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Part II

ODONATA FROM SOUTH MOROCCO, RIO DE ORO AND MAURETANIA, WITH BIOGEOGRAPHICAL NOTES*

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During spring 1975, dragonflies were collected in various localities in the Western (Atlantic) Sahara. Great faunal heterogeneity was found while moving from North to South. The Moroccan Sahara has a fauna which does not differ from that of North Atlantic Morocco; the fauna of Rio de Oro is very poor, but has even now been insufficiently "sampled"; the fauna of Mauretania is purely Ethiopian, but almost all species known from that country (ten out of twelve) also occur in Morocco and Algeria. Analysis of these dragonfly faunas and a comparison with other aquatic groups, confirm the theory that the boundary between the Ethiopian and Palaearctic domains runs through the desert, somewhere around the latitude of the Tropic of Cancer. It is also concluded that the expansion of the Ethiopian fauna, following the Eocene emergence of the Sahara, must have been more important than that of the Palaearctic fauna, since many Ethiopian elements still occur along the shores of the Mediterranean, but no Palaearctic species is yet known which has succeeded in establishing itself south of the Tropic of Cancer.

INTRODUCTION

The Odonata from Morocco, as far south as the high Atlas, are becoming well known (AGUESSE & PRUJA, 1958 a, b; LIEFTINCK, 1966; DUMONT, 1972) and the dragonfly fauna of Senegal is also rather well documented (PINHEY, 1962, references prior to 1959; AGUESSE, 1964, 1969; PINHEY, 1972; DUMONT, in press). However, the desert gap between these areas, limited in the

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west by the Atlantic ocean, in the east by the Erg Oriental, Erg Chech and the Majabat-al-Koubraâ, is almost unstudied. Our knowledge of Atlantic Morocco south of the Oued Souss is limited to data on four species by AGUESSE & PRUJA (1958 a, b). Nothing at all is known about Rio de Oro (formerly the Spanish Sahara). From Mauretania, five dragonfly species were known prior to now. All were found in the Adrar mountains, identified by FRASER (1952) and discussed from various points of view by DEKEYSER & VILLIERS (1956). Among these five, the migrant *Hemianax ephippiger* (Burmeister) has also been cited by AGUESSE & PRUJA (1958a) and by MONOD (1958) from other parts of the country.

The rationale for studying the aquatic fauna of this area and, in particular, its dragonflies, follows from: (1) the recent nature of the Sahara (or, at least, of large parts of it) and the need to study the remains of its original fauna, which are likely to be best preserved in some permanent aquatic biotopes; (2) the present expansion of the desert to the south and to the north, and the conversion of arid areas inside it into hyperarid areas, mainly under human influence (CLOUDSLEY-THOMPSON, 1974). These studies are thus urgent. In a number of cases, it may already be too late. Thus the larger mammals, which are almost extinct now, were still very plentiful at the beginning of this century (cf. LAVAUDEN, 1926).

The following data were gathered during an expedition which took me by car from Morocco, through Rio de Oro and Mauretania to Senegal (April-May 1975) and back (May-June 1975).

MOROCCAN SAHARA

The northern limit of the area taken here into consideration is the valley of the Oued Souss between its mouth and Aoulouz, i.e. roughly the 30th parallel and part of the adjacent territory to the North-East of the high Atlas.

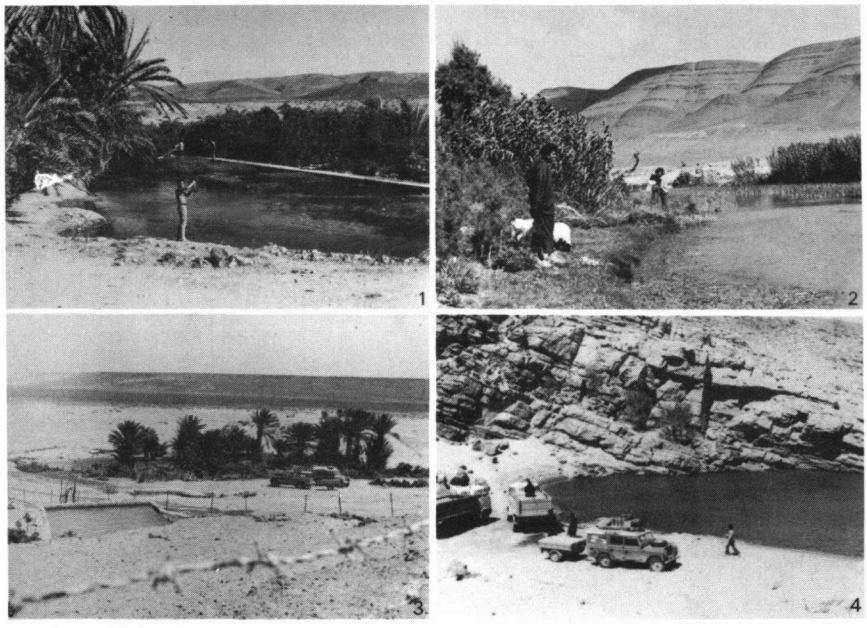
LOCALITIES VISITED

Foothills of the High Atlas

(1) Upper course of Oued Souss at Aoufour. 5.VI.1975
(2) Small Oued at Anezal, East of Jebel Siroua. 7.VI.1975
(3) Ouarzazate, lake El Mansour Eddahbi. 7.VI.1975

Anti-Atlas

(4) Oued Massa: a ford some 25 km N. of Tiznit. 6.IV.1975
(5) Oued Massa at the village of Assaka, 15 km E. of Tiznit. 3.VI.1975
(6) Aït Baha (de l'Anti Atlas): a series of pools in the bed of Oued Aït Baha 3.VI.1975.



Figs. 1-4. (1) Pond in oasis of Aït Boukha, Morocco, May 1975. The pond has been created by the damming of the outflow of a powerful source a few kilometers upstreams of the pond (Photo P. Grootaert); – (2) Oued Souss at Fask, Morocco, May 1975. The waterflow is permanent and the dragonfly fauna found was typical of the West-Mediterranean area (Photo P. Grootaert); – (3) The small oasis of Meseit, irrigated by springs on the south flank of the canyon of Saguiat el Hamra (background: the canyon and its north flank). In the foreground, two basins in which the outflow of the springs is "stocked" before it is released into the oasis. The final drying up of this oued happened at the dawn of historical times; the Hippopotamus still occurred here some 2000 years ago. Thus, in view of the nearness of the oases of the Oued Drâ and Seyad, it is likely that the fauna of the Saguiat was related to that of the former two, at least as far as the dragonflies are concerned. In fact, the freshwater microfauna of Meseit is palaearctic. (Photo I. Miron); – (4) The large semi-permanent Guelta of Zemmur. Water level fluctuations here are greatly determined by human influence. The picture (April, 1975) shows two trucks which pump up water several times a day and distribute it to the surrounding settlements. There is no shore vegetation and the submerged plants are *Characeae*. (Photo I. Miron).

Valley of Oued Seyad, latitude of Goulimime

(7) Oasis of Aït Boukha: a powerful spring with downstream pond and swamps (Fig. 1), grown with luxurious emergent and submerged aquatic vegetation. 6.IV.1975 and 31.V.1975.

(8) Fask: bed of Oued Seyad in flat, open country. 1.VI.1975 (Fig. 2).

(9) Talaiint-Irherbiin: bed of Oued Seyad in deep canyon. 1.VI.1975

(10) Tarhjijt near Tagmoute: muddy pools in bed of Oued Seyad. 1.VI.1975
(11) Aït Herbil: canalized stretch of Oued Seyad. 2.VI.1975. No dragonflies seen.
(12) Tamessoult: a large, concrete water basin. At the time of visit (2.VI.1975) almost completely dry, owing to low precipitation during previous winter. No dragonflies seen.

Bas Drâ area
(13) Mouth of Oued Chebeica with hypersaline water. No dragonflies seen.
(14) Mouth of Oued Ammafatma: as the preceding.
(15) Oued Drâ at ford 27 km N of Tan-Tan (6.IV and 30.V.1975). Water mesohaline and no dragonflies seen. One zygopteran, described by its observer as *Ischnura* sp. was seen here by Mr. D. Van Damme (Gent) in August 1974.

LITERATURE RECORDS

(16) Ait Melloul on Oued Souss, IV.1954: AGUESSE & PRUJA, 1958a.
(17) Ford on Oued Souss at Taroudannt, IV.1971: DUMONT, 1972.
(18) Oued near Tazenakht, S. of Tizi-n-Bachkoum, 19.IV.1971: DUMONT, 1972 (this is locality 32 in the paper cited, where it is correctly placed on the map in figure 9, but erroneously called "Aoulouz" in the text).
(19) Oued Beyad (without further specification; the locality cannot therefore be traced), 25.VIII.1948: AGUESSE & PRUJA, 1958a.
(20) Agadir Tissint (Lower Drâ valley), 1.IX.1941: AGUESSE & PRUJA, 1958a.
(21) Tata (Lower Drâ valley), 31.VIII.1941: AGUESSE & PRUJA, 1958a.
(22) Taskala near Aouinet Torkoz (Lower Drâ valley), VII.1951: AGUESSE & PRUJA, 1958b.
(23) Assa, XII.1938: AGUESSE & PRUJA, 1958b.

LIST OF SPECIES, WITH LOCALITY NUMBERS

Platycnemis subdilatata Selys: 2, 6, 8.
Ceriagrion tenellum nielseni Schmidt: 6.
Coenagrion c. coerulescens (Fonscolombe): 1, 2, 3, 6, 7, 8, 17, 18.
Cercion l. lindeni (Selys): 3, 4 (tenerals), 6, 7, 18.
Ischnura saharensis (Aguesse): 1, 2, 3, 5, 6, 7, 8, 15(?), 17, 18.
Calopteryx h. haemorrhoidalis (Vander Linden): 1, 2, 9 (larvae).
Anax imperator Leach: 6, 7, 9.
Anax parthenope (Selys): 3.
Hemianax ephippiger (Burmeister): 23.
Gomphus simillimus maroccanus Lieftinck: 16.

Onychogomphus costae Selys: larvae at 9, 10.
Crocothemis erythraea (Brullé): 2, 3, 6, 17, 18.
Orthetrum c. chrysostigma (Burmeister): 2, 3, 6, 20, 21.
Orthetrum nitidinerve (Selys): 1 (common), 8 (emerging).
Orthetrum ramburi (Selys): 2, 3.
Sympetrum fonscolombei (Selys): 3, 8, 18.
Trithemis annulata (P. De Beauvais): 20.
Trithemis arteriosa (Burmeister): 19, 20, 22.
Trithemis kirbyi ardens Gerstäcker: 1, 2.

RIO DE ORO

The water chemistry of the localities in Rio de Oro is discussed in DUMONT & COUSSEMENT (1976).

LOCALITIES VISITED AND SPECIES RECORDED

(1) Daya of El Aaiun in the bed of the Saguiat el Hamra (this term is used here in its strict meaning, i.e. the fossil stream bed, although later in the text, it is also used to designate the northern part of the Spanish Sahara). This daya (temporary pond) was described by VALVERDE (1957) as "crowded with animal life". Since the expansion of the City of El Aaiun from a village to a town of about 50,000 inhabitants, the daya has been grossly polluted by domestic sewage and little of the original "life" now remains. On 8.IV.1975 and 30.V.1975, no dragonflies were observed here. Mr. D. Van Damme, who spent two weeks here in August 1974, saw flocks of *Sympetrum fonscolombei* passing through the canyon of Saguiat el Hamra between El Aaiun and the next locality.

(2) Oasis of Meseit (8-9.IV.1975): about 15 km E. of El Aaiun, on the south flank of the canyon of the Saguiat, where a number of sulphurous springs are drained into artificial basins which are emptied at intervals into the irrigation system of the Oasis (Fig. 3). One exuvia of *Sympetrum fonscolombei* was found here on 9.IV.1975.

(3) Guelta Zemmur: C-W. Rio de Oro, 10.IV.1975 and 28.V.1975. This large rock-pool (Fig. 4) is not permanent. VALVERDE (1957) states that in June 1955 it was dry for the first time in thirty years, but I have no information of its fluctuations since then. Between my first and second visit, its level had gone down by about 1.5 m due to human exploitation (DUMONT & VAN DE VELDE, 1975). Although no dragonflies were seen, the guelta may attract migrants and *Hemianax ephippiger*, for example, which has been taken at Bir Moghrein, some 80 km E. of it, (AGUESSE & PRUJA, 1958b) must certainly occur here as well.

MAURETANIA
LOCALITIES VISITED

Adrar Mountains

(1) Molomhar (Oum Lemhar), 17 km N-W of the city of Atar. A canyon, wide at its mouth, gradually narrowing and ending up in a deep channel, a few meters wide, where lies the famous "Guelta Molomhar" (Figs 5, 6), well known for its relict fish fauna and the ethiopian freshwater medusa *Limnocnida tanganyicae* (Gunther). The guelta is permanent, but three pools in the lower parts of the canyon are not, although they may persist for several consecutive years following a period of rain. Visits on 19.IV.1975 and 24.V.1975.

(2) Hamdoun: a series of daya's in the bed of the Oued Seguellil, some 25 km S-SE of Atar. 20.IV and 23.V.1975.

(3) Terjit: two rather powerful springs, the outflow of which forms a brook and some local marshy spots over a distance of about 1500 m. This water is largely used for irrigating the Terjit oasis. 19.IV.1975.

(4) Toungad: a powerful spring, overgrown with reed. 23.IV. 1975.

(5) Guelta Itmarrene: a brackish water pond in a small oasis. No dragonflies seen. 24.IV. 1975.

(6) El Berbera: an idyllic spot at the bottom of a deep canyon, in which a circular, relatively deep pond is fed by several sources on the flanks of the canyon. 26.IV.1975.

(7) Dayet et Tefla: a rock-pool, containing very little water at the time of our visit (25. IV.1975), and where no dragonflies were seen.

(8) E'n Terguennt: a small pool with marginal reed, in a small oasis. 26.IV.1975.

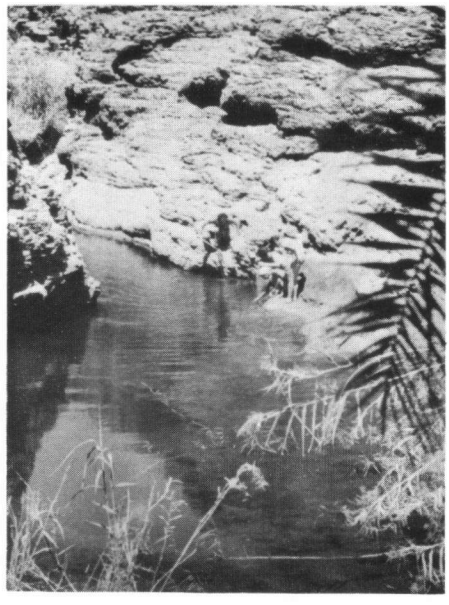


Fig. 5. The permanent Guelta of Molomhar, May, 1975. It is narrow and elongate and was about 5 m deep at the time of my visit. Markings on the rocky shores indicate a maximum depth of about 4-5 m more than the level shown (Photo P. Grootaert).

(9) Glat el Bil: three rock pools, two of which were extremely eutrophicated by goats and camels. No dragonflies seen. 24.IV.1975.

Tagant Mountains

(10) Moul Echnouk: a large, shallow pond in river bed near Nbeika. 4.V.1975.

(11) Amejjerji: Small, eutrophic pond (rich in fishes: *Clarias sp.*), in the river bed near Nbeika (Fig. 7). 4.V.1975.

(12) Guelta Matmata (el Tartega) near Nbeika, 3.V.1975. This is one of the largest gueltas of Mauretania, and in which specimens of the Nile Crocodile still occur. We paid a brief visit to this guelta shortly before dusk (3.V.1975). No dragonflies were seen, although it is quite certain that several species should live around this perennial water-body.

(13) Guelta Sellenbou near Moujderia, and two pools in Sellenbou canyon, about 500 m and 800 m lower than the big Guelta. 4.V.1975.

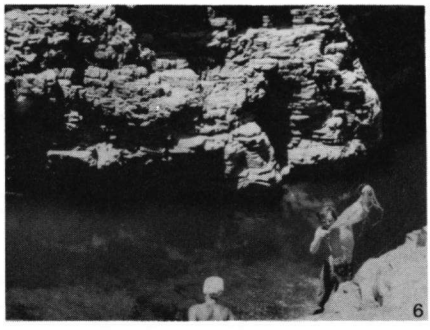


Fig. 6-7. (6) Guelta Molomhar, front view of middle section (Photo P. Grootaert); – (7) Amejjerji, near Nbeika. On the left side, where some grasses grow, *Pseudagrion whellani* and *I. senegalensis* were common. The pond is a multi-purpose resource: it serves as drinking water for man and cattle, a washing place and, as the pond was crowded with *Clarias sp.*, even as a fishing place. (Photo I. Miron).

Assaba Mountains

(14) Guelta el Ghaira: this guelta, like El Berbera in the Adrar, is fed by springs. Its overflow forms a small brook and some swampy patches in the plain below it. 6.V.1975.

(15) Water pit at Djouk, a few km north-west of El Ghaira. 6.V.1975.

(16) Le Bheyr (el Beher): a shallow, eutrophic lake, described in detail by TOUPET (1966), and a guelta in a canyon upstream of Le Bheyr, 7-8.V.1975.

(17) Well on top of Passe de Souffa. No dragonflies seen. 7.V.1975.
(18) Pool at Mbout. An extremely eutrophic pond, used for watering cattle but also as a source of drinking water by part of the population. No dragonflies seen. 10.V.1975.

Lower Senegal Valley
(19) Pond at Ghani, part of the connecting system of lake Rkiz and the river Senegal. 1.V.1975.
(20) Creek at Boubou-Karli, connected with the river during monsoon; now (2.V.1975) a large isolated pond.

LIST OF SPECIES, WITH LOCALITY NUMBERS

Ischnura senegalensis (Rambur): 1, 2, 3, 4, 6, 10, 11, 14, 16, 19. – This is the most widely distributed zygopteran of Mauretania. It was recorded from localities 1, 2, 3 by FRASER (1952) and DEKEYSER & VILLIERS (1956).
Pseudagrion whellani Pinhey: 1 (common at the deep guelta), 2 (male), 11 (common, many tandems). – This is the *Pseudagrion* from Molomhar which was identified as *P. acaciae* by FRASER (1952) and discussed under that name by DEKEYSER & VILLIERS (1956). Dr. R. Roy (Ifan, Dakar) kindly permitted me to re-examine a male specimen of the original Adrar series and this is certainly the same species as the one which I collected in the localities given above. The occurrence of this species as far north as the Adrar is quite interesting. It was known to be widespread in Central, South and East Africa and recently LINDLEY (1974) has reported it from Ivory Coast. Its existence in the Adrar and Tagant mountains has the same chorological significance as that of the medusa *Limnocnida*, i.e. it is further proof of the recent southward expansion of the desert.
Hemianax ephippiger (Burmeister): 6 (common), 8 (female). – Previously recorded from locality 1 by FRASER (1952) and by DEKEYSER & VILLIERS (1956). Further records from Mauretania by MONOD (1958): Mreyyé (Empty Quarter!), 28.XII.1953, plus an unidentified species (perhaps also *Hemianax?*) in the Habr-oû-Gdoûr, 10.I.1953. AGUESSE & PRUJA (1958 b) have records from Copollani (Jreida) near Nouakchott and Bir Moghrein (Fort Trinquet).
Acisoma panorpoides ascalaphoides (Rambur): 20. – First Mauretanian record of a widespread Ethiopian species, recorded from Senegal by FRASER (1951), AGUESSE (1964, 1969) and PINHEY (1972).
Brachythemis leucosticta (Burmeister): 10, 11, 14, 16, 19, 20. – First record for Mauretania of an ubiquitous Ethiopian species.
Crocothemis erythraea (Brullé): 14, 20. – First Mauretanian record of an ubiquitous Ethiopian and Mediterranean species.
Diplacodes lefebvrei (Rambur): 20. – New to Mauretania. A widely distributed

Ethiopian species, also common in North Africa and the Middle East.
Orthetrum c. chrysostigma (Burmeister): 14. – New to Mauretania. Distribution as the preceding species.
Orthetrum trinacria (Selys): New to Mauretania. Distribution as the two preceding species.
Pantala flavescens (Fabricius): 20. – First Mauretanian record of a circumtropical species which reaches the East Mediterranean basin.
Sympetrum fonscolombei (Selys). – No new records. Recorded from Atar (the town centre) by DEKEYSER & VILLIERS (1956).
Tramea basilaris (P. De Beauvais): 15, 20. – A typical Ethiopian species, which is here first recorded for Mauretania.
Trithemis arteriosa (Burmeister): 1, 2, 3, 4, 6, 10, 13, 14, 16, 20. – The most widespread Anisopteran of Mauretania. Recorded from localities 1, 2, 3 by FRASER (1952) and DEKEYSER & VILLIERS (1956).
Urothemis edwardsi (Selys): 20. – First record for Mauretania. Widely distributed in Africa, reaching Algeria and the Middle East.

DISCUSSION

The ultimate goal of the project of which the present contribution is a partial result and which extends over a four-year period, is to gain insight into what may have been the aquatic fauna of the Sahara prior to its recent desiccation. Dragonflies may be extremely good indicators in this respect. One of the important facts to be noted at this stage is that the fauna of the extreme south of Morocco, in places where sufficient water exists, does not show an increase in Ethiopian species, but conserves its typical image of a Lusitanian, or perhaps more correctly, Iberian-Maghrebic refuge (characteristic species: *Coenagrion caerulescens, Ischnura saharensis, Platycnemis subdilatata, Gomphus simillimus maroccanus, Onychogomphus costae, Orthetrum nitidinerve*). The spring fauna found here was in fact more "European" than that of the area East of the Atlas or inside the foothills of the high Atlas. A very remarkable find here was *Trithemis kirbyi ardens*, which was not found in Mauretania nor Senegal in that same period. The Ethiopian *T. arteriosa* known from the Drâ and Seyad valleys was also absent in spring and seems not to occur here outside the summer months. Cold oceanic winds cause the spring to be long and cool here, and even the typical Moroccan fauna mentioned above was clearly retarded when compared to e.g. the Marrakech and Rharb areas. A visit to the "deep south" during July-August must, therefore, be definitely rewarding. In view of the fact that the Drâ, Seyad and Anti-Atlas are now in the process of drying up, the "northern" populations found here must be regarded as potential relicts. They indicate a past pattern of distribution in which this still typical Palaearctic fauna had a more pronounced southward expansion. I therefore support the view that during

the pluvials not only the Ethiopian fauna moved north, but that also the Palaearctic fauna moved south and that the Sahara is not a boundary between faunal areas but that the boundary lies somewhere inside the Sahara (MONOD, 1938, 1956). A very detailed "taxonomy" of plant associations (QUÉZEL, 1965) and animal biotopes (VALVERDE, 1957) therefore only reflects a very "new" situation that tells us little about past conditions. The aquatic fauna in the north of Rio de Oro (rotifers, microcrustaceans, aquatic oligochaets: DUMONT & VAN DE VELDE; DUMONT & COUSSEMENT; DE HENAU & DUMONT, all in press) clearly suggests a relict fauna of European facies, supplemented by some African "minorities". Unfortunately, the two dragonflies we found in this area are migrants of no indicative value and the one biotope (Daya of El Aaiun) that might have conserved more species has been destroyed. Some promising spots exist further south, near Villa Cisneros, where (Sebkha Imililil) fishes (*Tilapia sp.*) occur, but at that latitude the fauna may already be Ethiopian, like in the Adrar mountains. Thus the fauna of Mauretania is an impoverished Ethiopian fauna, consisting of species with a wide distribution in Africa and reaching the Mediterranean in at least one place (only two exceptions). No Palaearctic relict is found among them and, therefore, one must conclude that the greater expansion of the Ethiopian fauna during the quarternary may have prevented palaearctic elements from crossing the Tropic of Cancer.

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REFERENCES

AGUESSE, P., 1964. Contribution à l'étude de la basse Casamance. IX. Odonates. *Bull. Inst. fr. Afr. n.* (A) 26: 712-719.

AGUESSE, P., 1969. Le Parc National du Niokolo-Koba (Sénégal) III. 6. Odonates. *Mém. Inst. fr. Afr. n.* 84: 85-95.

AGUESSE, P. & J.P. PRUJA, 1958a. Eléments pour une faune des Odonates du Maroc. *Bull. Soc. Sci. nat. phys. Maroc* 37 [1957]: 149-160.

AGUESSE, P. & J.P. PRUJA, 1958b. Odonates récoltés par M. Ch. Rungs au Maroc, au Sahara, en Mauritanie et au Sénégal. *C.r. Séanc. Soc. Sci. nat. phys. Maroc* 5: 103-106.

CLOUDSLEY-THOMPSON, J.L., 1974. The expanding Sahara. *Environm. Conserv.* 1.

DEKEYSER, P.L. & A. VILLIERS, 1956. Contribution à l'étude du peuplement de la Mauritanie. Notations écologiques et biogéographiques sur la faune de l'Adrar. *Mém. Inst. fr. Afr. n.* 44: 222 pp.

DE HENAU, A.M. & H.J. DUMONT, 1976. Aquatic Oligochaeta from Rio de Oro. *Bull. Inst. fr. Afr. n.* (In press).

DUMONT, H.J., 1972. Contribution à la connaissance des Odonates du Maroc. *Bull. Soc. Sci. nat. phys. Maroc* 52: 149-179.

DUMONT, H.J., 1976. Odonates au Sénégal pendant la saison sèche. *Bull. Inst. fr. Afr. n.* (In press).

DUMONT, H.J. & M. COUSSEMENT, 1976. Rotifers from Rio de Oro. *Hydrobiologia*, (In press).

DUMONT, H.J. & I. VAN DE VELDE, 1976 (1975). Copepoda, Cladocera and Anostraca from Rio de Oro (Northwestern Sahara). *Biol. Jaarb.* (In press).

FRASER, F.C., 1951. Report on a collection of Odonata and Neuroptera from Senegal. *Bull. Inst. fr. Afr. n.* 13: 1093-1098.

FRASER, F.C., 1952. Contribution à l'étude du peuplement de la Mauritanie. The Odonata of Mauretania. *Bull. Inst. fr. Afr. n.* 14: 479-484.

FRASER, F.C., 1956. Le Parc National du Niokolo-Koba. XIV. Odonata. *Mém. Inst. fr. Afr. n.* 48: 225-228.

LAVAUDEN, L., 1926. Les vertébrés du Sahara. Eléments de zoologie saharienne. Guénard, Tunis. 200 pp.

LIEFTINCK, M.A., 1966. A survey of the dragonfly fauna of Morocco (Odonata). *Bull. K. belg. Inst. Nat. Wet.* 42 (35): 1-63.

LINDLEY, R.P., 1974. The dragonflies of Korhogo. Ivory Coast. *Bull. Inst. fr. Afr. n.* (A) 36: 682-698.

MONOD, T., 1938. Remarques générales, in: La vie dans les régions désertiques de l'ancien monde. *Mém. Soc. Biogéogr.* 6: 375-405.

MONOD, T., 1957. Les grandes divisions chorologiques de l'Afrique. C.S.A. 24, Congrès de Yangambi.

MONOD, T., 1958. Majabat-al-Kourbraâ. Contribution à l'étude de l'Empty Quarter Ouest-Saharien. *Mém. Inst. fr. Afr. n.* 52: 400 pp.

PINHEY, E., 1962. A descriptive catalogue of the Odonata of the African continent (up to December 1959). 2 parts. Comp. Diamantes Angola, Lisboa. 322 pp.

PINHEY, E., 1972. Contribution à l'étude biologique du Sénégal Septentrional. XV. Odonata. *Bull. Inst. fr. Afr. n.* (A) 34: 26-34.

QUEZEL, P., 1965. La végétation du Sahara. Du Tchad à la Mauritanie. Fischer, Stuttgart. 333 pp.

TOUPET, C., 1966. Etude du milieu physique de l'Assaba (Mauritanie). *Init. Et. Afr.* 20: 152 pp.

VALVERDE, J.A., 1957. Aves del Sahara Español. Estudio ecologico del desierto. Consejo Superior de Investigaciones Científicas, Madrid. 481 pp.