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New records and distribution modeling of *Gryne orensis* (Sørensen) (Opiliones: Cosmetidae) support the Mesopotamian–Yungas disjunction in subtropical Argentina

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Abstract

The presence of *Gryne orensis* (Sørensen) (Opiliones: Cosmetidae) in a Yungas locality (northwestern Argentina) is reported for the first time, providing new evidence for the Mesopotamian-Yungas disjunct pattern. Combining a total of 19 new Mesopotamian records with previous, reliable citations from the literature, a dataset of 45 points was used to model the potential distribution of the species, using the presence-only methods BIOCLIM and MAXENT. Models supported the existence of a distributional gap across the Semiarid Chaco. The imprecise literature record from "El Impenetrable", province of Chaco, is assigned to three tentative locations to evaluate if models are affected by their inclusion; in all cases, the disjunction was maintained. It was thereby estimated that the actual record might have originated in a site closer to the Humid Chaco and/or associated to streams. This paper also provides a statement of the bioclimatic profile and identification of major environmental constraints that define the range of *G. orensis*.

Key words: Neotropical Region, disjunction, bioclimatic profile, potential distribution modeling, MAXENT, BIOCLIM

Introduction

As defined by Acosta (2002), the Argentinean opiliogeographical area called "Mesopotamia (*sensu stricto*)" covers an extensive humid and sub-humid plain, mainly arranged along the surroundings of middle and lower courses of Paraná and Paraguay rivers. It comprises provinces of Corrientes and Entre Ríos, extending westward in a strip along the eastern borders of the provinces of Formosa, Chaco and Santa Fe (*i.e.*, over the Humid Chaco ecoregion; Olson *et al.* 2001), up to a narrow projection reaching northern Buenos Aires (Acosta 2002). Along the Paraguay River, many Mesopotamian species also extend into eastern Paraguay while some probably even distribute further north. While most typical Mesopotamian species follow the described pattern closely, a number of entities—like *Discocyrtus dilatatus* Sørensen, 1884, *D. prospicuus* (Holmberg, 1876), *D. testudineus* (Holmberg, 1876) (Gonyleptidae: Pachylinae) and *Pectenobunus paraguayensis* (Canestrini, 1888) (Sclerosomatidae: Gagrellinae), among others—spread further into the inland province of Córdoba, reaching the base of the central Sierras (Acosta 1995, 2002). A few species revealed a disjunct pattern, with populations isolated in montane rainforests of Northwestern Argentina (NWA from now on), *i.e.*, the Yungas ecoregion (Brown *et al.* 2006). Thus far, species that exhibit this disjunct pattern are three gonyleptids: *Discocyrtus dilatatus* and *D. prospicuus* (Mesopotamian *sensu stricto*) and the Misiones species *Geraeocormobius sylvarum* (Holmberg, 1887), the latter actually representing a disjunction between Yungas and Paranense (Alto Paraná) forests (Acosta 1995, 2002, 2008; Acosta & Guerrero 2011).

This pattern has been given a central role in biogeographical hypotheses invoking climate change scenarios. In fact, between the Mesopotamian and Yungas conditions there is a separation, about 400–500 km wide, consisting of thorny Semiarid Chaco, where no harvestmen population from either of the adjacent regions are deemed to subsist (Acosta 1995, 2002). The presence of species on both sides of the sub-xeric Chaco has been attributed to

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Castiglioni 1970). Most of this ecoregion, encircled by the 47º isotherm of maximal temperatures (with absolute record—48.9ºC—in eastern province of Salta), was called the "South American pole of heat" (Prado 1993). Besides our reasoning for selecting localities that were accessible in 1973, it seems clear that, the farther we move into the Semiarid Chaco, the more that suitable habitats will be confined to riversides for *G. orensis*. Our own captures of *G. orensis* in some Mesopotamian localities (Villa Constitución; Santa Lucía; Colonia Dalmacia; El Colorado), as well as references in the literature (Valentinis de Martínez 1974), indicate this long-legged cosmetid as a frequent dweller of floodplains, on the margins of permanent or intermittent streams. An intricate network of tortuous rivers and "riachos" in the Humid Chaco, full of swamps and abandoned meanders, bordered by gallery forests, offers optimal ecological conditions for *G. orensis* in the eastern side of provinces of Formosa and Chaco (and adjacent areas in Paraguay); these favored conditions rapidly diminish towards the west (Ragonese & Castiglioni 1970, Ramella & Spichiger 1989, Nores 1992). Such micro-environmental details cannot be properly accounted for by methods used in the present study, so the continuity of the species across the Chaco (*e.g.*, along riparian vegetation) remains here untested.

Observations at hand, however, do not support the continuity. Surveys across the Semiarid Chaco are scarce, trapped in a "sampling vicious-circle" (the meager success, due to aridity, will not attract much interest of harvestmen collectors there). The only semi-systematic collecting in the region was carried out by us, consisting of an E–W transect along National Highway 81 in the province of Formosa (the same followed by Nores 1992), with some detours to Bermejo River. These samples retrieved a picture that might be considered consistent to the alleged Chaco gap: in our fieldwork Mesopotamian harvestment abruptly "vanished" from El Colorado onwards, maintaining the negative recording in all surveyed Chaco localities along almost 500 km. Negative localities included: Villa Rio Bermejito; meander near Estanislao del Campo; near Las Lomitas; Highway 39, bridge over Teuquito river; 50 km S Ingeriero Juárez—only samples of the Chaco cosmetid *Gnidia holmbergii* (Sørensen, 1884) in the latter—; and Pichanal (the first one indicated as 1 in Fig. 3 A, the rest depicted as crosses). Caimancito was our first site where either a Mesopotamian or Yungas harvestman reappeared. In any case, the disjunction of *G. orensis* is a provisional statement that needs consolidation in more parts of the range. As Silva (1994) warned for avian distribution, the gap in the Argentinean Chaco does not mean that Mesopotamian and Yungas ranges cannot be connected elsewhere, for example, through central Brazil or southern Bolivia, where harvestmen distribution is still poorly documented. The transverse "bridge" insinuated by the BIOCLIM model (Fig. 1, but not recovered by MAXENT) should at least draw our attention as a potential area of future research.

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