

Feeding preferences of gregarious nymphs and adults of the Desert locust, *Schistocerca gregaria* Forskal (*Orthoptera*, *Cyrtacanthacridinae*) in different habitats at Biskra oasis, Algeria

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ABSTRACT

The Desert locust *Schistocerca gregaria* is generally recognized as a polyphytophagous acridid that commonly causes substantial damage to pastures and crops. During the recent Desert locust upsurge in 2004, the opportunity was taken, at Biskra oasis in Algeria, to identify the types of plants preferentially eaten by gregarious Desert locusts by examining the plant types in their faeces. The plant parts seen in faeces of young nymphs were mainly grasses, especially *Cynodon dactylon* even when shrubs and trees were present. Older nymphs had less grasses in their faeces and more broad leaf crops, shrubs or trees. The faeces of adults contained very little grass remnants, and when broad leaf crops were present, there was a preference for Water melon *Citrullus lanatus* var. *caffer* and Melon *Cucumis melo* (*Cucurbitaceae*) and shrubs (young seedlings) of the common Fig *Ficus carica* (*Moraceae*) and apricot *Prunus armeniaca* (*Rosaceae*). At the site trees were present, *Casuarina torulosa* was most commonly eaten whereas nearby *Cupressus sempervirens* was not consumed at all. These feeding preferences not only reflect what plants are damaged at different stages of the life cycle but also have important consequences for survey for, and treatment of, the Desert locust.

Key words: Acridid, Gregarious Phase, Diet Preferences - Biskra Oasis

Introduction

The Desert locust *Schistocerca gregaria* Forskal is generally recognized as being phytophagous acridid that eats a wide variety of plants [8] and can cause substantial damage to pastures and crops. During the recent Desert locust upsurge that covered substantial parts of North Africa in 2004, the opportunity was taken, at Biskra oasis in Algeria, to precisely identify the types of plants preferentially eaten by Desert locusts in the gregarious phase. Detailed studies have been carried out on the food preferences of locusts in Africa, and in the summer breeding areas south of the Sahara and these studies have found that while some eat graminaceous plants,

others eat and other types of plant [2,4,1,5,9]. However, feeding preferences in the winter spring breeding areas in north Africa have not been studied and we chose to analyse the diet of nymphal and adult *S. gregaria* in areas with trees, shrubs and broad leaf crops and in open grasslands near the end of the winter-spring rains when vegetation is near full development.

Material and methods

The study was undertaken at three locations in the Biskra oasis, each with a different vegetation cover. From each location, we collected 830 individuals of *Schistocerca gregaria*, 260 young

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nymphs (first to third instar), 210 older nymphs (fourth, fifth instar) and 360 adults. Collections were made between the time of locust invasion in April 2004 until the end of the offspring generation in July.

The faeces from each locust was collected and placed in water for 24 hours, which softens the faeces and makes it possible to separate various vegetation fragments without damaging them. The vegetation fragments were then homogenized for up to 1 minute in a sodium hypochlorite solution (NaOCl), thus allowing the vegetation to be cleared without damaging the surface. The vegetation fragments were placed in Lugol's solution (or Canada balsam), on a microscope slide under a cover slip and observed under photonic microscope. The species of each of the vegetation fragments was identified using differences in the following characters: orientation of the cells relative to the central nerve; the form; the cut and fitting together of the cells; the characteristics of the cell membranes; the form and density of the stomata and the appearance of the trichomes (epidemic hairs, blisters and glands). The percent of faecal samples containing each plant species could then be calculated [7].

We announce that the number of individuals taken for each station is 830

Results and Discussion

A wide variety of plants were found at the three sites (Table 1). At Korah Station, grasses predominated but there were also some species of shrub (Table 1). To the west, was Oumache Station where there was a similar variety of grasses but there were for Water melon (*Citrullus lanatus* var. *caffer*) and Melon (*Cucumis melo*) crops along with was an overstory of shrubs of which *P. dactylefera*, *Ficus carica* and *Punica granatum* were the most common (Table 1). To the north was El-Outaya Station, which also had similar grasses to the other two sites but there were many trees, of which *Casuarina torulosa*, *Cupressus sempervirens* and *Pinus halepensis* were the most common (Table 1).

Korah Station, where grasses predominated

At Korah Station where grasses predominated, by far the most common species in the faeces of young nymphs was the grass *Cynodon dactylon* (Fig. 1). There was some *Hordeum sativum* present in the faeces but all other species were rare. By contrast, the faeces of older (fourth and fifth instar) nymphs contained a wide variety of species including *Ficus carica* (30%), *Phoenix dactyfera* (18%) *Punica granatum* (10%), *Olea europea* (8%) as well as *C. dactylon* (8%) (Fig. 2). In adults, the first four species dominated with little *C. dactylon* or any of the other grasses (Fig 3).

Western Station with Grasses, Crops and Shrubs (Oumache Station)

At the western station (Oumache), that had the grasses crops and shrubs, *C. dactylon* again dominated in the faeces of young nymphs, though watermelon *Citrullus lanatus* melon *Cucumis melo* and the shrub *Oryzopsis miliacea* were also present (Fig 4). Older nymphs had a shift away from *C. dactylon* towards other species, with Watermelon (*C. lanatus*) slightly dominant over a number of others (Fig 5). Adults ate little *C. dactylon* but fed on watermelon, melon and some of the shrubs (Fig. 6).

Northern Station with Grasses and Trees (El-Outaya)

At the northern El-Outaya station, where there were grasses and trees, *C. dactylon* again dominated in the faeces of young nymphs (Fig 7). Older nymphs had a shift away from *C. dactylon* towards shrubs, especially *Phoenix dactyfera* (Fig 8) but it was less than in the areas where there were no shrubs (Fig. 2). As in the other areas, adults ate little *C. dactylon* but fed on shrubs and the tree *Casuarina torulosa* (Fig. 9). The marked preference for the tree *C. torulosa* while leaving others uneaten (Fig. 9)

Discussion

While *Schistocerca gregaria*, eats a wide variety of plants, it does have a strong selectivity in its food even when many plant species are present (Le Gall et al., Young nymphs of the first three instars preferentially consume the lush short couch grass *Cynodon dactylon*. Even when shrubs and trees are present, young nymphs eat a great deal of this grass suggesting that the preference for it is very strong perhaps because young nymphs would find this lush grass easier to eat and/or digest than shrubs and trees. Kamal [10] found that young Desert locusts had a preference for this grass over *Penisetum* sp. in Red sea coast of Sudan and suggested that the higher nitrogen content of the plant made it more attractive (Kamal, 1985). The preference for *C. dactylon* is reduced in older nymphs, and while there is some feeding on this grass, older nymphs eat a wide variety of other plants including certain shrubs and even trees when they are present. For adults, there is little feeding on *C. dactylon*, and they commonly eat shrubs and trees. The preference for shrubs and trees has been reported by Stcherbinovsky, (1952) and Tokgaïev & Yagdyev(1965) in Latchininsky & Launois (1997) while Stoliarov (1964) in Latchininsky & Launois (1997) reported the presence of Desert locust adults on *Tamarix spp* and fruit trees in the USSR.

Table 1: Vegetation present at the three stations at Biskra oasis where locusts were collected.

Station	Plant species	Korah	Oumache	El-Outaya
Grasses				
	<i>Ampelodesma mauritanica</i>	+	+	+
	<i>Agropyrum junceum</i>	+	+	+
	<i>Avena sp</i>	+	-	+
	<i>Cynodon dactylon</i>	+	+	+
	<i>Hordeum murinum</i>	+	-	-
	<i>Hordeum sativum</i>	+	-	-
	<i>Imperata cylindrica</i>	+	+	+
	<i>oryzopsis miliacea</i>	+	+	+
	<i>Psamma arenaria</i>	-	+	-
Crops				
	<i>Citrullus lanatus Var Caffer</i>	-	+	-
	<i>Cucumis melo</i>	-	+	-
Trees				
	<i>Casuarina torulosa</i>	-	+	+
	<i>Cupressus sempervirens</i>	-	-	+
	<i>Ficus carica</i>	+	+	-
	<i>Phoenix dactylifera</i>	+	+	+
	<i>Phoenix canariensis</i>	-	-	+
	<i>Pinus halepensis</i>	-	-	+
	<i>Punica granatum</i>	+	+	+
	<i>Olea europaea</i>	+	+	+

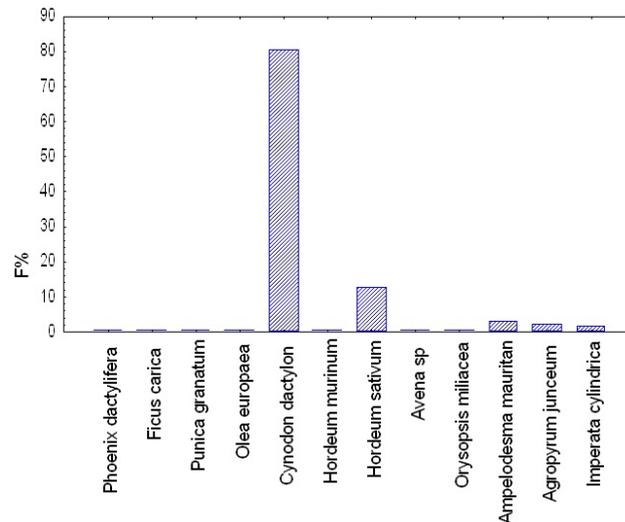


Fig. 1: Percentage of times different species of vegetation were present in the faeces of first to third instar *Schistocerca gregaria* collected from Korah Station.

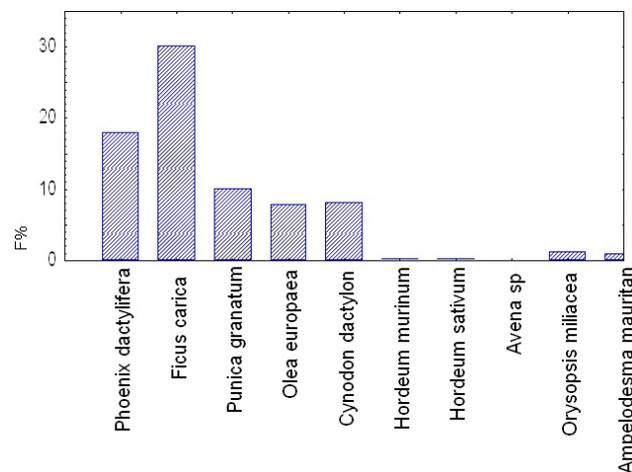


Fig. 2: Percentage of times different species of vegetation were present in the faeces of fourth to fifth instar *Schistocerca gregaria* collected from Korah Station.

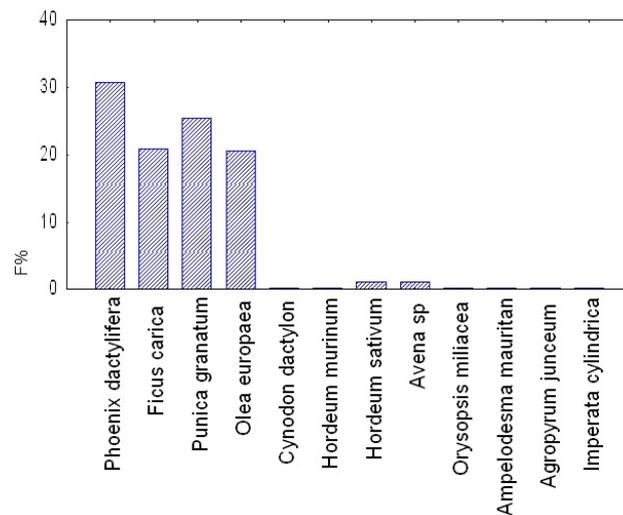


Fig. 3: Percentage of times different species of vegetation were present in the faeces of adult *Schistocerca gregaria* collected from Korah Station.

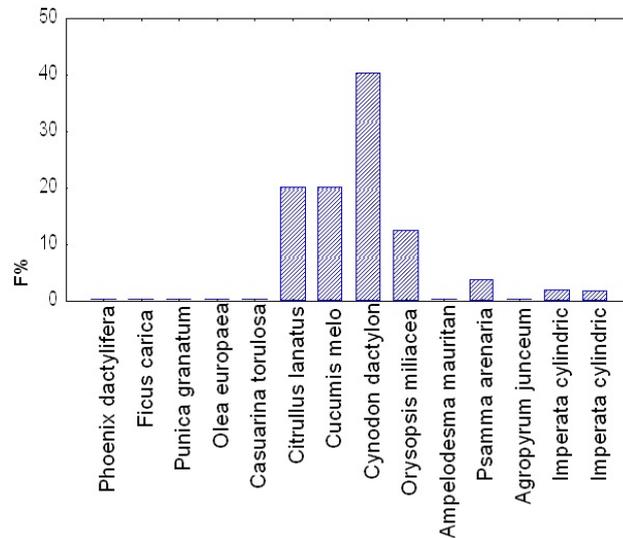


Fig. 4: Percentage of times different species of vegetation were present in the faeces of first to third instar *Schistocerca gregaria* collected from Oumache Station.

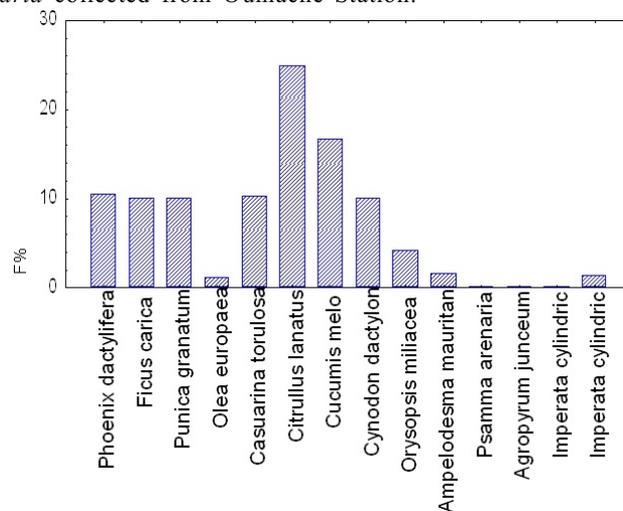


Fig. 5: Percentage of times different species of vegetation were present in the faeces of fourth to fifth instar *Schistocerca gregaria* collected from Oumache Station.

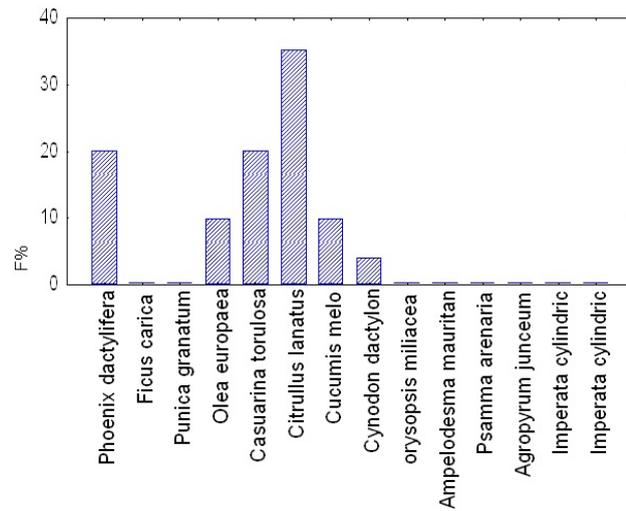


Fig. 6: Percentage of times different species of vegetation were present in the faeces of adult *Schistocerca gregaria* collected from Oumache Station.

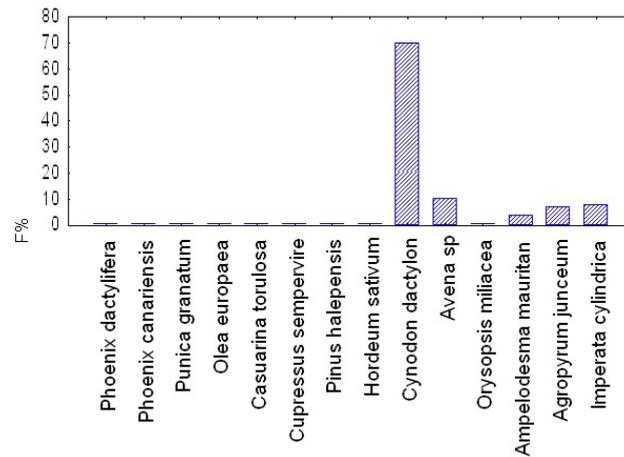


Fig. 7: Percentage of times different species of vegetation were present in the faeces of first to third instar *Schistocerca gregaria* collected from El-Outaya Station.

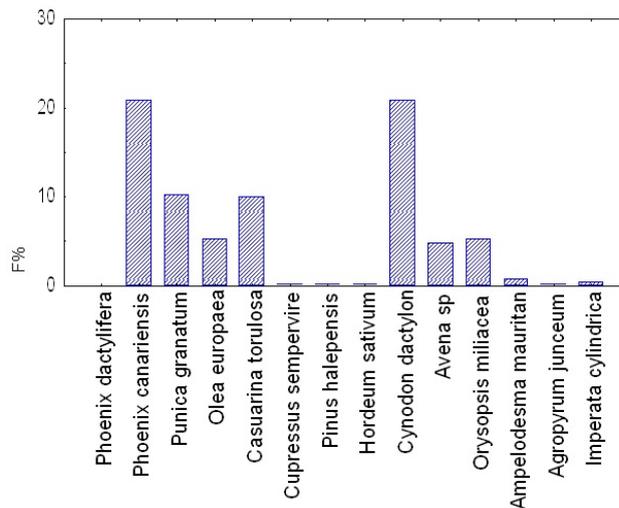


Fig. 8: Percentage of times different species of vegetation were present in the faeces of fourth to fifth instar *Schistocerca gregaria* collected from El-Outaya Station.

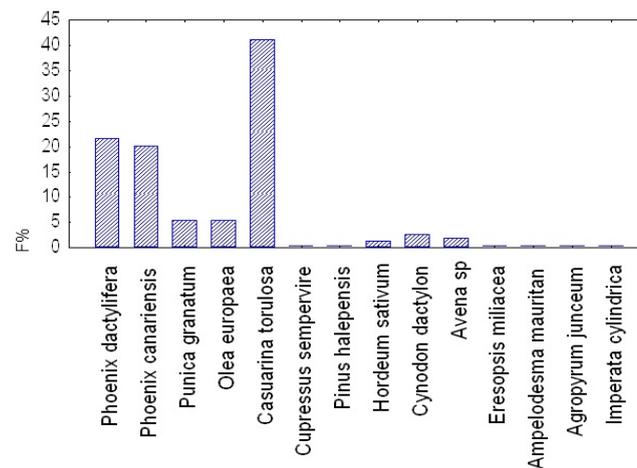


Fig. 9: Percentage of times different species of vegetation were present in the faeces of adult *Schistocerca gregaria* collected from El-Outaya Station.

We found that Desert locusts ate the watermelon *Citrullus lanatus* and melon *Cucumis melo*. which is consistent with the the results of Culmsee [9] who reported the presence of *S. gregaria* on a species wild citrullus, *Citrillus clocynthis* in Mauritania. We also found that when trees were present certain trees such as *Casuarina torulosa* were heavily damaged while other nearby species such as Cypress (*Cupressus sempervirens*) were not eaten at all. The avoidance of certain trees may be due to chemicals present such as tropolines [3] which are considered responsible for the natural durability of the wood.. These compounds, and particularly the α,β and l -thujaplicin, have often been isolated from a number of genera of the Cupressaceae (eg *Cupressus*, *Chamaecyparis*, *Juniperus*, *Thuja*.), help make the timber extremely resistant to biodegradation and have been shown to inhibit wood-destroying fungi and insects.

These feeding preferences not only reflect what plants are damaged at different stages of the Desert locust life cycle but also have important consequences for survey and treatment of this species. When surveying for young nymphs on survey, officers need to look in short grass but survey for adults, need to include looking in shrubs and trees. Targeting surveys to where locusts are likely to be particularly important early in upsurges to ensure that localised gregarious populations are located and controlled.

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