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A new subspecies of Barbastella barbastellus (Mammalia: Chiroptera: Vespertilionidae) from the Canary islands

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A new subspecies of the Western barbastelle, *Barbastella barbastellus*, is described herein from the Canary islands. This new taxon, found so far only in the islands of Tenerife and La Gomera, is morphologically distinguishable by a blackish chestnut dorsal fur, which is uniformly coloured with no grizzling shades, and by a whitish U-shaped hairy line on the lower border of the ventral side. The new subspecies seems ecologically linked to pine forest habitats and to areas that were originally occupied by the laurel forest. The endemic taxon is considered among the rarest and most endangered bat of the Canary islands and a specific programme to determine precisely population trends and habitat requirements is urgently required to establish an effective conservation strategy of the remaining populations.

Key-words: Bat - Chiroptera - Barbastella - new subspecies - Canary islands.

Introduction

Barbastella is a Palaearctic vespertilionid genus of bat widely distributed in Eurasia from the Atlantic to the Pacific coasts and North Africa (Koopman, 1993). Two allopatric species are at present recognized by most authors: the Western barbastelle, *Barbastella barbastellus*, and the Eastern barbastelle, *Barbastella leucomelas*, that are separated by a fuzzy line running along the Caucasus and Turkey (Koopman, 1993; Rydell & Bogdanowicz, 1997). This taxonomic arrangement is however open to question (Benda & Horáček, 1998; Horáček et al., 2000) since the main morphological difference (a notch in the outer border of the ear) is quite variable, even within each species (Hackethal et al., 1988; Kock, 1969; Qumsiyeh, 1985). On the other hand, some skull differences recently described between the two forms would support a specific distinction between these western and eastern barbastelles (Harrison & Makin, 1988; Harrison & Bates, 1991) but again these characters are variable (Horáček et al., 2000).

The western form *Barbastella barbastellus* is considered as monotypic and is distributed mainly in Europe east to the Caucasus with isolated populations in Morocco and the Canary islands (Rydell & Bogdanowicz,1997). An old citation from Senegal (Rochebrune, 1883) is doubtful. *Barbastella barbastellus* is known from the Canary islands since Cabrera (1904). This old record was overlooked until recent revisions of the bat fauna of the Canary archipelago (Ibáñez & Fernández, 1985; Trujillo, 1991).

We have had the opportunity to examine a total of 42 specimens of *Barbastella* collected from different localities of the Canary islands during several years, and have consistently found unique external morphological features which distinguishes them from other barbastelles. Reference museum specimens of *Barbastella barbastellus* from different localities from both Africa and Europe have been examined and compared with those from the Canaries. External (forearm) and skull measurements were obtained with dial calliper to a precision of 0.1 mm and compared among populations. Although no significant difference were found in measurements (see Tables 1 and 2), some external characters found in the island populations

have not been found in other specimens. Therefore the populations found on the Canary islands are distinct from any continental barbastelle and described herein as a new subspecies of *Barbastella barbastellus*.

The following abbreviations are used:
EBD = Estación Biológica de Doñana, Sevilla, Spain;
MNCN = Museo Nacional de Ciencias Naturales. Madrid, Spain;
MNH = Museo de La Naturaleza y El Hombre, Santa Cruz de Tenerife, Spain;
MHNG = Muséum d'histoire naturelle de Genève, Switzerland;
ULL = Universidad de La Laguna, Tenerife, Spain;
DT = Private collection of Domingo Trujillo;
CC = Private collection of Carlos Camacho.

Description

Barbastella barbastellus guanchae ssp. n.

Figs 1 and 2

Type material: Holotype: (MNH 109), adult male from Barranco de La Cantera, La Guancha (Tenerife island) (UTM 28RCS3840, 300 m a.s.l.), collected 1 September 1987 by D. Trujillo. Paratypes: (EBD 16024, 16028 and MNH 111, 110), 3 females and 1 male from Agulo, La Gomera island collected between 15 and 20 September 1987 by D. Trujillo, C. Ibáñez and R. Barone.

Diagnosis: Dorsal fur blackish chestnut with individual hairs coloured uniformly. Ventral fur greyish chestnut, also uniformly coloured except for a noticeable whitish U-shaped strip that extends through the flanks and proximal wing and tail membranes (Figs 1 and 2).

Description: Dorsal fur uniform blackish chestnut. Since the individual hairs are uniformly coloured, the fur lacks the grizzling shade typically found in the main land specimens. Ventrally, the fur is paler brown and hairs show whitish tips. A whitish band stretches along the flanks and the inner hairy parts of the wing and tail membranes (Figs 1 and 2). The colour of the band is distinct from the colour of the central part of the belly and it is an outstanding feature that was clearly noticeable in 40 out of the 42 specimens studied from the Canaries. It was also present in the remaining 2 specimens, although in a more blurry way. Twenty-nine out of 34 individuals studied for ear characters (Hackethal et al., 1988) showed a notch in the outer edge of both ears; this notch was present in only one ear in 4 specimens and only 1 individual had the notch missing in both ears.

Measurements: Average values for populations from the Canary islands are given by sex in Table 1. Measurements of the holotype (in mm) are:
forearm length: 39.0;
greatest length of the skull: 14.0;
condylobasal length: 13.3;
zygomatic breadth: 7.2;
C-M3 length: 4.5;
M3-M3 breadth: 5.5;
interorbital breadth: 3.7.

Etymology: the name refers to the village of La Guancha, up in the north of the island of Tenerife where the holotype was collected.

Distribution: It is known only from the islands of Tenerife and La Gomera (Fig. 3), but its presence is still possible in other western islands (e.g. La Palma).

Fig. 1. A live specimen of the endemic *Barbastella barbastellus guanchae* ssp. n. from La Gomera (Canary islands), showing its characteristic (and diagnostic) blackish, uniform dorsal colour.

Habitat: The new *Barbastella barbastellus guanchae* has been found in the islands along a wide altitudinal belt ranging from 20 to 1,380 m a.s.l. Interestingly, 14 out of the 15 known localities are located in the north-facing slopes, which are the wettest and more forested areas of the islands (Fig. 3). Barbastelles have been netted in habitats varying from scattered cultures in wooded areas (4 times) to well preserved pine and laurel forests (4 and 3 times respectively). We postulate that the original forests of the islands would have yielded a suitable habitat for that species, as it corresponds to mainland habitat of *Barbastella barbastellus* (Rydell & Bogdanowicz, 1997; Urbánczyk, 1999).

Comparison with continental *Barbastella*: When compared externally with other related forms of barbastelles the dorsally uniform colour of *Barbastella barbastellus guanchae* is outstanding. In all detailed descriptions of *Barbastella barbastellus barbastellus* (e.g. Miller, 1912) as well as in all the mainland specimens examined by us, and even in the descriptions of *Barbastella leucomelas* (e.g. Harrison & Makin, 1988; Harrison & Bates, 1991: Bates & Harrison, 1997), the dorsal fur of barbastelles is described as typically having grizzling shades due to the whitish tips of the hairs (Fig. 2).

Ventrally, both *Barbastella barbastellus barbastellus* and *Barbastella leucomelas* show a more variable colour with whitish hairs sparse or grouped but never making the U-shaped strip so clearly defined as in *Barbastella barbastellus guanchae* (Fig 2). A high percentage of individuals showing a notch in one or both ears is also characteristic in the European population of *Barbastella barbastellus*, being much less frequent in the species *Barbastella leucomelas* (Harrison & Makin, 1988; Bates & Harrison. 1997; Benda & Horáček, 1998).

All populations show significant sexual dimorphism in forearm length, as it is characteristic in other vespertilionid bats (Myers, 1978). There are no significant differences in forearm length between any island population and continental ones (Table 2) even when they are pooled as a single island population (Table 3).

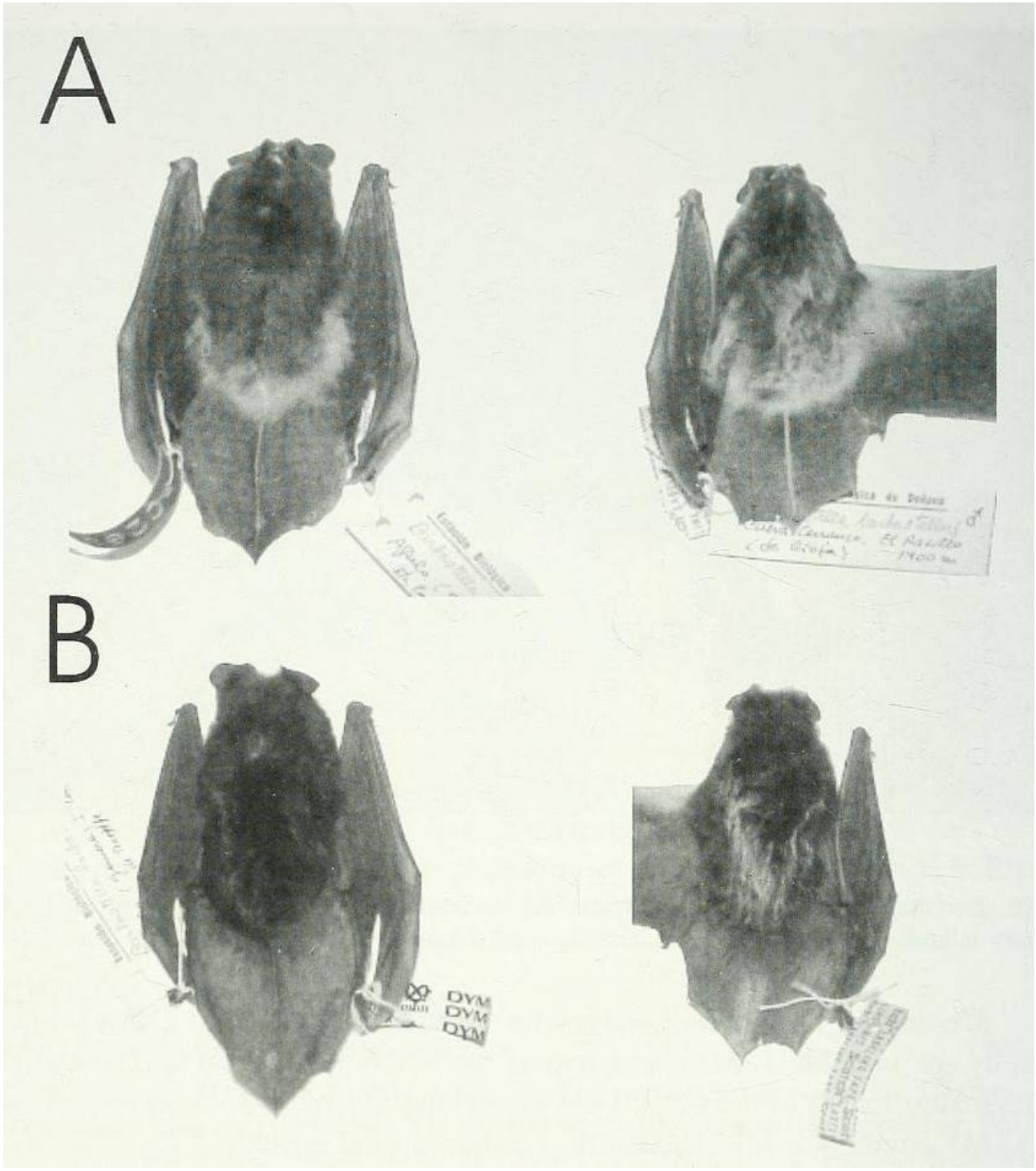

Fig. 2. Comparison of *Barbasrella barbastellus guanchae* ssp. n. (left) from the Canary islands and *Barbastella barbastellus barbastellus* (right) from the Iberian Peninsula. (A) ventral view, (B) dorsal view.

Skulls of *Barbastella barbastellus guanchae* are morphologically more similar to those of *Barbastella barbastellus barbastellus* as concerns the well developed supraoccipital flange of the mastoid region, when compared that of *Barbastella leucomelas* (Harrison & Makin, 1988). Skull measurements showed similar average values among populations of *Barbastella barbastellus barbastellus* (Table 1), but the significance of differences could not be tested because of small sample sizes.

The new subespecies *Barbastella barbastellus guanchae* shows also similar skull measurements with specimens of *Barbastella leucomelas* from Arabia (Harrison & Bates, 1991), but are slightly smaller than those from the Caucasus/Himalayas area (Bates & Harrison, 1997; Benda & Horáček, 1998).

	Barbastella b. guanchae		*Barbastella b. barbastellus*			
	Canary Islands		Morocco		Europe	
	male	female	male	female	male	female
FA	39.0 ± 0.71 21 37.2 - 40.1	40.7 ± 0.78 16 38.9 - 42.0	38.4	40.1	39.0 ± 0.83 30 37.2 - 40.9	40.1 ± 0.96 22 38.3 - 41.8
GLS	14.0 ± 0.08 3 13.9 - 14.1	14.1 ± 0.12 5 13.9 - 14.2	13.8	13.9	13.7 ± 0.29 3 13.4 - 13.9	14.1 ± 0.17 5 13.9 - 14.4
CBL	13.1 ± 0.28 3 12.8 - 13.4	13.4 ± 0.18 5 13.1 - 13.6	12.9	13.1	13.1 ± 0.46 3 12.8 - 13.6	13.4 ± 0.09 5 13.3 - 13.5
ZW	7.3 ± 0.10 3 7.2 - 7.4	7,5 ± 0.20 5 7.2 - 7.7	7.2	7.5	7.3 ± 0,11 3 7.2 - 7.4	7.6 ± 0.11 5 7.4 - 7.7
CM3	4.5 ± 0.18 3 4.3 - 4.7	4.6 ± 0.07 5 4.5 - 4.7	4.6	4.5	4.6 ± 0.11 3 4.5 - 4.7	4.6 ± 0.16 7 4.4 - 4.8
M3-M3	5.5 ± 0.07 3 5.4 - 5.5	5.5 ± 0.11 5 5.4 - 5.6	5.3	5.3	5.3 ± 0.17 3 5.1 - 5.4	5.6 ± 0.08 7 5.4 - 5.7

Tabel 1. External and skull measurements of specimens of *Barbastella barbastellus* s. l. (Mean ± 1 SD, n, Min - Max). Abbreviations: FA = Forearm length; GLS = Greatest length of the skull; CBL = Condylobasal length; ZW = Zygomatic width; CM3 = length from the upper canine to the upper third molar; M3-M3 = Width between upper third molars. SD = Standard deviation; n = sample size; Min = Minimum value; Max = Maximum value.

Specimens examined (type material included):
Barbastella barbastellus guanchae: The Canary Islands: 1 male (MNCN 542) without locality, 2 males (MNH 110, CC without number), 3 females (EBD 16024, 16028, MNH 111), 1 (CC without number), La Gomera; 1 female (?) (ULL without number), 1 male (MNH 109), Tenerife.
Barbastella barbastellus barbastellus: Morocco: 1 male (EBD 25851), Azrou; 1 female (EDB 8970), Chechaouen. Belgium: 2 males (MHNG 1710.5, 1710.6), without locality. France: 2 males (MHNG 874.55/1, 874.55/2), 2 males (MHNG 874.55/3, 874.55/4), Alsace; 2 males (MHNG 1710.26, MHNG 1493.28), 2 females (MHNG 975.95, MHNG 1493.27), Haute-Savoie. Germany: 1 female (MNCN 541), Berlin. Iberia: 1 male (EBD 9262), Cantabria; 1 female (EBD 9765), Guadalajara; 1 male 1 female (DT), Huesca; 1 male (MNCN 543) Madrid; 1 female (MNCN 544) Orense; 1 male (MNCN 546), 1 female (MNCN 545), 3 (MNCN 547, 548, 549) Salamanca; 2 males, 1 female (MNCN 550, 551, 552) Segovia; 1 male (EDB 15981), 1 female (EBD 18288), La Rioja; 2 males (DT), 1 female (DT), Zaragoza. Switzerland: 2 males (MHNG 1043.93, 1043.94), 5 females (MHNG 1043.88 - 1043.91, MHNG 1804.094), Valais; 13 males (MHNG 986.86 - 986,89, MHNG 1709.91 - 1709.96, MHNG 1710,1, MHNG 1710.7, MHNG 1709.89), 8 females (EBD 9904, 9905, MHNG 986.82, 986.83, MHNG 1709.90, MHNG 1710.8, MHNG 1710.2, 1710.3), Vaud. Additionally, 24 specimens from the Canary Islands (18 from Tenerife and 16 from La Gomera), and 17 from the Iberian Peninsula (11 from Zaragoza, 4 from Huesca and 2 from La Rioja) were captured, measured, checked for morphological characters (dorsal and ventral fur, and ear notch) and finally released.

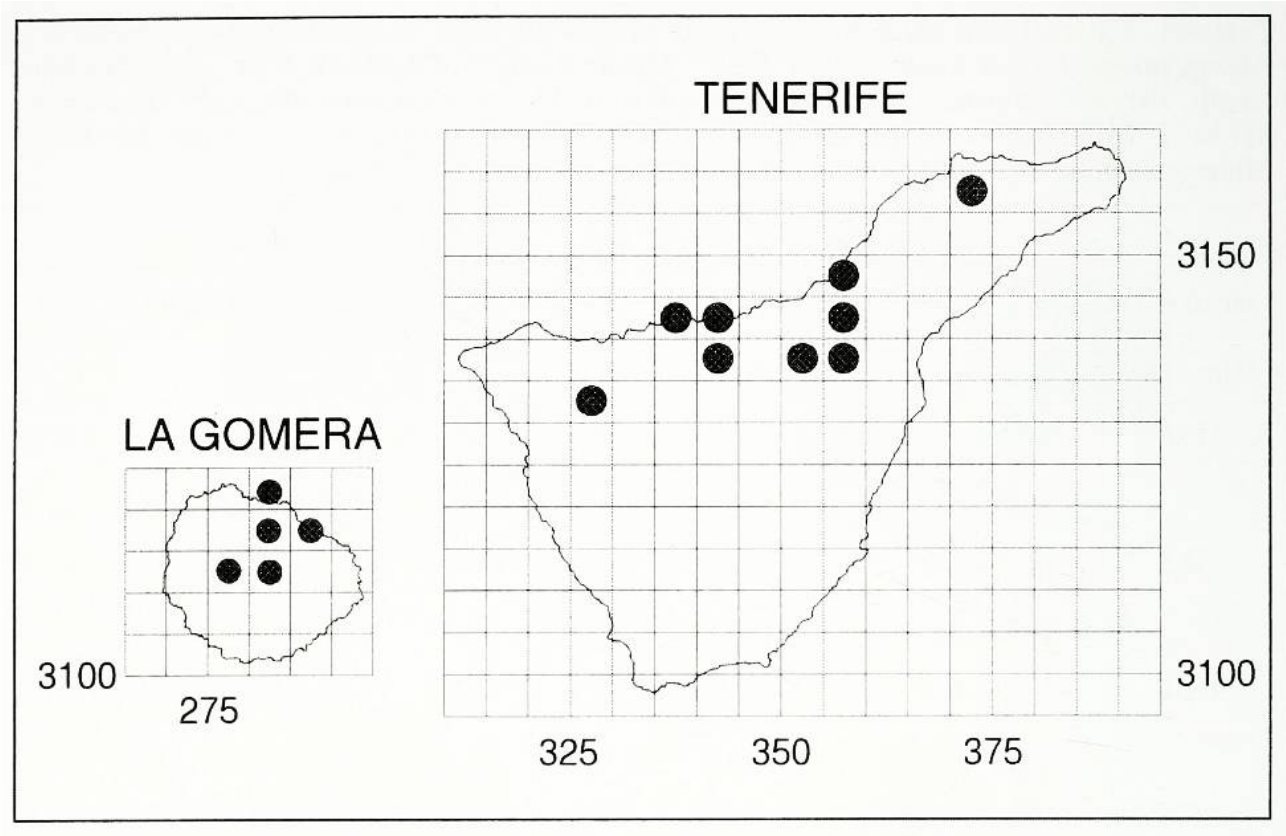

Fig. 3. All known collecting localities of the endemic *Barbastella barbastellus guanchae* in a 5 x 5 km UTM grid map of Tenerife and La Gomera (Canary islands).

Source	DF	F value	P
Locality	3	2.339	0.0795
Sex	1	21.457	<0.0001
Local * Sex	3	1.096	0.3557

Table 2. ANOVA test for differences in forearm length between sex and localities of barbastelle populations. Localities were Tenerife and La Gomera (Canary islands), Morocco and Europe.

Source	DF	F Value	P
Locality	2	1.456	0.2390
Sex	1	13.174	0.0005
Local * Sex	2	1.698	0.1893

Table 3. ANOVA test for differences in forearm length between sex and localities, but grouping the islands as a single population (Canary islands vs Morocco vs Europe).

Comments

Barbastella barbastellus is one of the rarest bat in Europe (Urbánczyk, 1999). It becomes even scarcer in the southern half of the Iberian Peninsula, being at present known only from three localities (Ibáñez et al., 1992). This trend is also found in Morocco, where it has been cited only from three localities, all from mountains of the Rif (Ibáñez, 1988), the Middle Atlas (Panouse, 1956) and the southern Grand Atlas (Fonderflick et al., 1998). Therefore, it seems that the distribution in both Iberia and Morocco is highly fragmented.

We suspect that the populations from the Canary islands are also highly isolated from continental populations. Moreover the species has not been found in the eastern islands of the Canary archipelago, which are closer to the mainland. Ongoing molecular analyses on these populations will help clarify this point. The bat fauna of the Canary islands shows clear Mediterranean affinities, although it supports endemic components like *Plecotus teneriffae* and *Pipistrellus maderensis*, the last is shared with the Madeira archipelago (Ibáñez & Fernández 1985).

The remaining species (*Pipistrellus kuhlii*, *Hypsugo savii*, *Nyctalus leisleri* and *Tadarida teniotis*) have not yet been examined carefully and some of them may need taxonomic revision. In fact, Ellerman & Morrison-Scott (1966) have already considered the populations of *Hypsugo savii* as to be differentiated at the subspecific level (*Hypsugo savii darwini*).

Conservation status: According to the small number of known observations and localities, *Barbastella barbastellus guanchae* can be considered the rarest species of the bat fauna of the Canary islands at present (Trujillo unpubl. data). This situation could be in part due to the loss of suitable habitats since the original forests have been fragmented and reduced due to agricultural and other human activities. Its historical status could have been worsened by the intense usage of DDT in the islands during the fifties to fight against the African locust (*Schistocerca gregaria*). Studies on size of populations and ecological requirements of this new taxon are urgently required to allow the design of effective short- and long-term measures to assure its conservation.

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