Dalkut we were welcomed by the Assistant Governorate (the Governor was out on a trip), who spoke of the Governorate concern over the spread of the weedy shrub 'sheraz' *Dodonaea angustifolia* which he feels if nothing is done it will create a similar problem like *Prosopis juliflora* (*Acacia juliflora*) in the eastern part of the province which is now being actively controlled by uprooting.

### **November 15**

Meeting at the Directorate of Agriculture, going over the information collected, seeds, herbaria and soil samples. Present were: Saeed Bin Masoud Al Omari, Saleem Nadaf, Salih Al Hinahi, Msalam Ali Hardan, Ali Shehade and Ahmed Osman. At the end of the day we visited the tree garden, which contain over 90 species, collected from the different areas of province and present a valuable source of seeds for these trees.

## **November 16**

A rap up meeting was held at the Hotel with Eng. Mosalam Ahmed Bin Suhail Tabouk Assistant DG, Agricultural Directorate. We provided a summary of the trip and our recommendations for future activities. The main areas discussed included seed collection and storage, maintenance of seed viability through proper storage facilities, rehabilitation work on degraded rangeland, In-situ conservation of genetic material, and training of support staff. We left Salalah late afternoon for Muscat.

## **November 17**

A final meeting was held at Rumais Station, where herbaria were split into two leaving one half for Oman. Due to lack of proper germplasm storage facilities in Oman the seeds collected in Dhofar were send with Mr Ali Shehadeh for storage at ICARDA Genebank after phytosanitary papers were issued. A Field visit was made to the animal research station with Dr Abdul Mohsen Al Nadi (water relation expert) to see experimental plots assessing water use by different forages including two indigenous species (*Cenchrus ciliaris* and *Coelachyrum piercei*). Sprinklers are irrigating the plots and germination has just started. Settlement was made for outstanding bills for Air tickets.

## **November 18**

Back to Dubai by car

### **Summary of activities**

The mission was guided by the list of species provided by Oman researchers as priority (Table 1). As agreed in a previous meeting ICARDA-APRP contributed:

- Two scientists
- Airline return tickets Muscat-Salalah for five participants

Also provided (on loan basis):

- GPS units (three)
- Pressing boards (ten)
- Two Cameras (one movie)

The Ministry of Agriculture and Fisheries contributed:

- One senior scientist and nine technicians
- Cars/fuel during the mission (2-3)
- Accommodation and perdiems of participating national staff.

At each site soil samples were taken to help describe the site. The samples will be analyzed at the soil laboratory at Salalah for physical and chemical characteristics. Herbaria samples were taken at all sites while seeds were collected in most sites. The Herbaria were split between Rumais and ICARDA-Dubai, while all the seeds were sent to the Genetic Resources Unit, ICARDA, for 'blackbox' storage, until suitable storage facilities become available within the country.

A database has been collected for passport data in all sites, which will be used for Herbaria samples.

On the job training was provided for all support staff during the mission in all aspects of germplasm collection, use of GPS and in the handling and storage of Herbaria samples (Figure 3)



*Figure 3. On the job training for Omani Researchers on various aspects of germplasm collection*

### **Discussion and Recommendations**

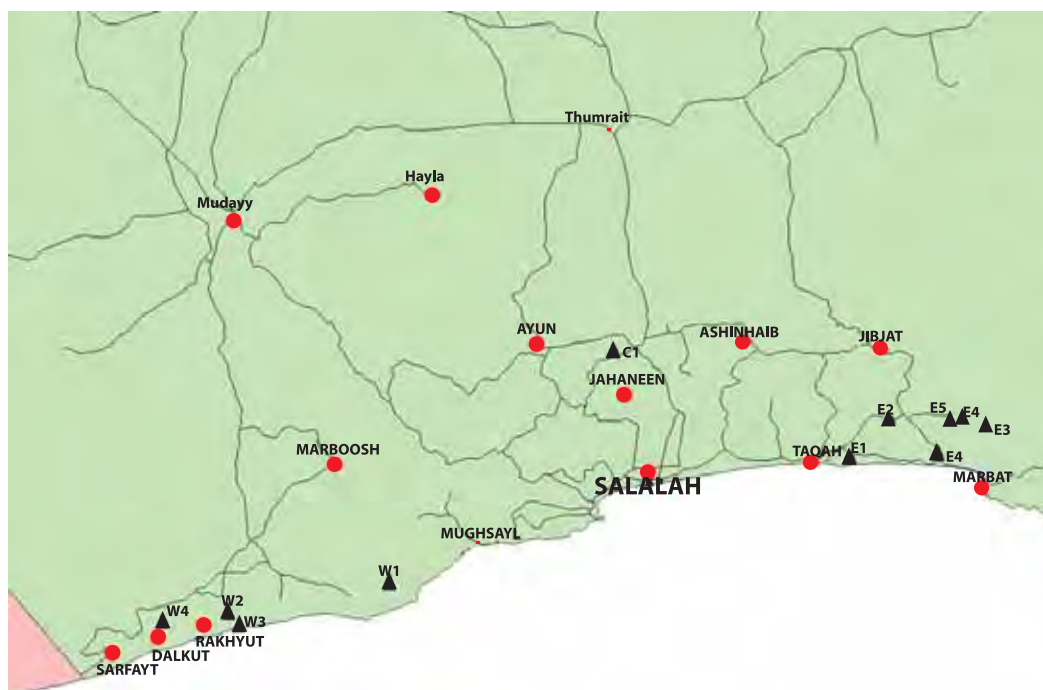
Dhofar province consists of many ecological niches created by the topography rainfall and condensation. The Salalah plain receives a mean annual rainfall of 100mm but a few kilometers to the north; the mountains receive up to 500 mm. The escarpment and plateau receive dense mists during the Kharif, where condensation is a major source of moisture for the vegetation. The large numbers of camels, cattle and goats quickly consumes the lush growth of the range during the 'kharif'. Both herders and government officials mentioned the problem of overstocking during our mission, and it was clearly demonstrated by the grazing lines on the trees (Figure 1), and by camels turning into grazers for what ever they find on the ground. Camels normally browse on tree-branches. The tree-barks have also been eaten up by camels in some cases, which could lead to death of these trees. Many of the sites visited are in immediate need for de-stocking if they have to recovery. Annual grasses are the dominant species, suggesting that perennial grasses especially in areas of high rainfall have been eaten up. Attempt for reseeding of the range was tried at Tawi Ateir in 1996 but failed due to open grazing.

Based on our field visits and discussions with government officials and herders the following recommendations are suggested:

- The stocking rate on the range is currently estimated at 2-3 times the carrying capacity, every effort need be given to reduce animal numbers. Without such step no range improvement program can succeed. The government program to create a market for excess animals is the only hope in the horizon.
- Range enclosures (currently about 25) are providing useful information on the

potential for rangeland recovery. Also they are important for seed collection. The numbers of these enclosures need to be increased (doubled) for In-situ conservation of biological diversity on the rangelands of Dhofar

- Currently the enclosures are opened for the herders at the end of each season. The new enclosures (10m x 10m) should be kept closed for a longer time in order for perennials (grasses) to recover and establish.
- The tree garden behind the building of the Agricultural Directorate, comprising over 90 tree and shrub species is important source of seeds for these species. A similar field need be established for seed multiplication of important range grasses. Large seed quantities will be needed if rehabilitation programs for the degraded rangelands are to be attempted.
- Small quantities of seeds of range plants are currently stored at room temperature. Proper cold storage facility is needed if seeds are to be stored for long time.
- Staff working on range/forestry are under the Agricultural Directorate (The Range Directorate was moved to Muscat in 1999) have received training (Diploma) in forestry and range work. They are in need of more training on all aspects of seed production, seed and herbaria storage and maintenance.
- A vacuum seed collector is available, but seed threshers and cleaners are lacking. ICARDA-APRP is providing seed scarifiers and seed cleaner equipments for the Sultanate of Oman. The seed multiplication efforts at Salalah can benefit from these facilities.



*Figure 4. Map showing germplasm collection sites (▲) in Dhofar province during November 2001.*

**Table 1:** List of target species as suggested by the Omani researchers for the collection mission in Dhofar, November 2001.**Multipurpose fodder trees and shrubs**

*Acacia gerardi*  
*Acacia laeta*  
*Acacia nilotica*  
*Acacia oerfota*  
*Acacia senegal*  
*Acacia tortilis*  
*Allophytus rubifolius*  
*Anogeissus dhofarica*  
*Cadaba spp*  
*Euclea schimperi*  
*Ficus spp*  
*Grewia spp.*  
*Maytenus spp*  
*Moringa peregrina*  
*Phamnus staddo*  
*Prosopis spp.*  
*Tamarindus indica.*  
*Tamarix aphylla.*  
*Ziziphus spp.*

**Grasses**

*Apluda mutica.*  
*Aristida spp.*  
*Cenchnus spp.*  
*Dactyloctenium spp*  
*Dichanthium spp*  
*Dyschoriste dalyi*  
*Loudetia flavida*  
*Panicum spp.*  
*Vigna radiata*  
*Setaria spp.*  
*Themda quadrivalis*

**Table 2:** Identification of herbaria collected in Dhofar province November 2001**Trees and shrubs**

*Acacia etbaica*  
*Acacia gerardi*  
*Acacia nilotica (subspecies indica)*  
*Acacia laeta*  
*Acacia Senegal*  
*Anogeissus dhofarica*  
*Belepharis dhofarensis*  
*Belepharispermum hirtum*  
*Dodonaea angustifolia*  
*Delonix elata*  
*Dracaena serrulata*  
*Euphorbia balsamiphora*  
*Ficus vasta*  
*Ficus sycomorus*  
*Gerwia bicolor*  
*Maytenus dhofarensis*

*Ormocarpum dhofarens*  
*Premna resinosa*  
*Tamrindos indica*  
*Zizyphus spina-christi*

### **Grasses**

*Apluda mutica*  
*Cenchrus sp.*  
*Cyprus rotundus*  
*Dactyloctenium scindicum*  
*Dichanthium micranthum*  
*Dichanthium aristatum*  
*Dyschoriste dalyi*  
*Loudetia flavida*  
*Seteria sp.*  
*Themeda quadrivalis*  
*Trigonella sp.*

**Table 3:** Number of accessions of each species collected in Dhofar, Sultanate of Oman in November 2001

### **Trees and shrubs Grasses and Legumes**

<i>Acacia etbaica</i>	1
<i>Apluda mutica</i>	2
<i>Acacia gerardi</i>	1
<i>Cenchrus sp.</i>	1
<i>Acacia nilotica (subspecies indica)</i>	1
<i>Dactyloctenium scindicum</i>	1
<i>Acacia laeta</i>	1
<i>Dichanthium aristatum</i>	1
<i>Acacia Senegal</i>	2
<i>Dyschoriste dalyi</i>	1
<i>Anogeissus dhofarica</i>	2
<i>Loudetia flavida</i>	1
<i>Belepharispermum hirtum</i>	1
<i>Seteria sp.</i>	1
<i>Euphorbia balsamiphora</i>	1
<i>Themeda quadrivalis</i>	2
<i>Ormocarpum dhofarens</i>	1
<i>Trigonella sp</i>	1