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Analysis of the Panurginae distribution in West-Africa and report of new data for *Meliturgula scriptifrons* (WALKER 1871) in Mali (Hymenoptera, Apoidea, Andrenidae)

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A b s t r a c t : Panurginae are usually considered absent in West-Africa. Now, recently several species were observed or described in a region extending Southern the Sahara from Lake Chad since Atlantic coast. One reports here new data for *M. scriptifrons* (WALKER 1871) found in Northern Mali. On the basis of these new observations, one deepens a former discussion on the Panurginae distribution in West-Africa.

K e y w o r d s : Panurginae, *Meliturgula*, Sahara, Mali, distribution.

Introduction

The distribution of the Panurginae in Africa is strongly fragmented. North Africa welcomes a typical and very diversified Mediterranean fauna. Southern, 15 Ethiopian species, belonging to several typical nearly endemic groups, are mainly distributed in Namibia and South Africa (Map 1). Between these two main poles, some isolated populations are locally observed, principally in Eastern Africa, reaching Northern Saudi-Arabia (PATINY 2001; PATINY & GASPAR 2000a, b). Several studies (PATINY 2001; PATINY & GASPAR 2000 a) reported also the presence of such isolates, implying 3 species (*Borgatomelissa brevipennis* (WALKER 1871); *Melitturga albescens* PÉREZ 1895; *Meliturgula senegaliae* PATINY 1999), in Western Africa, Southern Nouakchott (Mauritania), between Chad Lake (Chad) and the Atlantic coast.

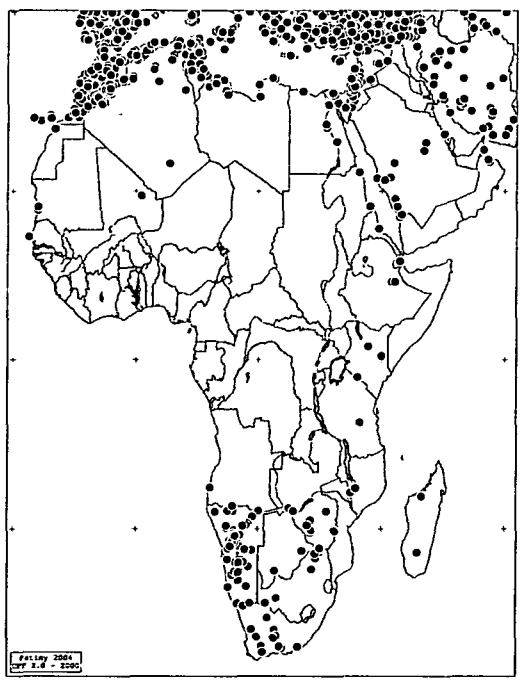
Recently, the study of some BMNH (London) series revealed the presence of a fourth Panurginae species in the latter area: *Meliturgula scriptifrons* (WALKER 1871). The presence of this species in the region is remarkable, notably because *M. scriptifrons* is a typical Ethiopian species, very frequent in Southern Africa and also the most widely expanded *Meliturgula* in East Africa.

In the present paper, one reports these new data, proposes a general mapping of the African Panurginae and deepens the PATINY & GASPAR (2000a, b) hypothesis concerning the formation of the West African isolated populations.

Results

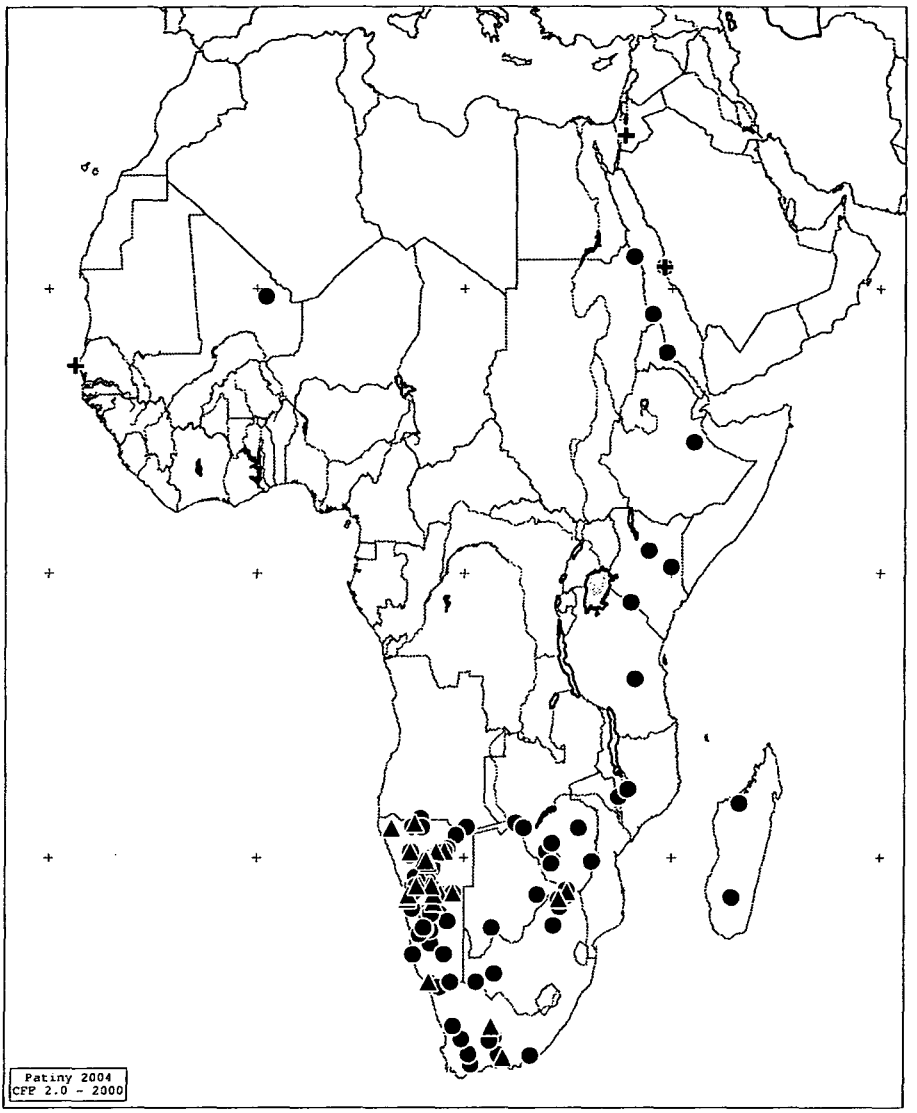
Tab. 1: Checklist and distributions overview of the main Panurginae group in the Ethiopian region: *Meliturgula* FRIESE 1903.

Genus *Meliturgula* FRIESE 1903		
Subgenus *Meliturgula* s.str.	Subgenus *Poecilomelitta* FRIESE 1912	Subgenus *Popovmeliturgula* PATINY 1999
M. braunsi FRIESE 1903 Distribution: Namibia, South-Africa *M. haematospila* COCKERELL 1935 Distribution: Namibia, South-Africa *M. insularis* BENOIST 1962 Distribution: Madagascar *M. scriptifrons* (WALKER 1871) Distribution: Angola, Botswana, Erythrea, Ethiopia, Kenya, Malawi, Mali, Namibia, Saudi Arabia, South-Africa, Sudan, Tanzania, Zimbabwe *M. wilmattae* COCKERELL 1932 Distribution: South-Africa	*M. eardleyana* PATINY 2000 Distribution: Namibia, South-Africa *M. flavida* (FRIESE 1913) Distribution: Namibia, South-Africa *M. fuliginosa* (FRIESE 1913) Distribution: Namibia *M. rozeni* EARDLEY 1991 Distribution: Namibia	*M. denesia* PATINY 1999 Distribution: Jordan *M. ornata* (POPOV 1951) Distribution: Saudi Arabia *M. senegaliae* PATINY 1999 Distribution: Senegal

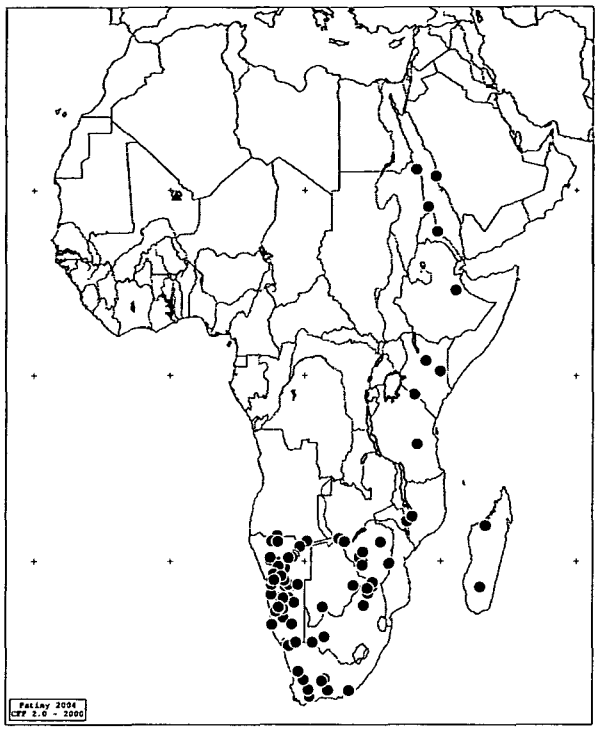


Panurginae data (15000+ specimens)

Map 1: Global distribution of the Panurginae in Africa and around the Mediterranean basin (on basis of the data included in the Banque de Données Fauniques Gembloux-Mons).



Map 2: Geographical distributions of the 3 *Meliturgula* subgenera: *Meliturgula* s.str. (dots), *Meliturgula* (*Poecilomelitta*) (triangles), *Meliturgula* (*Popovmeliturgula*) (crosses).



Map 3: Geographical range of *Meliturgula scriptifrons*. The new data from Mali are designated by a triangle superimposed on the dot. Data: Mali, Aguelhok, 26 ix 76, G. Popov.

Discussion

PATINY & GASPAR (2000a, b) and PATINY (2001) discussed the main characteristics of the Panurginae distribution in Africa, proposing hypothesis to explain the formation of these populations. However, the new data reported here for *M. scriptifrons* in North Mali allow deepening several points of this discussion.

Panurginae, particularly *Meliturgula*, must be regarded as ecologically strongly linked to the xeric ecosystems. Indeed, most of the known species are distributed in wide opened and dry habitats. Besides, the highest diversity scores for these species are recorded in the Mediterranean like regions and the deserts peripheries (EARDLEY 1991; PATINY 2001; PATINY & GASPAR 2000a, b; WARNCKE 1972, 1985, 1987). The ranges are also linked to the mountain chains, where the bees can find favourable temperature and dryness gradients (Map 1). The new locality recorded here for *M. scriptifrons* in Mali fits to this general definition of the Panurginae distribution. Aguelhok is positioned along an affluent of the large Tilemsi Oued close to the Adrar of Iforas, a typical zone of peri-desert steppes (Map 3).

When considering the four species of which presence was reported in Western Africa, it is interesting to observe that each belongs to a group (genus, subgenus or species) more diversified and abundant (generally nearly endemic) elsewhere in Africa (Table 1). *Melitturga* (*Australomelitturga*) is endemic in Southern Africa, *M. albescens* is thus the subgenus only species distributed Northern the Sahara. Likely, the Western populations

of *B. brevipennis* and *M. senegaliae* constitute isolates of respectively *Borgatomelissa* PATINY 2000 and *Meliturgula* (*Popovmeliturgula*) PATINY 1999, which are mainly distributed in the Arabian Peninsula (Map 2). Finally, the here reported data of *M. scriptifrons* in Mali appear also as such an isolate of a mainly Southern distributed species (Map 3).

These data analysis leads to conclude, that migrations opportunities between Western Africa and the other parts of the continent must exist or have existed. However, the modalities of these populations exchanges remain to define. In the frame of this research of understanding several observations can be made.

Firstly, it seems obvious that isolation appeared several time in history. Indeed, the taxonomical isolation observed in the *M. albescens* and *M. senegaliae* cases implies to hypothesis rather long time isolation. On the contrary, no taxonomical divergence was observed between populations of *B. brevipennis* and *M. scriptifrons*. In these latter cases, the Western populations formation could have been more recent. Moreover, one can hypothesis, in regard of the contemporary ecosystems expansion, that the concerned populations are no more connected one to each other.

Secondly, the Western Africa populations of Panurginae seem to be relict. They are indeed strongly reduced, isolated of their closest relative, and seemingly very narrowly expanded. One can thus consider that they could be the contemporary forms of former wider distributions. Regarding the contemporary distribution of the here studied species, the Western Africa populations could have 2 distinct origins, coming either from Southern or Eastern Africa. The hypothesis of East-West populations migrations is interesting in the cases of such species as *B. brevipennis* and *M. senegaliae*. In the opposite, concerning *M. albescens*, no *Australomelitturga* populations are known in Eastern Africa, the subgenus being nearly endemic in Southern Africa. The *M. scriptifrons* distribution offers a particular case, which could be explained by the 2 previous hypothesis, the species being present both in Southern and Eastern Africa. Nevertheless, even if an origin from East Africa can be argued to explain the presence of *M. scriptifrons* in Mali, it must be considered as a secondary Western expansion. The main populations of the species being South-African, a Southern primary origin seems to be the most relevant hypothesis.

The current Palaeo-ecological knowledge of Africa offers good explanatory hypothesis for these migration mechanisms. One knows that the Earth is submitted to a cycle of glacial and interglacial periods. In Africa, these climate changes influence notably the relative ranges of the rainforest and deserts. During the glacial maximums, deserts are drier than now and probably very unfavourable for life, while the tropical rainforest is strongly reduced and partly replaced by scrubs and savannas (LEROUX 1996). Now, these latter formations are the typical habitats of Panurginae, which are, like most bees, xerophilous species. This reduction of the rainforest can thus be regarded as having allowed the formation of metapopulations, which can have been splitted into several others under the pressure of the re-expansion of the forest during interglacial. This ecosystems distribution change can thus be regarded as having been favourable to Southern-Northern populations migrations through Africa. It can explain notably the contemporary distribution of *M. albescens* and eventually the here reported data for *M. scriptifrons* in Mali.

On the contrary, during the interglacial periods, while the rainforest expands to its maximum, constituting probably an obstacle to the xeric species dispersion, the deserts are moister than previously. They are then occupied by savannas and semi-deserts formations, and consequently more favourable to the Panurginae expansion. These interglacial conditions can thus be regarded as favourable to the Eastern-Western migrations and offer a good explanation to the *B. brevipennis* and *M. senegaliae* presence in Western Africa.

Concerning *M. scriptifrons* and its reported presence in Western Africa, no preference can be given in favour of one or else of the 2 possible hypothesis. It is not possible to define on the basis of the available elements, which is the exact origin of the observed and here reported Malian population. Nevertheless, the existence of this population, reinforce the interest of the previous hypothesis in the frame of a discussion of the Panurginae distribution modes in Africa. Finally it must be underlined that the previous hypothesis constitute also strong explanatory hypothesis for the distribution of numerous other bees groups in Africa, such as *Uromonia* MICHENER 1981 (Melittidae) or *Systropha* ILLIGER 1806 (Halictidae) for instance (PAULY & al 2001; PATINY in preparation).

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