The genus *Paragryllodes* Karny, 1909 in tropical Africa (Orthoptera, Grylloidea, Phalangopsidae): new taxa and field observations on the habitat of the species

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ABSTRACT
The African species of the phalangopsid genus *Paragryllodes* are revised on the basis of an important material recently collected in Eastern and Central Africa. The type species of the genus, *P. borgerti* Karny, 1909, is redescribed, together with *P. fuscifrons* Chopard, 1934 and *P. pictus* Chopard, 1958, and 11 new species (*P. bipunctatus* n. sp., *P. centralis* n. sp., *P. deleportei* n. sp., *P. dissimilis* n. sp., *P. kessala* n. sp., *P. longixiphus* n. sp., *P. makandensis* n. sp., *P. makokou* n. sp., *P. minor* n. sp., *P. orensis* n. sp., *P. unicolor* n. sp.) are described. Keys for males and females are given for Eastern African species and for Western and Central African species. Direct observations of the crickets in the field allow to define the life habits of these forest-dwelling species as nocturnal, dendrophilous and cavicolous, hiding during the day in cavities above ground level. Preliminary data on the distribution of *Paragryllodes* in Africa are given.

KEY WORDS
insects,
Orthoptera,
Gryllidea,
rainforest,
Africa,
habitat,
new species.

RÉSUMÉ

Le genre Paragryllodes *Karny, 1909 en Afrique tropicale (Orthoptera, Grylloidea, Phalangopsidae) : taxa nouveaux et observations sur l'habitat des espèces.*

La révision des espèces africaines du genre *Paragryllodes* (Phalangopsidae) est effectuée sur la base d'un important matériel récemment collecté en Afrique centrale et orientale. L'espèce type du genre, *P. borgerti* Karny, 1909, est redécrite, de même que *P. fuscifrons* Chopard, 1934 et *P. pictus* Chopard, 1958, et 11 espèces nouvelles (*P. bipunctatus* n. sp., *P. centralis* n. sp., *P. deleportei* n. sp., *P. dissimilis* n. sp., *P. kessala* n. sp., *P. longixiphus* n. sp., *P. makandensis* n. sp., *P. makokou* n. sp., *P. minor* n. sp., *P. orensis* n. sp., *P. unicolor* n. sp.) sont décrites. Des clés d'identification sont proposées pour les mâles et pour les femelles, pour les espèces d'Afrique orientale d'une part et pour celles d'Afrique centrale et occidentale d'autre part. L'observation directe des spécimens dans le milieu naturel permet de définir l'habitat de ces espèces forestières: ce sont des espèces nocturnes, dendrophiles et cavicoles, qui se cachent dans des cavités au-dessus du sol pendant le jour. Des données préliminaires sont présentées sur la répartition de *Paragryllodes* en Afrique.

MOTS CLÉS
insectes,
orthoptères,
Gryllidea,
forêt tropicale,
nouvelles espèces.

INTRODUCTION

The Phalangopsidae constitute the most diverse cricket family as far as the number of taxa, the habitat and the communication designs are concerned. To understand the origin and evolution of this diversity, it is necessary to analyse the above features in reference to patterns of relationships (Eldredge & Cracraft 1980; Grandcolas *et al.* 1994). This in turn necessitates first that the phylogenetic systematics of the clade under study is reasonably understood, and second that the states of the characters of interest (here the habitat, the acoustic and associated behaviours) are known, i.e. have been studied in the field and, when necessary, in laboratory. The present knowledge of the phylogeny and life habits of the phalangopsid crickets precludes such historical analysis at a large phylogenetic scale. Studies on well-characterised monophyletic subgroups have been achieved however. They allowed to reconsider the current model of the evolution of acoustic communication in crickets (Alexander 1960, 1962, 1967; Otte 1977; Bailey 1991): basic proposals of the model were then partly invalidated, while the evolution of the acoustic apparatus and repertoire appeared labile and homoplastic (Desutter-Grandcolas 1997a, b). Similarly, the analysis of the habitat showed that this feature is strongly phylogenetically constrained in the groups under study and that its evolutionary changes are determined by its ancestral state (Desutter-Grandcolas 1993, 1994). In the case of troglobitic evolution for example, to be ancestrally cavicolous – staminicolous appeared exaptative to an evolutionary shift toward a subterranean habitat (*sensu* Gould & Vrba 1982). Reversion from a subterranean to an epigean habitat was also put in evidence (Desutter-Grandcolas 1993, 1994). In fact, the use of phylogeny in studies of the evolution toward a troglobitic way of life shows that the traditional theoretical context of cavernicolous evolution (Vandel 1964; Barr 1968; Juberthie 1984; Howarth 1987) is flawed and needs to be built anew on sound, unbiased, hypotheses (Desutter-Grandcolas 1997c).

African Phalangopsidae have never been included up to now in historical analyses: preliminary phylogenetic analyses showed that no evident relationships could be found between them or with other Phalangopsidae (Desutter 1990); also,

their life habits are almost unknown (Chopard 1969, but see Desutter-Grandcolas 1998a). A preliminary step is then to redefine these taxa together with their biological features. The present paper deals with the life habits of the African species of the genus *Paragryllodes* Karny, 1909. This is the second contribution to the knowledge of the biology of this taxon, another paper presenting the first calling song ever mentioned in this genus and discussing its physical and biological significance in the frame of cricket calling song efficiency (Desutter-Grandcolas 1998b).

Up to now, two *Paragryllodes* species were known in Western Africa, one in Central Africa and six in Eastern Africa (cf. species list); this genus is also present in the Madagascan (5 sp.) and Indian (3 sp.) regions (Chopard 1968; Otte 1994; Gorochov 1996; Desutter-Grandcolas 1998b). Information on the life habits of these species are very scarce: Bhowmik (1970) gave some information on the Indian *P. anjani* Bhowmik; the life habits of African species have however never been documented.

The study of an important material recently collected in Central and Eastern Africa allows me to redescribe most of the previously known species, including the type species of the genus, and to describe twelve new species, of which eleven are described here (see also Desutter-Grandcolas 1998b). On the base of my own observations in the field the life habits of these species can moreover be specified. Preliminary data on the distribution of the genus are also indicated.

MATERIAL AND METHODS

Most of the examined material has been collected by the author in Gabon, the Central African Republic and Tanzania. All specimens were kept dry to preserve coloration. Male and female genitalia were dissected, cleaned with cold KOH and preserved with glycerine in special vials pinned with the specimens. Homologies on genitalic structures follow Desutter (1987, 1990).

In the field, *Paragryllodes* specimens were observed and collected by sight during the first part of the night with a small head lamp, in order to directly observe the natural habitats and activities of the species. No attractive baits or traps were used. These nocturnal crickets were also looked for during the day to determine where they hide during their inactivity period.

ABBREVIATIONS AND SYMBOLS

Institutions

ANSP The Academy of Natural Sciences, Philadelphia;
MNHN Muséum national d'Histoire naturelle, Paris;
SM Senckenberg Museum, Frankfurt/Main;
ZMC Zoologisk Museum, Copenhagen.

Female genitalia

Membranous parts figured with dots.

Male genitalia

Membranous parts figured with dots.

DV ectophallic dorsal valves;
E epiphallus;
EC A ectophallic apodemes;
EN A endophallic apodemes;
EP P epiphallic parameres;
F ectophallic fold;
R rami;
VV ectophallic ventral valves.

Measurements (in mm, mean number in parentheses)

Lpron median length of pronotum;
Lteg length of right tegmen;
LFIII length of femur III;
Lovip length of ovipositor;
LTIII length of tibia III;
Wpron posterior width of pronotum;
Wteg width of right tegmen (at the level of the anterior angle of the mirror).

Tegmina: yellow parts figured with dots.

DEFINITION OF THE GENUS

Genus *Paragryllodes* Karny, 1909

Paragryllodes Karny, 1909: 478. – Chopard 1968: 291. – Desutter 1987: 224 (Neoaclidae). – Desutter 1990: 321 (Phalangopsidae, Homoeogryllinae). – Otte 1994: 52 (tribe Endacustini).

Montigryllus Sjöstedt, 1910: 112. – Chopard 1968: 291 (synonymy).

Pseudendacustes Chopard, 1928: 25. – Chopard 1968: 291 (synonymy).

TYPE SPECIES. — *Paragryllodes borgerti* Karny, 1909 (by monotypy).

DISTRIBUTION. — Tropical Africa south of the Sahara, Madagascar, Comores, Sri Lanka, India, Seychelles.

DESCRIPTION

Paragryllodes has been defined by Karny (1909) to include a new species *P. borgerti*, which he described on two females originating from Tanzania (Amani). The description of *P. borgerti* is very brief and imprecise, and the definition of the genus itself is uncertain. A more extensive definition including, among other characters, male and female genitalia is thus necessary.

Size variable. Coloration black brown mottled with yellow (Fig. 1); main yellow line on the face transverse or vertical according to species groups (see below). Fastigium very narrow, grooved, sharply separated from the vertex; lateral ocelli close to each other, compared to their distance to the median ocellus. Eyes strongly protrud-ing. Scapes very large, longer than wide. Last joint of maxillary palpi moderately elongate, slightly enlarged toward the apex and with apical truncation.

Legs ringed yellow and dark brown, except in *P. pyrrhopterus* Kaltenbach and *P. unicolor* n. sp. Tibiae I with inner tympanum only. Tibiae II with two apical spurs. Tibiae III strongly serrulated on their basal two thirds and without spines between the first subapical spurs; with four outer and three or four inner subapical spurs, and three outer (the median the longest) and three inner (the median and dorsal subequal in length) apical spurs. Tegmina always present in both males and females, not covering the whole abdomen. Wings lacking. Cerci very long.

Male. Metanotum and tergites without clear glandular structure (in particular, no metanotal area covered with dense setae and no eversible tergal region). Apical spurs of tibiae III not modified. Posterior angles of supra-anal plate not elongate. Length of subgenital plate variable. Tegmina always present and completely overlapping; not corneous. Stridulum variably developed.

Male genitalia elongate and thin, without a large dorsal cavity. Epiphallic sclerite transverse or quadrate, the rami long and not separate from the main sclerite. Epiphallic parameres more or less triangular in shape, most often partly covered with long setae, never hook-like. Ectophallic apodemes long and thick. Ectophallic dorsal valves well developed and elongate, their shape differing in each species group. Endophallic apodeme comprising a small, median and vertical plate and a variable apodeme on each side of the endophallic sclerite.

Female. Tegmina always present, overlapping or not. Length of ovipositor variable.

Female genitalia. Copulatory papilla long and tubular, or short and triangular in shape.

LIST OF AFRICAN SPECIES OF PARAGRYLLODES

Eastern African species

P. borgerti Karny, 1909 (Tanzania, Amani)
P. minor n. sp. (Tanzania, Amani)
P. dissimilis n. sp. (Tanzania, Amani)
P. unicolor n. sp. (Tanzania, Amani)
P. campanella Desutter-Grandcolas, 1998b (Tanzania, Kimbosa)
P. kenyanus Kaltenbach, 1982 (S. Kenya, Chyulu Hills)
P. pyrrhopterus Kaltenbach, 1982 (Tanzania, West Usambara)
P. silvaepluvialis (Sjöstedt, 1910) (Tanzania, Kilimandjaro)
P. affinis (Sjöstedt, 1910) (Tanzania, Kilimandjaro), juvenile type

Western African species

P. fuscifrons Chopard, 1934 (Ivory Coast)
P. optimus Gorochov, 1996 (Eastern Nigeria, Kororofa Territory)

Central African species

P. pictus Chopard, 1958 (Equatorial Guinea, Annobon Island)
P. makandensis n. sp. (Gabon, Ogooué Offoué)
P. makokou n. sp. (Gabon, Ogooué Ivindo)
P. kessala n. sp. (Gabon)
P. orensis n. sp. (Gabon, Sette Cama)
P. deleportei n. sp. (Congo)
P. bipunctatus n. sp. (Gabon, Ogooué Offoué)

P. longixiphus n. sp. (Gabon, Ogooué Ivindo)
P. centralis n. sp. (Central African Republic, Salo)

Eastern African species on one hand and Western and Central African species on the other can easily be separated by several morpho-anatomical differences:

1. Species from East Africa: size medium to large (except *P. minor* and *P. silvaepluvialis*). Tibiae III with four outer and four inner subapical spurs. Tibiae II with three apical spurs, the inner dorsal one not reduced. Coloration not very contrasted; face with a longitudinal yellow median line between median ocellus and labrum. Male stridulum not complete (except in *P. campanella*), but the harp well delimited. Male subgenital plate short. Male genitalia: dorsal valves more or less acute. Female tegmina overlapping at least over part of their length (except in *P. silvaepluvialis*). Female copulatory papilla elongate and tubular.

2. Species from Western and Central Africa: size small. Tibiae III with four outer and only three inner subapical spurs. Tibiae II with three apical spurs, the inner dorsal one greatly reduced (lacking in *P. longixiphus*; not known in *P. optimus*). Coloration very contrasted; face with a transverse yellow line under each antennal socket and a median spot under median ocellus (an additional longitudinal yellow median line between median ocellus and tip of labrum present only in *P. longixiphus*, *P. pictus* and *P. optimus*). Male stridulum diffuse; harp present but not separated from the chords. Male subgenital plate elongate. Male genitalia: dorsal valves having the shape of narrow, vertical plates (except in *P. pictus*). Female tegmina not overlapping. Female copulatory papilla short, more or less triangular in shape.

SYSTEMATIC

EASTERN AFRICAN *PARAGRYLLODES* SPECIES

Paragryllodes borgerti Karny, 1909
(Figs 1; 2A, E, J, K; 3A, B)

Paragryllodes borgerti Karny, 1909: 479. – Chopard 1958: 26 (Chopard referred erroneously to *P. borgerti* for specimens originating from Madagascar and belonging to other species). – Chopard 1968: 291. – Kaltenbach 1982: 242, 246 (Madagascan specimens cited by Chopard in 1958). – Otte 1994: 52.

TYPE LOCALITY. — Tanzania, Amani.

TYPE MATERIAL. — Holotype ♀, 1904, Coll. A. Borgert (Orth. 68). Paratype: 1 ♀, same locality, date and collector as the holotype (Orth. 68a) (SM). The type specimens could not be examined. However, according to Dr S. Ingrisch, who kindly accepted to check them, they agree with the following description (internal genitalia not studied); Dr Ingrish additionnally indicated that the holotype has one foreleg and both mid legs missing, and that the paratype has no tegmina, the left hind leg broken and no right hind leg. The identity of the paratype appears still uncertain, as this specimen presents an unusually long ovipositor (see below) and no tegmina (those probably lost).

MATERIAL EXAMINED. — **Tanzania.** East Usambara mountains, Amani, 1000 m, 15.V.1995, coll. L. Desutter-Grandcolas (MNHN), 1 ♂, 1 ♀, rainforest, on a dead trunk partly laying on the ground, at night; 15.V.1995, 1 ♂, herbaceous area, ground slope, at night; 19.V.1995, 4 ♂ ♂, 4 ♀ ♀, herbaceous area, ground slope, at night; 20.V.1995, 1 ♂, 3 ♀ ♀, herbaceous area, ground slope, at night; 21.V.1995, 2 ♂ ♂, 1 ♀, rainforest, ground slope, at night; 21.V.1995, 1 ♂, rainforest, on trail, at night; 22.V.1995, 1 ♂, 1 ♀, rainforest, ground slope, at night; 23.V.1995, 1 ♂, 1 ♀, herbaceous area, ground slope, at night

OTHER MATERIAL EXAMINED. — **Tanzania.** East Usambara mountains, Amani, 1000 m, 19.V.1995, coll. L. Desutter-Grandcolas (MNHN), 1 ♂, 1 ♀, herbaceous area, ground slope, at night; 22.V.1995, 1 ♀, rainforest, on trail, at night; 30.IX.1982, coll. D. Otte (ANSP), 1 ♀. — Muguruwandege, 10 km NNW Morogoro, 26.V.1995, 1 ♂, 1 juvenile, galery forest on slope, on trunk, under loose bark at 1.50 m high, at night; coll. L. Desutter-Grandcolas (MNHN), 1 ♀, between two rocks delimiting a small cavity.

MEASUREMENTS. — Males (n = 5): Lpron: 2.8-3 (2.9); Wpron: 3.5-4.2 (3.8); Lteg: 4.8-5.9 (5.4); Wteg: 4.4-5.2 (4.9); LFIII: 13-15.2 (14.2); LTIII: 12-13.8 (13.1). Females (n=5): Lpron: 3.1-3.8 (3.4); Wpron: 4-4.7 (4.2); Lteg: 4.7-5.6 (5.1); Wteg: 2.4-2.9 (2.7); LFIII: 13.9-16.4 (14.7); LTIII: 12.8-15.6 (13.7); Lovip: 13.6-17.1 (15.1). Female holotype: Lpron: 3.2; Wpron: 4; Lteg: 5.3; Wteg: 2.5; LFIII: 14.5; LTIII: 13; Lovip: about 17. Female paratype: Lpron: 4.2; Wpron: 5; LFIII: 16; Lovip: about 21. Type specimens mesured by Dr S. Ingrisch.

REDESCRIPTION

Size moderately large. Face dark brown, shining,

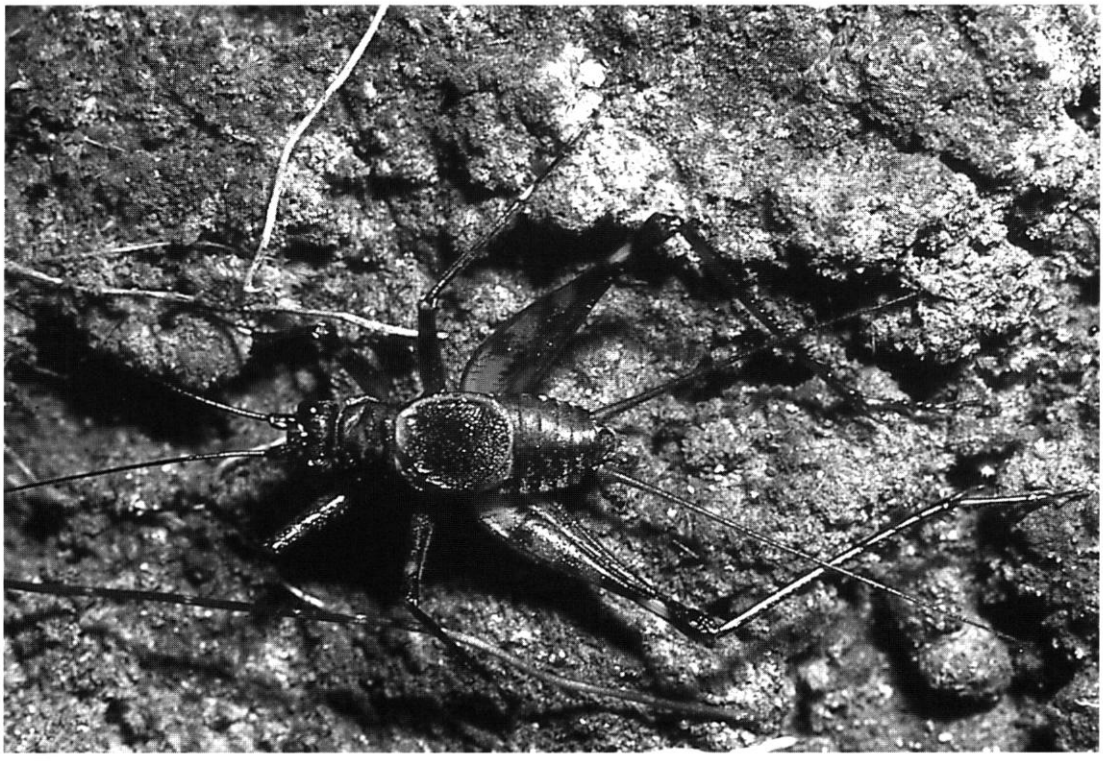

FIG. 1. – *Paragryllodes borgerti* Karny. Male.

with a yellow longitudinal line from the median ocellus to the tip of the labrum, and sometimes with indistinct yellowish spots; yellow line almost equally large over its whole length, the lateral parts of the labrum brown. Cheeks and vertex dark brown, with more or less distinct yellowish dots. Fastigium entirely blackish or with a short, more or less visible, yellowish line along its borders not reaching the median ocellus. Ocelli whitish, all equal in size. Scapes dark brown on their front side, with an indistinct paler dot near the upper border, and light brown on their upper side. Antennae brown, with small, largely separated yellowish rings. Pronotum dark brown, the dorsal disc not clearly mottled with yellow. Abdomen black with abundant yellowish setae, the ventral side lighter.

Legs yellowish brown mottled with dark brown; tibiae with four dark rings. Tibiae I-III with respectively two, three and six apical spurs; median and third inner apical spurs of tibiae III subequal. Tibiae III serrulated along their whole length, except between the first subapical spurs. Femora I and II: two dark rings, one at the knee, the other subapical, separated by an ivory coloured spot. Femora III: dorsal and inner faces with four brown bands, outer face slightly striated with brown. Basitarsomeres brown, their base whitish; basitarsomeres III with five to eight outer, and one to four inner dorsal spines, in addition to the apical ones.

Male. Tegmina covering nearly half of the abdomen, rounded at apex. Dorsal field brown, except for its yellow base, outer margin and apex (Fig. 2A); lateral field dark brown. Right tegmen: dorsal margin, from the level of the file down to the vanus fold largely thickened; venation: harp well-developed, crossed by about ten veins; stridulatory file: 148–172 teeth (mean number 156, n = 5); lateral field with five to six parallel longi-

tudinal veins (subcostal and its ramifications). Venation of left tegmen: harp well-developed, thin; around the harp, cuticle thicker, with numerous small veins; anal margin of dorsal field largely bisinuated. No evident glandular structure on the tergites or supra-anal plate; metanotum with two smooth nodosities.

Male genitalia. Dorsal valves long, decidedly longer than epiphallus and epiphallic parameres, almost straight and thin. Epiphallic parameres triangular without outgrowth, the apex sometimes slightly more slender (Fig. 3A, B).

Female. Tegmina covering half of the abdomen or slightly less, overlapping over their whole length; brown except for their yellow base, outer margin and apex (Fig. 2E); lateral field brown; veins brown, lighter on dorsal field. Venation: dorsal field with two to four parallel longitudinal veins, often subdivided into two or three veins; lateral field with generally four ramifications of subcostal vein. Supra-anal plate brownish, with a large yellowish line on the base and apex. Subgenital plate margin generally straight, rarely slightly bisinuated. Ovipositor most often slightly longer than femora III (except in the female paratype, who has a very long ovipositor).

Female genitalia. Copulatory papilla very long, the apex thin and clearly filiform on part of its length (Fig. 2J).

REMARK

According to available specimens, *P. borgerti* appears quite variable in size (see measurements) and coloration (yellow spots on head and pronotum). Male and female genitalia are however characteristic compared to the other species of the genus.

Among the specimens examined, several males and females could not be identified with certainty; they are gathered in the paragraph "Other material examined". The copulatory papilla of the three Amani females is thus shorter and more convex at apex than that of *P. borgerti* females (compare Fig. 2J and K). The male and female found at Muguruwandege are larger than the specimens from Amani and their coloration is more contrasted; male genitalia are bigger, the ectophallic apodemes being more straight. The status of these specimens is yet uncertain.

Paragryllodes minor n. sp.
(Figs 2B, H; 3C, D)

TYPE MATERIAL. — Holotype ♂, 21.V.1995, rainforest, on a hollow dead standing tree, at night. Paratypes: 22.V.1995, 2 ♂ ♂, rainforest, on a hollow dead standing tree, at night (MNHN).

TYPE LOCALITY. — Tanzania, East Usambara mountains, Amani, 1000 m, coll. L. Desutter-Grandcolas.

ETYMOLOGY. — Species named according to its small size.

MEASUREMENTS. — Males (n = 3): Lpron: 2.4-2.5 (2.4); Wpron: 3-3.3 (3.2); Lteg: 4.4-4.5 (4.5); Wteg: 4.3-4.4 (4.4); LFIII: 10.9-11.3 (11.1); LTIII: 8.7-10 (9.4).

Species very close to *P. borgerti*, but much smaller in size (compare the measurements) and easily recognisable by male tegmina and genitalia.

DESCRIPTION

Coloration similar to that of *P. borgerti*, except for the following: yellow longitudinal line of the face enlarged on the labrum, which is entirely light-coloured; cheeks with a yellow brown spot under the eye, this spot extending between the subgenual suture and the posterior margin of the cheek; vertex highly mottled with yellow, thus presenting two brown median spots and an additional round, brown spot behind each eye; dorsal disc of pronotum mottled with yellow (Fig. 2H); basitarsomeres III light yellowish brown, with three to four outer spines and no inner spine (except apical ones).

Male. Tegmina only slightly longer than large, the apical margin truncated and thickened at its anal corner (Fig. 2B, arrow); coloration yellowish brown, yellow at the base and on the outer margin; lateral field brownish. Stridulatory file: 119-139 teeth (n = 2).

Male genitalia. Quite similar to those of *P. borgerti*, but the epiphallic parameres larger and as if indented, and the dorsal valves more distinctly converging at apex (Fig. 3C, D).

Female. Unknown.

Paragryllodes dissimilis n. sp.
(Fig. 2F, L)

TYPE MATERIAL. — Holotype ♀, 21.V.1995, rainfo-

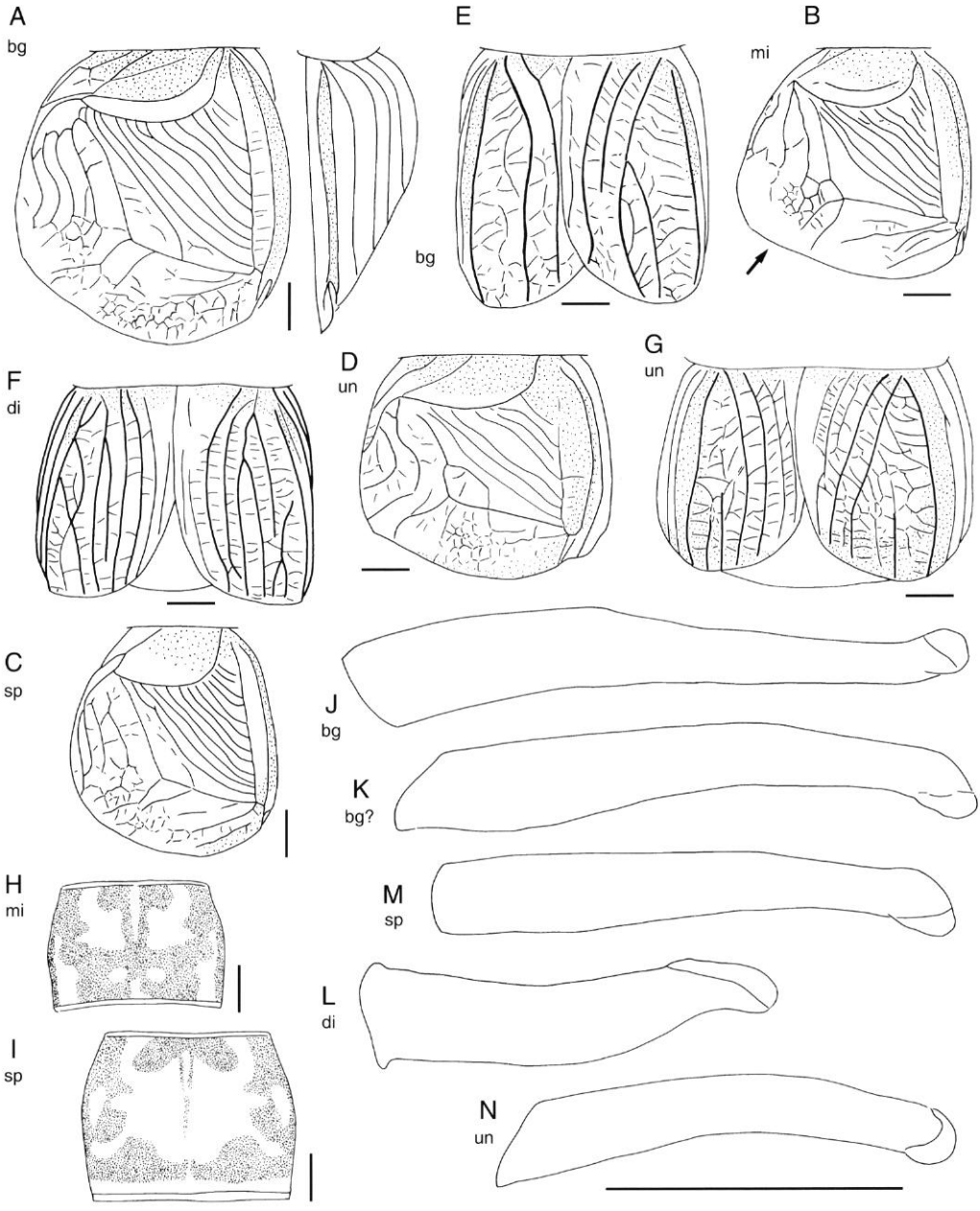

FIG. 2. – Male (A-D) and female (E-G) tegmina, (H-I) dorsal disc of pronotum and female copulatory papilla in lateral view (J-N) of: *Paragryllodes borgerti* Karny (bg), *P. minor* n. sp. (mi), *P. dissimilis* n. sp. (di), *P. unicolor* n. sp. (un) and *Paragryllodes* sp. (sp). Scale bars: 1 mm.

rest, on a hollow dead standing tree, at night (MNHN).

TYPE LOCALITY. — Tanzania, East Usambara mountains, Amani, 1000 m, coll. L. Desutter-Grandcolas.

ETYMOLOGY. — The name of this species refers to the unusual shape of the copulatory papilla of the female, compared to other East African species of the genus.

MEASUREMENTS. — Lpron: 3; Wpron: 4.3; Lteg: 4.4; Wteg: 2.5; LFIII: 14; LTIII: 12.8; Lovip: 15.5.

DESCRIPTION

Coloration almost similar to that of *P. borgerti*, except for the following: yellow longitudinal line of the face enlarged over the whole tip of the labrum. Cheeks yellowish brown. Vertex and area behind the eyes dark brown, with some yellowish spots toward the occiput. Fastigium black. Pronotum almost entirely dark brown, the anterior margin and a few spots on the dorsal disc yellowish. Abdomen black with many ochre setae.

Legs contrastingly ringed brown and yellow. Femora I and II: one incomplete basal ring in addition to the two more apical rings. Femora III: four dark rings on the inner side, only the two most apical ones complete; outer and dorsal sides striated with light brown. Tibiae with four brown rings. Basitarsomeres III: four outer and no inner dorsal spines (in addition to the apical ones).

Male unknown.

Female. Tegmina smaller than in *P. borgerti;* their coloration dark brown, only the base and the anterior quarter between the dorsal and lateral fields yellow; tegmina overlapping only at their base (Fig. 2F). Supra-anal plate black brown, not shining. Subgenital plate with a straight apical margin.

Female genitalia. Copulatory papilla small and large, without a filiform apical part (Fig. 2L).

Paragryllodes sp.
(Fig. 2C, I, M)

MATERIAL EXAMINED. — **Tanzania.** East Usambara mountains, Amani, 1000 m, 15.V.1995, coll. L. Desutter-Grandcolas (MNHN),1 ♀, rainforest, dead trunk partly lying on the ground, at night; 16.V.1995, 1 ♀, at night, ground slope; 19.V.1995, 2 ♀ ♀, herbaceous area, ground slope, at night; 22.V.1995, 1 ♀, rainforest, ground slope, at night; 23.V.1995, 1 ♂, herbaceous area, ground slope, at night.

MEASUREMENTS. — Male: Lpron: 2.2; Wpron: 3; Lteg: 4.4; Wteg: 3.9; LFIII: 11; LTIII: 9.8. Females (n = 4): Lpron: 2.9-3.3 (3.1); Wpron: 3.8-4.1 (4); Lteg: 4.4-5.2 (4.7); Wteg: 2.4-2.7 (2.6); LFIII: 12.9-14.7 (13.7); LTIII: 11.7-13.4 (12.4); Lovip: 13.2-15.4 (14.1).

I consider here one male and five females originating from Amani (Tanzania) characterised by their small size (see the measurements) and their extremely light coloration. No diagnostic feature however could be found in male and female genitalia to separate them from other species.

DESCRIPTION

Coloration very light brown. Face light-coloured; in addition to the yellow longitudinal line, three yellow spots under each antennal socket, two transverse narrow ones, located just under the antennal socket, and a more developed one, rounded or forming a large band, located between the two transverse spots and the epistemal suture. Vertex yellowish, with a longitudinal clear brown line just behind the fastigium. Margins of the fastigium yellow, these lines extending around the median ocellus up to the yellow longitudinal line on the face. Cheeks heavily mottled with light brown.

Dorsal disc of the pronotum largely light brown (Fig. 2I). Legs similar to those of *P. borgerti*, but lighter and more variegated. Basitarsomeres III light-coloured, entirely or only at its base, with four to six outer spines and zero to three inner spines (in addition to apical ones).

Male. Tegmina covering about half of the abdomen, their shape and venation almost similar to those of *P. borgerti* (Fig. 2C). Stridulatory file: 141 teeth (n = 1).

Male genitalia. Similar to those of *P. borgerti*.

Female. Tegmina similar to those of *P. borgerti*, but smaller. Supra-anal plate also similar to that of this last species.

Female genitalia. Copulatory papilla similar to that of *P. borgerti*, but slightly shorter and less filiform at the apex (Fig. 2M).

Paragryllodes unicolor n. sp.
(Figs 2D, G, N; 3E)

TYPE MATERIAL. — Holotype ♂, 21.V.1995, rainforest, on a dead standing tree, at night. Allotype ♀, 19.V.1995, herbaceous area, ground slope, at night. Paratypes: 15.V.1995, 1 ♂, 1 ♀, rainforest, on a dead trunk partly lying on the ground (♂), at night; 21.V.1995, 2 ♀ ♀, rainforest, on a dead hollow trunk or on ground slope, at night; 22.V.1995, 1 ♀, rainforest, ground slope, at night (MNHN).

TYPE LOCALITY. — Tanzania, East Usambara Mountains, Amani, 1000 m, coll. L. Desutter-Grandcolas.

OTHER MATERIAL EXAMINED. — Same locality and collector as the holotype: 15.V.1995, 1 ♀, rainforest, in the dead part of a hollow trunk, at night; 1 ♀, F1 raised in laboratory from the preceding female (MNHN).

ETYMOLOGY. — Species named according to the uncommon colour of legs I and II.

MEASUREMENTS. — Males (n = 2): Lpron: 3.1-3.4; Wpron: 4.1-4.6; Lteg: 4.6-4.9; Wteg: 4.5-4.8; LFIII: 14.7-15.5; LTIII: 12.3-14.2. Females (n=4): Lpron: 3.7-4.1 (3.9); Wpron: 4.8-5 (4.9); Lteg: 4.2-4.8 (4.5); Wteg: 2.6-3.1 (2.8); LFIII: 14.7-16.4 (15.8); LTIII: 13.3-14.5 (14); Lovip: 16.3-18.8 (17.9).

Species characterised by the uniform coloration of its legs (especially I and II) and by its male and female genitalia and tegmina.

DESCRIPTION

Face black, with a median longitudinal yellow line from the median ocellus to the tip of the labrum; lower part of the labrum yellow. Cheeks brown, with indistinct lighter spots. Vertex black brown, with some variable yellowish longitudinal lines, short and narrow. Fastigium black; a small yellowish line along each of its margins. Scapes black on the front side, lighter on the dorsal side. Pronotum brown to black brown; dorsal disc sometimes lighter, with ochre pyriform spots and a large yellowish line along the posterior margin. Overall coloration of the legs ochre. Femora I and II: knees black brown; an ivory coloured spot usually present near the apex on the dorsal side. Femora III ochre, the knees black brown on the outer side; inner and outer sides with four brown rings more or less distinct, only the apical one being well formed. Tibiae light-coloured, faintly ringed, somewhat darker at the base and at the apex. Basitarsomeres I and II brown, their base ivory-coloured. Basitarsomeres III light ochre, with four to seven outer dorsal spines and zero to two inner ones (in addition to apical ones). Abdomen black, not shining, the supra-anal plate entirely black.

Male. Tegmina short, only slightly longer than large, the apex slightly rounded (Fig. 2D); their coloration black brown; dorsal field entirely circled with yellow, except on the ochre inner margin. Venation: mirror and apical field not well formed, reticulated. Stridulatory file: 132 teeth (n = 1). Lateral field black, with five parallel longitudinal veins.

Male genitalia. Dorsal valves large at their base and distinctly thinner and converging toward the apex. Epiphallic parameres large and flat, with a small outgrowth on their outer dorsal margin (Fig. 3E). Epiphallic sclerite concave dorsally.

Female. Tegmina overlapping over nearly their whole length (Fig. 2G); their coloration black brown, the dorsal field entirely circled with yellow and thickened at the apex.

Female genitalia. Copulatory papilla relatively short, concave dorsally and without apical filiform part (Fig. 2N).

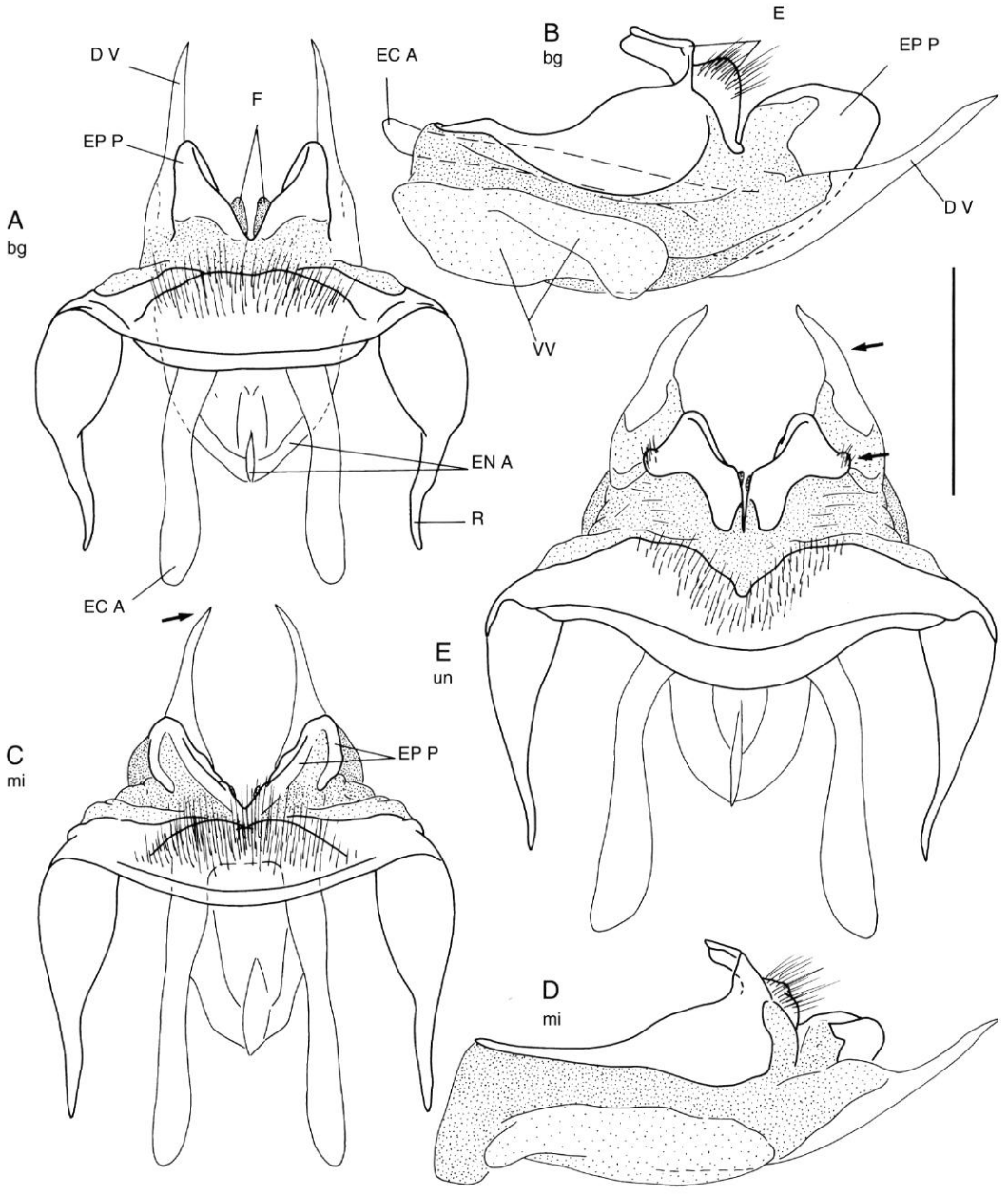

FIG. 3. – Male genitalia in dorsal (A, C, E) and lateral (B, D) view of: *Paragryllodes borgerti* Karny (bg), *P. minor* n. sp. (mi) and *P. unicolor* n. sp. (un). Scale: 1 mm. Abbreviations: DV: ectophallic dorsal valves; E: epiphallus; EC A: ectophallic apodemes; EN A: endophallic apodemes; EP P: epiphallic parameres; F: ectophallic fold; R: rami; VV: ectophallic ventral valves.

KEYS TO *PARAGRYLLODES* SPECIES FROM EASTERN AFRICA

As several species are known by one sex only, separate keys are proposed here for males and females.

Key for males (except *P. dissimilis*)

1a. Legs uniformly light brown, except for darker knees, not ringed 2

1b. Legs distinctly ringed brown and yellow 3

2a. Very large species (femora III: 20 mm; Lteg: 8 mm). Male genitalia: epiphallic parameres with a large outgrowth (Kaltenbach 1982, fig. 9) ..... *P. pyrrhopterus* Kaltenbach, 1982

2b. Smaller species (femora III: 14.7-15.5 mm; Lteg: 4.6-4.9 mm). Male genitalia: Epiphallic parameres with only a small outgrowth (Fig. 3E) .... *P. unicolor* n. sp.

3a. Male tegmina: stridulatory apparatus complete, the harp, mirror and chords well-developed; apical field short but distinct; stridulatory file with about 900 teeth. Male genitalia: epiphallic parameres with long dorsal processus; dorsal valves very short, almost not projecting beyond epiphallic parameres (Desutter-Grandcolas 1998b, fig. 4) ..... *P. campanella* Desutter-Grandcolas, 1998b

3b. Male tegmina: stridulatory apparatus not complete, only the harp well-developed; mirror and chords more or less reticulated apically; no distinct apical field; stridulatory file with less than 200 teeth (not examined in *P. kenyanus*, *P. pyrrhopterus* and *P. silvaepluvialis*). Male genitalia (not examined in *P. silvaepluvialis*) without dorsal processus on epiphallic parameres; dorsal valves projecting well beyond the epiphallic parameres 4

4a. Small species originating from Kilimandjaro (male stridulatory file and genitalia not examined) ..... *P. silvaepluvialis* (Sjöstedt, 1910)

4b. No 5

5a. Male genitalia: dorsal valves very long and acute, their apex strongly diverging on the two thirds of their length (Kaltenbach 1982, fig. 8) ..... *P. kenyanus* Kaltenbach, 1982

5b. Male genitalia: dorsal valves long and acute, but their apex only slightly converging 6

6a. Coloration dark brown, mottled with yellowish; dorsal disc of pronotum almost entirely brown, with only a few yellowish flecks 7

6b. Coloration decidedly lighter; dorsal disc of pronotum largely yellowish brown .. .. *Paragryllodes* sp.

7a. Large species (LFIII: 13-15,2 mm). Tegmina decidedly longer than large, their

apical margin rounded (Fig. 2). Male genitalia as in Fig. 3A, B .... *P. borgerti* Karny, 1910

7b. Smaller species (LFIII: 10.9-11.3 mm). Tegmina only slightly longer than large, their apical margin truncated (Fig. 4). Male genitalia as in Fig. 3C, D .... *P. minor* n. sp.

Key for females (except *P. minor*, *P. pyrrhopterus*, *P. kenyanus*)

1a. Legs uniformly light brown, except for darker knees, not faintly ringed .... *P. unicolor* n. sp.

1b. Legs distinctly ringed brown and yellow 2

2a. Size small. Ovipositor less than 10 mm. Tegmina small (2 mm long) and not overlapping (Sjöstedt 1910, fig. 11) ..... *P. silvaepluvialis* (Sjöstedt, 1910)

2b. Size bigger. Ovipositor more than 12 mm. Tegmina longer, usually more than 4 mm long, and overlapping at least over part of their length 3

3a. Copulatory papilla short and high, triangular in section (dorsal side narrow; ventral side large); its apex acute and small (Desutter-Grandcolas 1998b, fig. 6) ..... *P. campanella* Desutter-Grandcolas, 1998

3b. Copulatory papilla decidedly thinner 4

4a. Copulatory papilla very long and thin, with a distinct filiform apical part (Fig. 2J) ..... *P. borgerti* Karny, 1909

4b. Copulatory papilla much shorter, without an apical filiform part 5

5a. Coloration dark brown, mottled with yellow. Tegmina overlapping over their base only (Fig. 5). Copulatory papilla as in Fig. 2L ..... *P. dissimilis* n. sp.

5b. Coloration decidedly lighter. Tegmina overlapping over nearly their whole

WESTERN AFRICAN *PARAGRYLLODES* SPECIES

Paragryllodes fuscifrons Chopard, 1934
(Figs 4A, I; 5A, B)

Paragryllodes fuscifrons Chopard 1934: 64. – Chopard 1968: 291. – Otte 1994: 52.

TYPE LOCALITY. — Ivory Coast, Dimbokro.

MATERIEL EXAMINED. — Holotype ♂ (MNHN). Ivory Coast, Adiopodoumé, 1 ♂, 1920, coll. Vuillaume (MNHN).

MEASUREMENTS. — Male holotype: Lpron: 2.6; Wpron: 3.5; Lteg: 3.8; Wteg: 3.2; LFIII: 11; LTIII: 9.7. Adiopodoumé specimen: Lpron: 2.4; Wpron: 3.1; Lteg: 3.8; Wteg: 3.2; LFIII: 10.6; LTIII: 9.4.

The female type designated by Chopard (1934) originates from Gabon (Bas Ogooué) and actually belongs to another species, tentatively designated here as *Paragryllodes* sp. *affinis longixiphus*.

DESCRIPTION

In addition to the characters mentioned by Chopard (1934: 64):

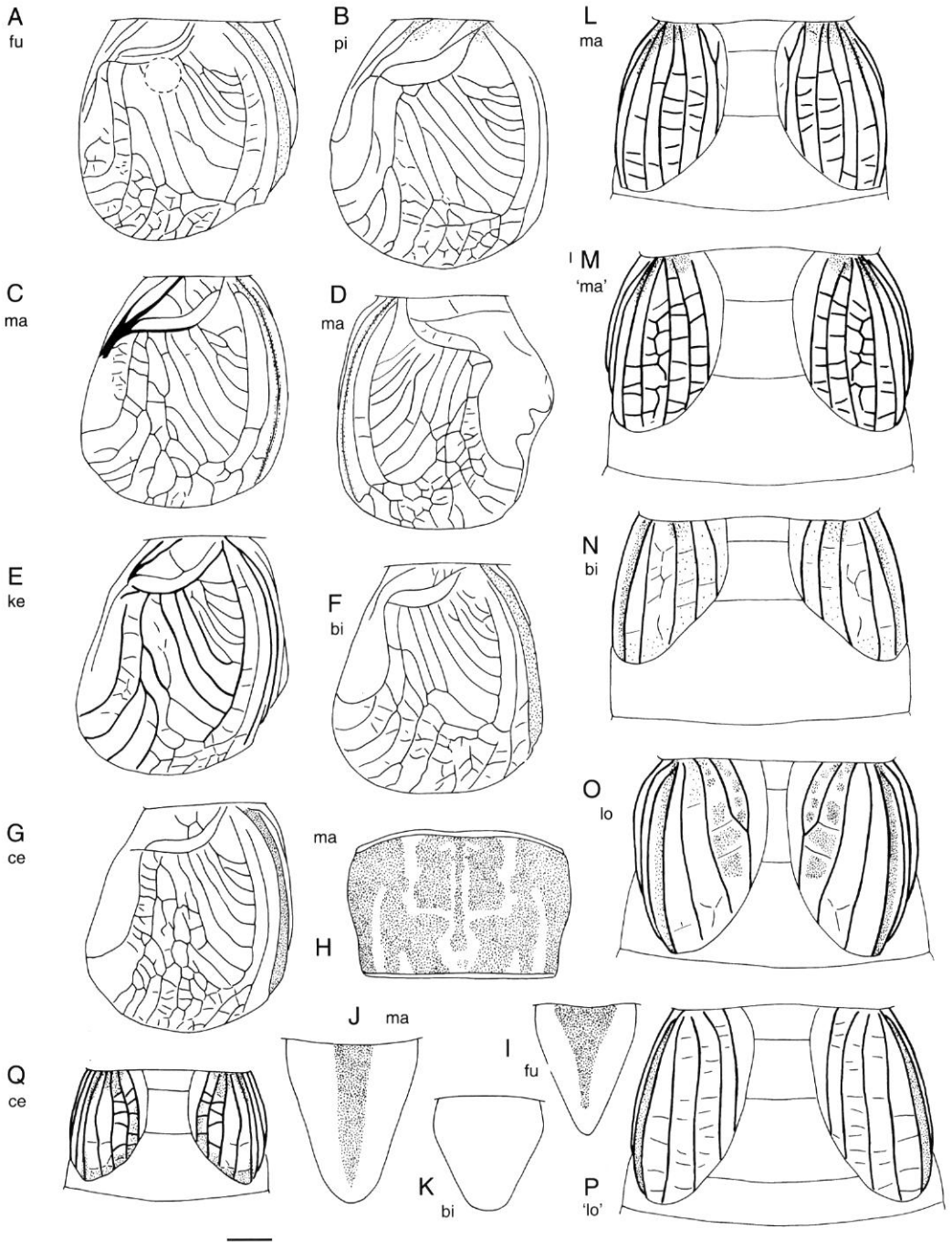

FIG. 4. – Male right (A-C, E-G) and left tegmina (D), dorsal disc of pronotum (H), male subgenital plate (I-K) and female tegmina (L-Q) of: *P. fuscifrons* Chopard (fu), *P. pictus* Chopard (pi), *P. makendensis* n. sp. (ma), *P. kessala* n. sp. (ke), *P. bipunctatus* n. sp. (bi), *P. centralis* n. sp. (ce), *P. longixiphus* n. sp. (lo), *Paragryllodes* sp. aff. *makendensis* ('ma') and *Paragryllodes* sp. aff. *longixiphus* ('lo'). Scale bar: 1 mm.

FIG. 5. – Male genitalia in dorsal (A, C) and lateral (B, D) view, female subgenital plate (E-G) and female copulatory papilla in dorsal and lateral view (H-J) of: *P. fuscifrons* Chopard (fu), *P. pictus* Chopard (pi), *P. makendensis* n. sp. (ma), *Paragryllodes* sp. affinis *makendensis* ('ma') and *Paragryllodes* sp. (sp). Scale bars: 1 mm; female copulatory papilla: scale as in Fig. 2J-N; male genitalia: scale as in Fig. 3. Abbreviations: DV: ectophallic dorsal valves; EC A: ectophallic apodemes; EP P: epiphallic parameres; F: ectophallic fold; R: rami.

Male. Tegmina as in Fig. 4A. Stridulatory file damaged. Subgenital plate resembling that of *P. makandensis* (cf. *infra*), but the brown median part thinner at its apex (Fig. 4I).
Male genitalia. Size small. Epiphallic parameres very short, their apex quite large and rounded (Fig. 5A, B).
Female. Unknown.

REMARKS
The additional specimen examined, originating from Adiopodoumé, presents the following features: stridulatory file with 66 teeth; left tegmen almost entirely thickened, only the harp being thin and translucent; a large indentation at the level of the plectrum; subgenital plate coloration evident only near the apex; male genitalia: epiphallic parameres larger and more rounded at the apex, their inner crest larger dorsally and sharper ventrally.

CENTRAL AFRICAN *PARAGRYLLODES* SPECIES

Paragryllodes pictus Chopard, 1958
(Fig. 4B, 5C, D)

Paragryllodes pictus Chopard, 1958: 79. – Chopard 1968: 292. – Otte 1994: 52.

TYPE LOCALITY. – Equatorial Guinea, Annobon.

MATERIAL EXAMINED. — Holotype ♂, 3.VII.1956, cratère (forest), coll. P. Viette (MNHN).

MEASUREMENTS. — See Chopard (1958).

DESCRIPTION
In addition to the characters indicated by Chopard (1958): face with a longitudinal yellow line, greatly enlarged from the middle of the face downwards and covering the whole labrum, and a small transverse yellow fleck under each antennal socket. Tibiae III with four outer and three inner subapical spurs (not three on each side as indicated by Chopard). Tibiae II with only two apical spurs (inner dorsal one lacking).
Male. Subgenital plate moderately elongate and bordered with yellowish (except on its base). Stridulatory apparatus without a distinct harp and mirror (Fig. 4B). File with 81 teeth (n = 1). Left tegmen with two indentations at mid-length, the distal one well-developed.
Male genitalia. Epiphallic parameres very largely bilobated, their ventral part with three large and rounded processes (Fig. 5C). Dorsal valves much longer than epiphallus, their base large, their apex narrower and bent upwards (Fig. 5D). Ectophallic apodemes short and closely set, their apex only diverging. Endophallic sclerite extremely small.

Paragryllodes makandensis n. sp.
(Figs 4C-E, H, J, L; 6A, B)

TYPE MATERIAL. — Holotype ♂, 10.VI.1994, at night, on a hollow vine at 2.50 m high; 22.V.1994, allotype ♀, at night, on a horizontal dead trunk lying at 15 cm above the ground. Paratypes: 22.V.1994, 1 ♂, at night, on a sloping dead trunk reaching the ground on one side; 22.V.1994, 1 ♂, at night, on a broken horizontal dead trunk; 23.V.1994, 1 ♂, 1 ♀, at night, on a horizontal dead trunk at 2 m high; 24.V.1994, 1 ♀, by day, on a trunk at 2 m high, near a large cavity in the trunk; 24.V.1994, 1 ♀, at night, on a trunk lying against a dead trunk, at 40 cm high; 27.V.1994, 1 ♀, by day, on the lower side of a dead branch; 27.V.1994, 1 ♀, at night, on a large tree with termite nest and with fallen bits of bark near its base; 28.V.1994, 1 ♂, by day, under a dead trunk; 31.V.1994, 1 ♂, 1 ♀, at night, on trunks at 1 m (♂) and 1.50 m (♀) high; 4.VI.1994, 2 ♂ ♂, 1 ♀, at night, on dead trunks lying completely (♀) or not (♂) on the ground; 7.VI.1994, 1 ♀, at night, on a horizontal dead trunk at 1.80 m from the ground; 9.VI.1994, 2 ♂ ♂, at night, on horizontal dead trunks at 1.50 m and 2 m from the ground; 10.VI.1994, 1 ♀, at night, on a horizontal dead trunk at 80 cm from the ground; 11.VI.1994, 1 ♂, at night, on trunk; 11.VI.1994, 1 ♀, at night, on a horizontal dead trunk at 1.50 m from the ground; 28.VI.1994, 1 ♀, at night, on a large termite nest located on a trunk; 28.VI.1994, 1 ♂, by day, on a horizontal dead trunk covered with mosses at 20 cm from the ground; 29.VI.1994, 1 ♂, 2 ♀ ♀, by day, on the lower side of a horizontal dead trunk at 1.50 m from the ground, not under bark; 30.VI.1994, 1 ♀, at night, on a trunk at 1.50 m high; coll. L. Desutter-Grandcolas, 1.VII.1994, 1 ♀, at night, on a trunk at 30 cm above a cavity at the base of the trunk; coll. P. Grandcolas (MNHN), 10.VII.1993, 1 ♂, 1 ♀, at night, on trunk.

TYPE LOCALITY. — Gabon, La Makandé, affl. Offoué.

OTHER MATERIAL EXAMINED. — Same locality as the holotype, 22.V.1994, 3 juveniles, at night, on a trunk

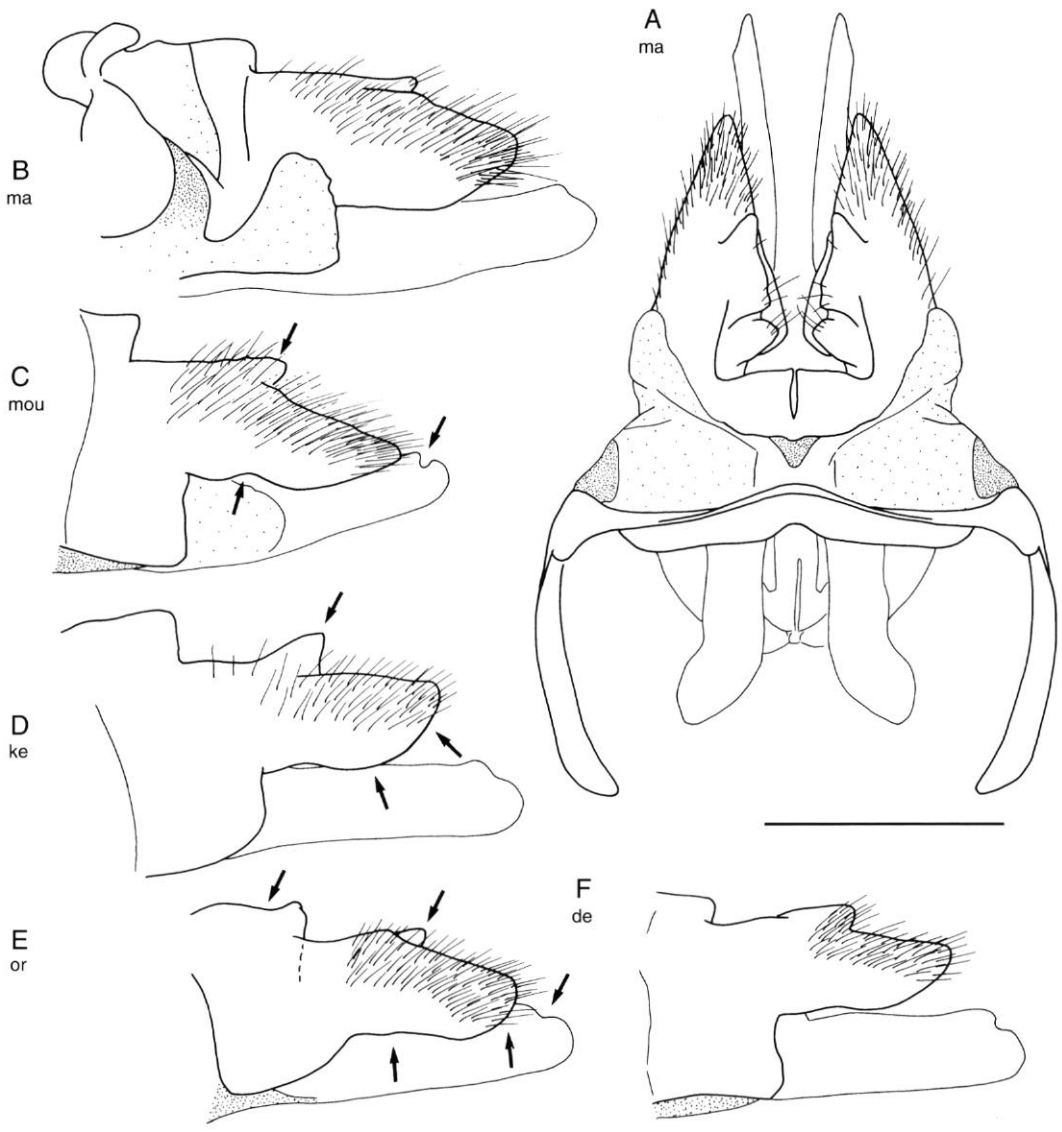

FIG.6. – Male genitalia in dorsal (A) and lateral (B-F) view of: *P. makendensis* n. sp. (ma), *P. kessala* n. sp. (ke), *P. makokou* n. sp. (mou), *P. orensis* n. sp. (or) and *P. deleportei* n. sp. (de). Scale bar: 1 mm.

located near a sloping dead trunk, or on a slopping vine, or on a stub near a horizontal dead tree at 15 cm from the ground; 23.V.1994, 1 juvenile, at night, on a dead trunk at 2 m from the ground; 24.V.1994, 7 juveniles, at night, on a sloping dead trunk reaching the ground on one side, or on a trunk, or on a small vertical root, or on a longitudinally plicated vine; 26.V.1994, 1 juvenile, at night, on trunk; 29.V.1994, 1 juvenile, at night, on a root; 30.V.1994, 4 juveniles, at night, on trunk, or on a sloping dead trunk reaching the ground on one side; 31.V.1994, 2 juveniles, at night, on trunk, or on a horizontal dead tree; 3.VI.1994, 5 juveniles, at night, on trunk, or on a horizontal dead tree, or on the lower side of a dead branch near the ground; 5.VI.1994, 1 juvenile, at night, on trunk; 6.VI.1994, 3 juveniles, at night, on trunk, on a root, or on a horizontal dead tree at 1.50 m from the ground; 7.VI.1994, 2 juveniles, at

night, on a horizontal dead tree at 1.80 m from the ground; 28.VI.1994, 2 juveniles, at night, on a vine near dead wood; 29.VI.1994, 1 juvenile, by day, on the lower side of a horizontal dead trunk at 1.50 m from the ground, not under bark; 29.VI.1994, 1 juvenile, at night, on trunk; coll. L. Desutter-Grancolas, 1.VII.1994, 1 juvenile, at night, on trunk; Coll. P. Grandcolas (MNHN), 10.VI.1993, 1 juvenile, at night, on trunk.

ETYMOLOGY. — The name of this species is derived from the locality where it has been collected.

MEASUREMENTS. — Males (n = 5): Lpron: 2.3-2.5 (2.4); Wpron: 2.9-3 (3); Lteg: 3.9-4.2 (4); Wteg: 3.1-3.4 (3.3); LFIII: 10.5-11.1 (10.9); LTIII: 9.1-9.5 (9.3). Females (n = 5): Lpron: 2.6-2.9 (2.7); Wpron: 3.1-3.5 (3.3); Lteg: 2.1-2.8 (2.4); Wteg: 1.4-1.6 (1.5); LFIII: 10.5-12 (11.5); LTIII: 9.5-10.2 (10); Lovip: 10.8-12.7 (11.8).

DESCRIPTION

Face dark brown to black, shining, with an indistinct dark greyish part above the epistemal suture, sometimes connected with the large yellow spot under the median ocellus; on each side, a yellow transverse line under the eye and the antennal socket, connected with the yellowish cheek; mouthparts dark brown to black, without distinct median yellow spots or lines, mandibles dark reddish brown in their apical half. Cheeks otherwise with an irregular blackish line near its posterior border. Eyes clear brown. A large black spot behind each eye. Fastigium deeply furrowed, its median part black, its borders yellow, its sides black brown. Median ocellus protruding; lateral ocelli smaller, and closer to each other than to median ocellus. Space between the upper border of the antennal socket, the eye and the fastigium yellow, with a transverse black line at the level of each lateral ocellus. Vertex black brown with six longitudinal yellow lines and a very thin median one. Scapes dark brown, their lateral and upper sides light yellow. Antennae brown with very small yellow rings.

Anterior and posterior margins of the pronotum yellow. Lateral lobes otherwise black with a diffuse clear spot near the anterior angle. Dorsal disc black brown with several longitudinal yellow lines and spots (Fig. 4H). Abdomen dorsally black deeply mottled with yellowish. Ventral side yellowish with a dark brown median line.

Legs light yellow with black brown marks. FI: a dark apical ring, numerous black spots on its whole length often fused on its outer side; two dark lines on its ventral side. FII: almost similar to FI, but with an additional subapical, incomplete dark ring and fewer black spots on the outer side. FIII with an apical and a subapical black rings; an additional black spot on the inner and dorsal sides; inner and dorsal sides otherwise with black spots; outer side stripped with black brown. Tibiae: four distinct dark rings, the two more basal ones (toward the knee) usually connected by a dark line on the dorsal side of the tibiae. Basitarsomeres black, their bases ivory-coloured. Tibiae with respectively two, three and six apical spurs; tibiae II: ventral inner spur the longest, the dorsal inner one being reduced. Tibiae III serrulated over its whole length except between the first subapical spurs.

Male. Subgenital plate elongate, light yellow with a dark conical median line usually not reaching the apex (Fig. 4J). Tegmina light brown, the limit between the dorsal and lateral fields yellow. Venation of right tegmen: dorsal field as in Fig. 4C, the margin between the file and the first cord largely thickened; file with 48-56 teeth (mean number 53, n = 5); lateral field with three to four longitudinal veins. Left tegmen almost similar to the right one, but the inner border with two thick indentations separate or not from the rest of the wing membrane, the inner one third of the tegmen thickened (Fig. 4D).

Male genitalia. Fig. 5A, B. Epiphallic parameres elongate, their apex conical, with numerous long setae on their dorsal sides; inner side with a distal, vertical crest, often subdivided into two or three small lobes, and with a more ventral conical process. Dorsal valves elongate; their apex having the shape of a thin and vertical plate with a dorsal notch. Ectophallic apodemes large, straight and parallel except for their divergent apex. Endophallic apodeme extending largely apart from the endophallic sclerite.

Female. Coloration similar to that of males. Tegmina short, not overlapping (Fig. 4L); their coloration brown, only the base and part of the vein separating the dorsal and the lateral fields marked with yellow. Venation: dorsal and lateral fields with three to five and four to five longitu-

dinal parallel veins respectively. Subgenital plate as in Fig. 5E. Ovipositor usually longer than hindfemora.
Female genitalia. Copulatory papilla not elongate, more or less triangular in shape; a longitudinal crest usually distinct dorsally; apex separate from the rest of the papilla, but not as in *P. bipunctulatus* (compare Figs 5H and 7I).
Juveniles. Coloration similar to that of adults.

Paragryllodes sp. aff. ***makandensis***
(Figs 4M; 5F, I)

MATERIAL EXAMINED. — **French Equatorial Africa.** Mid Congo, high forest of Mayombé, 1937, coll. Aubert de la Rüe (MNHN), 1 ♀.

MEASUREMENTS. — Female: Lpron: 3.1; Wpron: 3.9; Lteg: 2.7; Wteg: 1.8; LFIII: 12.8; LTIII: 11.1; Lovip: 13.9.

This female resembles *P. makandensis* by the size and colour of its tegmina (Fig. 4M), its subgenital plate (Fig. 5F) and its general coloration (including that of the face). It is different however by its larger size (compare the measurements) and its copulatory papilla (apex narrower, dorsal crest only slightly distinct: Fig. 5I).

Paragryllodes sp.
(Fig. 5G, J)

MATERIEL EXAMINED. — **Cameroon.** Lolodorf, XII.1952, coll. A. I. Good (ANSP), 1 ♂. — Bitye, Ja River, dry season (ANSP), VII.1909, 1 ♀; 1949-1950, ii / i (401), coll. J. B.-S, J. D. (ZMC), 1 ♂.

MEASUREMENTS. — Lolodorf male: Lpron: 2.3; Wpron: 3.1; Lteg: 4.1; Wteg: 3.3; LFIII: 10.4; LTIII: 9; stridulatory file: 62 teeth. Other male: Lpron: 2.4; Wpron: 2.9; Lteg: 4; Wteg: 3.3; stridulatory file: 65 teeth (no hind legs). Female: Lpron: 2.6; Wpron: 3.5; LFIII: 11.4; LTIII: 10; Lovip: 11.8 (no tegmina left).

The genitalia of both males resemble those of *P. kessala* (cf. *infra*) by the shape of the epiphallic parameres in lateral view, the base of the epiphallic parameres being however more concave dorsally and the dorsal valves larger; however the epiphallic parameres have a smaller inner crest and a sharper apex in the Lolodorf ♂, while the parameres are globally narrower in the other male. Both males have a subgenital plate similar to that of *P. makandensis*. The coloration of their faces are however different: in the Lolodorf male, the coloration is similar to that of *P. makandensis*, except for the fact that the greyish area is extending down to the epistemal suture; in the other male, the face is highly coloured above the epistemal suture and up toward the median ocellus, including two additional black lines that gather just under the median ocellus.
The female resembles *P. makandensis*, except for the posterior border of its subgenital plate (only slightly bisinuated: Fig. 5G), the coloration of its face (not separate from the epistemal suture) and its copulatory papilla (flatter, without a distinct apex and dorsal crest, and with a basal margin ventrally bisinuated: Fig. 5J).
The status of these specimens is uncertain, as they present both similar and very different features. They may belong to a new species close to *P. kessala*, but additional material would be necessary to estimate intraspecific variation. Also *P. kessala* is known by one male only.

Paragryllodes makokou n. sp.
(Fig. 6C)

TYPE MATERIAL. — Holotype ♂, 3.VII.1989, at night, on a dead trunk not laying on the ground. Paratypes: 5.VII.1989, 1 ♂, at night, on a large dead trunk laying on the ground; 10.VII.1989, 2 ♂ ♂, at night, on a horizontal dead branch not laying on the ground (MNHN).

TYPE LOCALITY. — Gabon, Ogooué Ivindo, 8 km SW Makokou, Plateau of Ipassa, coll. P. Grandcolas.

ETYMOLOGY. — Name of this species according to the locality where it has been collected.

MEASUREMENTS. — Males (n = 4): Lpron: 2.6-2.8 (2.7); Wpron: 3.3-3.5 (3.4); Lteg: 4-4.3 (4.1); Wteg: 3.3-3.6 (3.4); LFIII: 11.4-12.6 (11.6); LTIII: 9.9-10.9 (10.2).

DESCRIPTION
Species very close to *P. makandensis* by its general coloration (including male subgenital plate and tegmina), the face and mandibles darker.
Male. Stridulatory file: 63-64 teeth (n = 2).
Male genitalia. Fig. 6C. Quite similar to those of

P. makandensis (compare Figs 6B and 6C), but the epiphallic parameres somewhat longer and with a thinner apex; their ventral margin concave; their inner crest with a very large dorsal lobe. Ectophallic dorsal valves with a distinct notch at the apex.
Female. Unknown.

Paragryllodes kessala n. sp.
(Figs 4E; 6D)

TYPE MATERIAL. — Holotype ♂, 20.VI.1994, at night, on trunk at 1.50 m high (MNHN).

TYPE LOCALITY. — Gabon, around Kessala, 40 km SE Franceville, rainforest, 400 m north bank of Passa River, coll. L. Desutter-Grandcolas.

ETYMOLOGY. — Name of this species according to the locality where it has been collected.

MEASUREMENTS. — Male (n = 1): Lpron: 2.4; Wpron: 3.2; Lteg: 4; Wteg: 3.1; LFIII: 10.4; LTIII: 9.4.

DESCRIPTION
Species very similar to *P. makandensis*, especially by its coloration. Face and mouthparts somewhat darker, but apex of mandibles more clearly orange, and cheeks less spotted with yellow.
Male. Stridulatory file: 56 teeth (n = 1). Supra-anal plate larger and narrower than in *P. makandensis*. Tegmina somewhat narrower, all the veins strong (Fig. 4E).
Male genitalia. Fig. 6D. Quite similar to those of *P. makandensis* (compare Fig. 6B and Fig. 6D), but the epiphallic parameres very short with a large and ventrally rounded apex; their ventral margin slightly concave (but less so than in *P. makokou*: compare Figs 6C and 6D); inner crest with a very large dorsal lobe oriented vertically.
Female. Unknown.

Paragryllodes orensis n. sp.
(Fig. 6E)

TYPE MATERIAL. – Holotype ♂, 7.VII.1994, at night, on a partly hollow and cracked vine. Paratype: 10.VII.1994, 1 ♂, at night, on a standing dead trunk (MNHN).

TYPE LOCALITY. — Gabon, Sette Cama, outer part of the lagoon, dry coastal forest on sandy soil, coll. L. Desutter-Grandcolas.

OTHER SPECIMEN EXAMINED. — Same locality, date, collector and habitat as the paratype, 3 juveniles (MNHN).

ETYMOLOGY. — Name of this species according to the near-shore location of the type locality.

MEASUREMENTS. — Males (n = 2): Lpron: 2.2-2.3; Wpron: 2.8-2.9; Lteg: 3.6-3.9; Wteg: 2.9-3.1; LFIII: 9.6-10; LTIII: 8.3.

DESCRIPTION
Species very similar to *P. makandensis*. Face and mouthparts brownish, the area above the epistemal suture and the apex of the mandibles lighter. Tibiae II: dorsal inner apical spur greatly reduced.
Male. Stridulatory file: 59 teeth (n = 1).
Male genitalia. Fig. 6E. Quite similar to those of *P. makandensis* (compare Fig. 6B and E), but the epiphallic parameres with a short and rounded apex; ventral margin almost straight; their inner crest with a wider dorsal lobe, not oriented vertically. Median part of epiphallic sclerite and apex of the ectophallic dorsal valves as in Fig. 6E.
Female. Unknown.

Paragryllodes deleportei n. sp.
(Fig. 6F)

TYPE MATERIAL. — Holotype ♂, 7.XII.1996, plateau forest with Maranthaceae (MNHN).

TYPE LOCALITY. — Congo, Mbomo, near Mboko, coll. P. Deleporte.

ETYMOLOGY. — Species dedicated to P. Deleporte.

MEASUREMENTS. — Male: Lpron: 2.3; Wpron: 2.8; Lteg: 3.8; Wteg: 3; LFIII: 10.5; LTIII: 8.8.

DESCRIPTION
Species very similar to *P. makandensis* except for the following characters of male genitalia (female unknown). Face and mouthparts dark brown with diffuse greyish or yellowish spots.
Male. Stridulatory file: 55 teeth.
Male genitalia. In dorsal view, apex and inner crest of the epiphallic parameres thinner. In late-

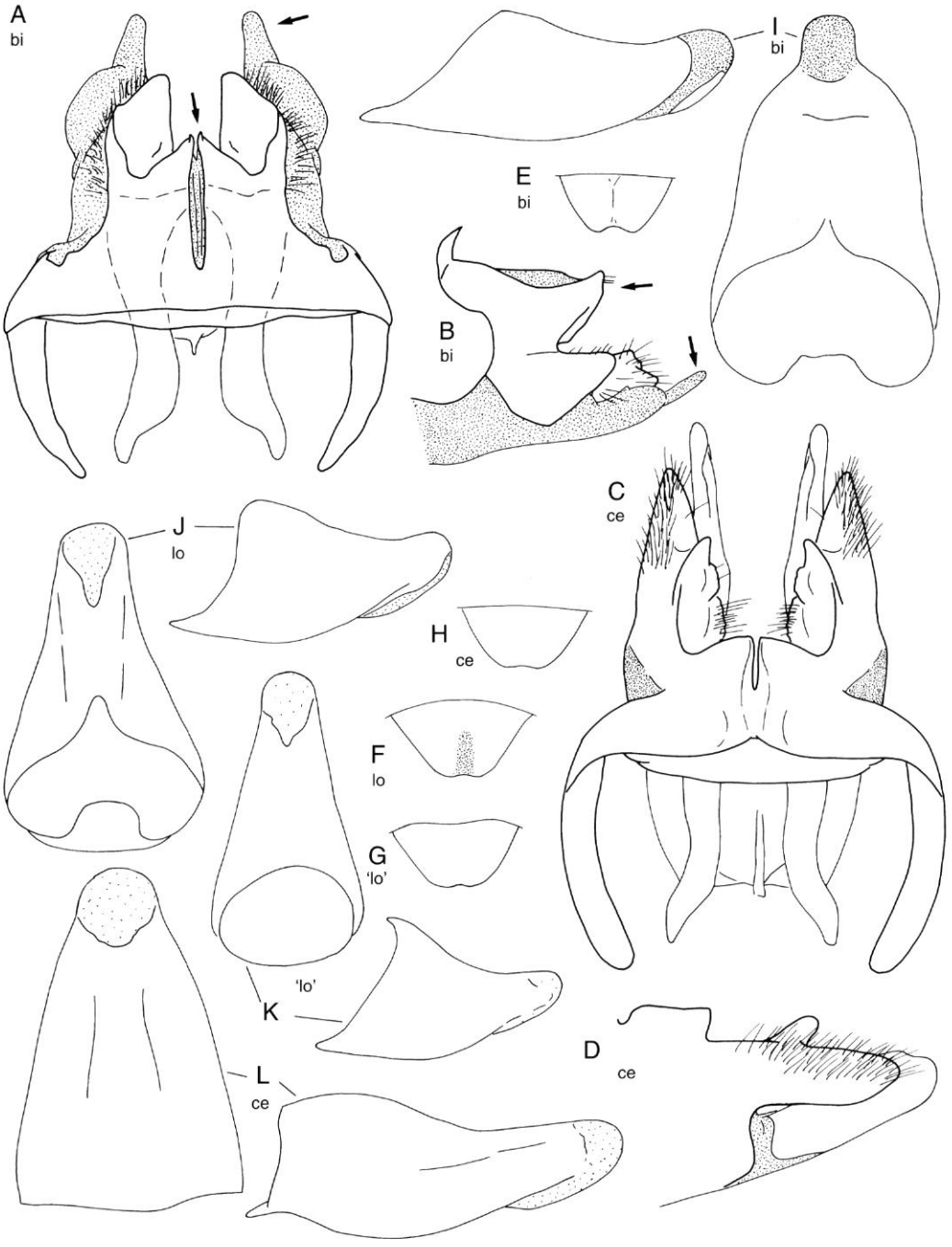

FIG.7. – Male genitalia in dorsal (A, C) and lateral (B, D) view, female subgenital plate (E-H) and female copulatory papilla (I-L) of: *P. bipunctatus* n. sp. (bi), *P. centralis* n. sp. (ce), *P. longixiphus* n. sp. (lo) and *Paragryllodes* sp. affinis *longixiphus* ('lo'). Scale bars: female copulatory papilla: scale as in Fig. 2J-N; male genitalia: scale as in Fig. 3; female subgenital plate: scale as in Fig. 4.

ral view (Fig. 6F), epiphallic parameres not wide as in *P. makandensis*, nor rounded as in *P. kessala* and *P. orensis*; their ventral margin not as concave as in *P. makokou*.

Female. Unknown.

Paragryllodes bipunctatus n. sp.
(Figs 4F, K, N; 7A, B, E, I)

TYPE MATERIAL. — Holotype ♂, 11.VI.1994, at night, on a trunk at 2 m high; 3.VI.1994, Allotype ♀, at night, at 1.80 m high on a trunk. Paratypes: 29.V.1994, 1 ♂, at night, at 1.80 m high on a trunk; 30.V.1994, 1 ♂, at night, at 1.20 m high on a trunk; 4.VI.1994, 1 ♂, at night, at 1.80 m high on a trunk; 4.VI.1994, 1 ♀, at night, on a dead trunk partly laying on the ground; 8.VI.1994, 1 ♂, by day, on a trunk with the bark partially raised (MNHN).

TYPE LOCALITY. — Gabon, Ogooué Offoué, La Makandé, coll. L. Desutter-Grandcolas.

OTHER MATERIAL EXAMINED. — Same locality and collector as the holotype: 30.V.1994, 1 juvenile, at night, on the ground on dead branches; 30.V.1994, 1 juvenile, at night, at 1.50 m high on a trunk; 1.VI.1994, 1 juvenile, by day, behind a termite nest on a trunk; 10.VI.1994, 1 juvenile, at night, flooded forest, on a trunk (MNHN).

ETYMOLOGY. — Species named according to the colour of its face.

MEASUREMENTS. — Males (n = 3): Lpron: 2.2-2.4 (2.3); Wpron: 3.1-3.3 (3.2); Lteg: 3.7-4 (3.8); Wteg: 3.3-3.4 (3.3); LFIII: 10.7-10.9 (10.8); LTIII: 8.6-9.7 (9). Females (n=2): Lpron: 2.8-3; Wpron: 3.6-4; Lteg: 2.4-2.5; Wteg: 1.5-1.6; LFIII: 12.8-13.3; LTIII: 10.2-11; Lovip: 12.9-13.8.

DESCRIPTION

Species resembling *P. makandensis* but easily recognisable by the following characters: mouthparts brown, except for two transverse yellow spots under the epistemal suture and more or less extended on the base of the mandibles.

Male. Subgenital plate shorter and wider than in *P. makandensis*, and entirely of a clear yellow (Fig. 4K). Male tegmina: dorsal fields more rectangular in shape (compare figs 4C and 4F); their coloration lighter, especially on the whole margin; margin largely thickened, except along the lateral field. Stridulatory file: 44-50 teeth (n = 2).

Male genitalia. Fig. 7A, B. Epiphallic parameres short and without a distinct inner crest. Median part of the epiphallic sclerite largely developed as two large and vertical cones. Ectophallic dorsal valves short, their apex rounded and narrow, and sclerotinized only ventrally. Endophallic apodeme extremely short and reduced.

Female. Subgenital plate shorter, but of the same colour than that of *P. makandensis* (Fig. 7E). Tegmina: upper margin of the lateral field, a fleck at the base of the dorsal field, the margin and part of the dorsal field yellow (Fig. 4N).

Female genitalia. Fig. 7I. Copulatory papilla more rectangular than triangular in shape, and without a longitudinal dorsal crest; its apex well separate from the rest of the papilla; its ventral, basal margin subdivided by a variably wide, median furrow.

Juveniles. Recognisable by the two yellow spots below the epistemal suture.

Paragryllodes longixiphus n. sp.
(Figs 4O; 7F, J)

TYPE MATERIAL. — Holotype ♀, 19.VII.1989, at night, on a dead trunk not laying on the ground (MNHN).

TYPE LOCALITY. — Gabon, Ogooué Ivindo, 8 km SW Makokou, Plateau of Ipassa, coll. P. Grandcolas.

OTHER MATERIAL EXAMINED. — **Central African Republic.** Salo, 40 km S Nola, W Sangha, rainforest, 3.VI.1995, coll. L. Desutter-Grandcolas (MNHN), 1 ♀, at night, on a trunk with cavities at its base and surrounded by vines.

ETYMOLOGY. — Species named according to the length of the ovipositor of the female.

MEASUREMENTS. — Female holotype: Lpron: 3.1; Wpron: 3.8; Lteg: 3.2; Wteg: 1.8; Lovip: 17.9. Additional female: Lpron: 2.9; Wpron: 3.7; Lteg: 3.2; Wteg: 1.3; LFIII: 12.6; LTIII: 10.3; Lovip: 16.7.

DESCRIPTION

Species similar to the preceding, from which it can be separated by the following features: face as in *P. makandensis*, but the grey surface above the epistemal suture here yellow and extended up to the yellow spot under the median ocellus; four additional small black dots in a row above the

epistemal suture, the suture itself bordered with dark brown; upper margin of the labrum, under the epistemal suture, continuously bordered with yellow (compare with *P. bipunctatus* and *P. centralis*). Tibiae II: dorsal inner apical spur greatly reduced (lacking ?). Hindlegs missing.

Female. Tegmina quite long (see measurements); their coloration brown, some of the veins of the dorsal field with yellow flecks; vein separating the dorsal and lateral fields yellow and entirely bordered with yellow on its outer margin (Fig. 4O). Subgenital plate light yellow, its apex spotted with light brown (Fig. 7F). Ovipositor very long.

Female genitalia. Fig. 7J. Copulatory papilla triangular in shape, thus resembling that of *P. makandensis*, but its base narrower and the apex narrow on nearly half the total length of the papilla.

Male. Unknown.

Paragryllodes sp. aff. ***longixiphus***
(Figs 4P; 7G, K)

MATERIAL EXAMINED. — **Gabon.** Bas Ogooué (MNHN), 1 ♀ (female type of *P. fuscifrons* Chopard, 1934),

MEASUREMENTS. — Female: Lpron: 2.8; Wpron: 3.6; Lteg: 3.3; Wteg: 1.6; LFIII: 10.9; LTIII: 9.4; Lovip: 15.

DESCRIPTION

This female resembles *P. longixiphus* by the following characters: ovipositor very long, much longer than the hindfemora, apex of the copulatory papilla narrow on about half the length of the papilla (Fig. 7K), tegmina long with a large yellow band on the upper margin of the lateral field (Fig. 4P), subgenital plate not short (Fig. 7G).

Several differences exist however between this female and the females of *P. longixiphus*, namely the colour of the subgenital plate (entirely light yellow), of the tegmina (no distinct rows of yellow spots between the veins of the dorsal field, space between the first two veins of the lateral field entirely yellow) and of the face (an additional longitudinal dark spot above the epistemal suture), and the base of the copulatory papilla (with round margins).

Paragryllodes centralis n. sp.
(Figs 4G, Q; 7C, D, H, L)

TYPE MATERIAL. — Holotype ♂, 22.III.1995, at night, on a dead trunk laying at 1.50 m from the ground. Allotype ♀, *id.* (MNHN).

TYPE LOCALITY. — Central African Republic, 110 km W Mbaiki, Bambio, W Lobaye, semi-deciduous forest, coll. L. Desutter-Grandcolas.

OTHER MATERIAL EXAMINED. — Same locality, date and collector as the holotype: 2 juveniles (collected with the allotype); 1 juvenile, at night, on a trunk with a termite nest (MNHN).

ETYMOLOGY. — Species named according to its distribution in Africa.

MEASUREMENTS. — Male: Lpron: 2.1; Wpron: 2.6; Lteg: 3.8; Wteg: 3; LFIII: 9.8; LTIII: 8. Female: Lpron: 2.6; Wpron: 3.3; Lteg: 2.4; Wteg: 1.4; LFIII: 11.4; LTIII: 9.9; Lovip: 12.4.

DESCRIPTION

Species resembling *P. longixiphus*, but with the following characteristics. Face: transverse yellow line under the epistemal suture subdivided into three spots, two long, lateral ones, and one rounded, median one; median yellow part of the face not directly connected to the yellow spot under the median ocellus, but surrounded by two longitudinal black lines.

Male. Subgenital plate as in *P. makandensis*. Tegmina (Fig. 4G): space between the first two longitudinal veins of the lateral field entirely yellow; inner margin of dorsal field largely thickened; left tegmen with two deep lateral indentations, the basal one much larger. Male stridulatory file with about 60 teeth (n = 1).

Male genitalia. Fig. 7C, D. Similar to those of *P. makandensis*, but of smaller size; inner crest of the epiphallic parameres smaller and higher; epiphallic parameres narrower in lateral view, their ventral margin straight; ectophallic dorsal valves smaller.

Female. Subgenital plate entirely light yellow (Fig. 7H). Tegmina as in Fig. 4Q: vein separating the dorsal and lateral fields yellow at its base and apex; yellow areas on the base and apex of the tegmina, and near the inner border. Ovipositor only slightly longer than the hindfemora.

Female genitalia. Fig. 7L. Copulatory papilla resembling that of *P. makandensis*, but the apex larger in dorsal view and much thinner in lateral view; median dorsal crest only slightly visible.

Juveniles. Coloration similar to that of the adults.

Keys to *Paragryllodes* species from Western and Central Africa

As several species are known by one sex only, separate keys are proposed here for males and females.

Key for males (except *P. longixiphus*)

1a. Subgenital plate entirely light yellow and relatively large and small (Fig. 4K). Mouthparts: two yellow longitudinal spots under the epistemal suture. Genitalia: apex of ectophallic dorsal valves straight and very narrow (Fig. 7B) .... *P. bipunctatus* n. sp.

1b. Subgenital plate decidedly longer and not uniformly coloured 2

2a. Subgenital plate brownish bordered with yellowish except at its base. Genitalia: apex of dorsal valves narrow and bent upwards (Fig. 5D) .... *P. pictus* Chopard, 1958

2b. Subgenital plate yellowish with a median conical black line on almost its whole length. Genitalia: apex of ectophallic dorsal valves not so different from the base 3

3a. Mouthparts: upper margin of the labrum, under the epistemal suture, yellow, subdivided into two lateral, longitudinal yellow lines and one median smaller spot. Face yellowish with four small black dots in a row; this yellow area separated from the yellow spot under the median ocellus by two black lines .... *P. centralis* n. sp.

3b. Mouthparts and face brownish, without distinct yellow spots or line (except may be *P. optimus*: Gorochov 1996, fig. 141) 4

4a Subgenital plate: median dark line much larger at its base than at its apex, and abruptly narrowed toward the apex (Fig. 4I). Genitalia: epiphallic parameres and ectophallic dorsal valves very short (Fig. 5B). Species originating from Western Africa ..... *P. fuscifrons* Chopard, 1934

4b. Subgenital plate: median dark line regularly narrowed toward the apex (Fig. 4J). Genitalia: epiphallic parameres and ectophallic dorsal valves longer (Fig. 6). Species originating from Central Africa (except *P.* optimus) 5

5a. Genitalia: dorsal valves widely diverging from each other and bent downward (Gorochov 1996, fig. 139). Species originating from Nigeria .... *P. optimus* Gorochov, 1996

5b. Genitalia: dorsal valves not or only slightly diverging, and not bent downward 6

6a. Genitalia: epiphallic parameres very large in lateral view (Fig. 6B) ..... *P. makandensis* n. sp.

6b. Genitalia: epiphallic parameres different 7

7a. Genitalia: epiphallic parameres sharp-pointed at the apex, their ventral margin concave in lateral view 8

7b. Genitalia: apex of the epiphallic parameres decidedly more rounded, their ventral margin less concave or straight in lateral view 9

8a. Genitalia as in Fig. 6C. Species originating from Gabon ..... *P. makokou* n. sp.

8b. Genitalia as in Fig. 6F. Species originating from Congo ..... *P. deleportei* n. sp.

9a. Genitalia as in Fig. 6D. Species originating from Gabon ..... *P. kessala* n. sp.

9b. Genitalia as in Fig. 6E. Species originating from Gabon ..... *P. orensis* n. sp.

Key for females (except *P. fuscifrons*, *P. pictus*, *P. makokou*, *P. kessala*, *P. orensis*, *P. deleportei*, *P. optimus*)

1a. Subgenital plate light yellow with a large, apical brown spot. Copulatory papilla triangular in shape, the apex narrow on about half the length of the papilla (Fig. 7J). Ovipositor very long (more than 17 mm in the specimens examined). Mouthparts: a continuous yellow line under the epistemal suture ..... *P. longixiphus* n. sp.

1b. Subgenital plate entirely light yellow. Ovipositor smaller (less than 14 mm in the specimens examined). Copulatory papilla and mouthparts different 2

2a. Copulatory papilla more quadrangular than triangular in shape, the apex very narrow; no distinct median dorsal crest (Fig. 7I). Subgenital plate short (Fig. 7E). Mouthparts: two longitudinal yellow spots under the epistemal suture ..... *P. bipunctatus* n. sp.

2b. Copulatory papilla triangular in shape, the apex much larger; a distinct median dorsal crest present (Figs 5H, 7L). Subgenital plate longer (Figs 5E, 7H). Mouthparts different 3

3a. Face brown or greyish above the epistemal suture. Mouthparts with no distinct yellow spots. Tegmina brown, only the base of the dorsal field and the base of the vein separating the dorsal and lateral fields yellowish (Fig. 4L) ..... *P. makandensis* n. sp.

3b. Face yellowish above the epistemal suture, with two distinct black lines under the median ocellus. Mouthparts with three yellow spots under the epistemal suture. Tegmina: vein separating the dorsal and lateral fields entirely bordered with yellow, except in its median length (Fig. 4Q) ..... *P. centralis* n. sp.

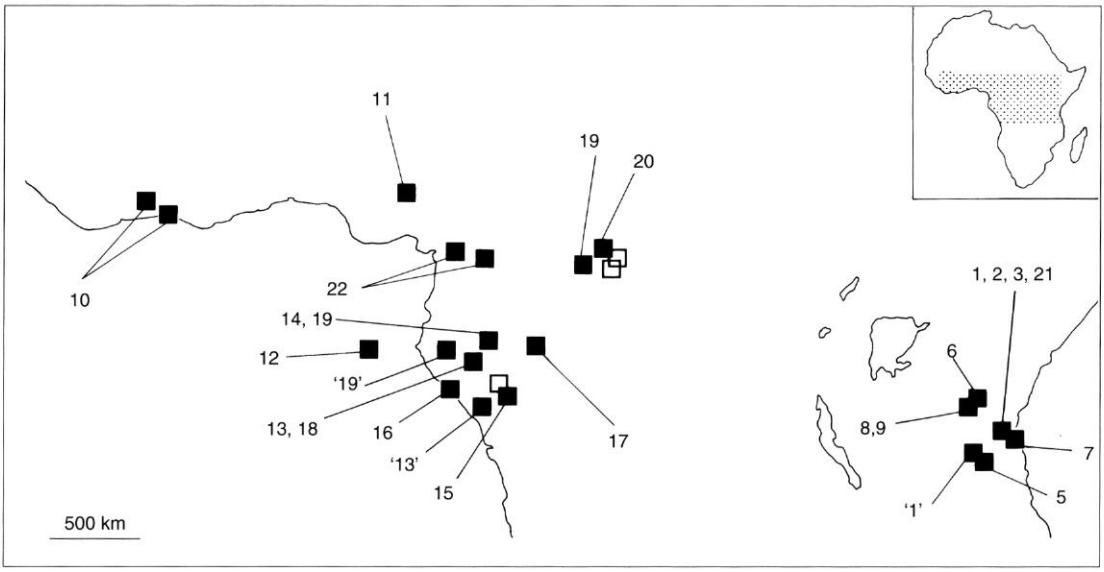

FIG. 8. – Distribution map of *Paragryllodes* species in tropical Africa. Symboles: **1**, *P. borgerti*; **'1'**, *P. borgerti* (?); **2**, *P. minor*; **3**, *P. dissimilis*; **4**, *P. unicolor*; **5**, *P. campanella*; **6**, *P. kenyanus*; **7**, *P. pyrrhopterus*; **8**, *P. silvaepluvialis*; **9**, *P. affinis*; **10**, *P. fuscifrons*; **11**, *P. optimus*; **12**, *P. pictus*; **13**, *P.makendensis*; **'13'**, *Paragryllodes* sp. aff. *makendensis*; **14**, *P. makokou*; **15**, *P. kessala*; **16**, *P. orensis*; **17**, *P. deleportei*; **18**, *P. bipunctatus*; **19**, *P. longixiphus*; **'19'**, *Paragryllodes* sp. aff. *longixiphus*; **20**, *P. centralis*; **21**, *Paragryllodes* sp.; **22**, *Paragryllodes* sp.; **9**, location where no *Paragryllodes* could be found.

LIFE HABITS

Information on the life habits of *Paragryllodes* species are very scarce, probably because these insects are nocturnal, live in forests and are not attracted by light. *Paragryllodes* species are thus not mentioned in the few papers dealing with African cricket communities (Paulian 1947; Chiffaud 1981) and no biological information exists in taxonomic papers dealing with this genus. Bhowmik (1970) studied the cricket fauna of the great Nicobar Island (India) and described the life habits of *Paragryllodes anjani* Bhowmik, 1970: " This species is found in the Campbell Bay forest where they are a very big wild type of trees with several vertices from the root. These vertices are usually at a height of six to seven feet from ground and extend up to long distances which are meant for additional support of the trees. These insects were always found hovering over on or around these vertices. They are good jumpers and even by slightest disturbance they take shelter in the holes of ground protected by the vertices. Rarely the insects were seen hovering over a fallen tree or branch, but it was very difficult to approach them". Desutter-Grandcolas (1995) used these data to preliminarily define *Paragryllodes* species as dendrophilous, hiding in cavities at ground level (D, CG). The data presented here are the first direct and precise information on the life habits of the African species of the genus.

My observations in Central and Eastern Africa confirmed that *Paragryllodes* species are nocturnal and forest-dwelling, even though not all types of forests proved to be occupied (cf. *infra*). Most specimens were actually collected in forest and during the night. Exceptions concern ten specimens collected in forest but during the day, mostly in refuge habitat, and 31 specimens found in Eastern Africa on track (one specimen) or ground slopes. Bear ground surfaces, and especially high track borders, are however very attractive to crickets, especially phalangopsids, gryllids and nemobiines, as observed in Africa, but also in New Caledonia and the neotropics (Desutter-Grandcolas pers. obs.). Males may use these places as singing positions, as repeatedly

TABLE I. – Observations on the nocturnal habitats of *Paragryllodes* sp. Abbreviations: in dead trunks and branches: **G**, dead trunk on the ground; **AG**, dead trunk above ground level; **S**, sloping dead trunk partly on the ground and above; **ST**: hollow dead standing tree. On standing trees: **UB**, under raised bark; **T**, trunk with termite nest; **C**, trunk with cavities at the level of the roofs, on the trunk, and/or at the level of termite nest; **D**, dead wood near the trunk or at its base; **V**, large, plicated vine on the trunk. On vines: abbreviations similar to those used for standing and dead trees categories, **C** referring here to hollow vines. (1) According to Desutter-Grandcolas (1998b).

At night	On standing trees	Dead trunks and branches	On root	On vines	Between rocks	Track, ground slopes (forest)	ground slopes (unforested areas)
P. borgerti		1 ♂ 1 ♀: S				4 ♂ ♂, 2 ♀ ♀	7 ♂ ♂, 8 ♀ ♀
P. borgerti (?)	1 ♂ 1 J: UB				1 ♀	1 ♀	1 ♂, 1 ♀
P. minor		3 ♂ ♂: ST					
P. dissimilis		1 ♀: ST					
Paragryllodes sp.		1 ♀: S				1 ♀	1 ♂, 2 ♀ ♀
P. unicolor		1 ♂: S / 1 ♂, 2 ♀ ♀: ST				2 ♀ ♀	1 ♀
P. campanella (1)	1 ♂, 1 ♀ / 1 ♂, 2 ♀ ♀ (CD) 1 ♀ (D)						
P. makendensis	1 ♂, 1 ♀, 1 J 1 ♀ (TD), 1 ♀ (T), 1 ♀, 6 J (TC), 1 ♂, 1 J (D), 1 ♀ (CD) 1 J (TCD), 1 ♂, 1 J (C) 1 ♂, 1 ♀, 1 J (TCV)	3 ♂ ♂, 6 ♀ ♀, 3 J: AG 3 ♂ ♂, 3 J: S 1 ♀: G 1 J: ST	2 J, 1 J (CD)	2J, 1J (S) 1 ♂ (C), 2J (D)			
P. makokou		3 ♂ ♂: AG, 1 ♂: G					
P. kessala	1 ♂						
P. orensis		1 ♂, 3 J: ST		1 ♂ (C)			
P. bipunctatus	5 ♂ ♂, 1 ♀, 3 J	1 ♀: S / 1 J: G					
P. longixiphus	1 ♀ (CV)	1 ♀: S					
P. centralis	1 J (T)	1 ♂, 1 ♀, 2 J: S					

observed for *Ectecous* males in Brazil (Desutter-Grandcolas in prep.). The presence of hiding holes near or under small tree roots may also explain that of cavicolous crickets.

Paragryllodes individuals were mostly collected during their activity period on arboreal structures: none were found in the leaf litter or on plant leaves, which reveals dendrophilous habits. According to my observations (Table 1), both standing trees and dead trunks, either on the ground or above ground level, are used (51 versus 46 collected specimens, i.e. 39.5% and 35.7% of collected specimens respectively). The presence of dead wood could be significant for the choice of habitat: 55 specimens have been collected on or near dead wood, i.e. 42.6%. Conversely *Paragryllodes* does not seem to particularly select trees or trunks with termite nests (16 specimens, i.e. 12.4%) or cavities (15 specimens, i.e. 11.6%). The availability of such structures on trees were however hard to estimate in the natural environment, owing to scale effect.

The refuge, diurnal habitat of *Paragryllodes* species is more difficult to define, as few specimens were encountered during the day (Table 2): these were collected behind a termite nest on a trunk, or at a cavity border on a trunk, or under raised bark, or on the lower surface of a dead horizontal trunk; one *P. borgerti* (?) female was also encountered in a small cavity delimited by two rocks in Tanzania. According to the habitat categories defined by Desutter-Grandcolas (1995), the refuge habitat of these *Paragryllodes* species could thus be tentatively defined as cavities above ground level. As mentioned above, Bhowmik (1970) indicated that disturbed *Paragryllodes anjani* sheltered in ground cavities at the base of tree roots. This was not confirmed with African *Paragryllodes* species and could reveal heterogeneous life habits among *Paragryllodes* species.

TABLE 2. – Observations on the diurnal habitats of *Paragryllodes* sp.

By day	On standing trunk	Dead trunks and branches
P. makendensis *P. bipunctatus*	1 ♀ (near cavity on trunk) 1 ♂: under bark 1 J: behind a termite nest	3 ♂ ♂, 3 ♀ ♀, 1 J: AG, on lower side of trunk, not under bark

Habitat characterisation of *Paragryllodes* species by Desutter-Grandcolas (1995) should anyhow be modified into "dendrophilous, hiding during the day in cavities at ground level (Indian species) or above ground (African species)".

To confirm the preceding observations, no *Paragryllodes* was found when large ground cavities, large enough for human to stand inside, were investigated for crickets. Similarly, no *Paragryllodes* has ever been mentioned from caves or large ground holes of Western and Central Africa (Villiers 1971), although these places sheltered many other Phalangopsidae (*Homoeogryllus* and mostly *Phaeophilacris* species). This may confirm that cavernicolous habits may be expected only in straminicolous or dendrophilous crickets which usually hide during the day in cavities at ground level, and not in cavities above ground: this hypothesis about the pre-adaptation to troglobitic evolution had been proposed for the Central American phalangopsids Amphiacustae (Desutter-Grandcolas 1993; 1997b), but could reveal of a much larger significance at least in crickets (Desutter-Grandcolas 1998a).

Concerning the geographic distributions (Fig. 8), *Paragryllodes* is presently known from Western Africa (Ivory Coast, Nigeria), Central Africa (Cameroon, Equatorial Guinea, Central African Republic, Gabon, Congo) and Eastern Africa (Kenya, Tanzania). Such a distribution may signify that this genus exists in fact through the whole forested Africa south of the Sahara, and consequently imply that the distribution of this taxon is very imperfectly known today. This should be tempered however by the following observations. Several types of forests were sampled for *Paragryllodes* in Central (RCA, Gabon) and Eastern Africa (Tanzania). In Central Africa, *Paragryllodes* was found only in large patches of forests: at Franceville (Gabon) and N'Goto (RCA), no *Paragryllodes* was encountered in gallery forests, although it was present in large forests nearby and although the gallery forests were intensively sampled. In Eastern Africa, *Paragryllodes borgerti* has been found both in rainforest and in a gallery forest located on a slope. Other phalangopsid genera, such as *Phaeophilacris*, *Homoeogryllus* (RCA, Gabon) and less constantly *Larandeicus* (RCA), are present both in gallery forests and large forests (Desutter-Grandcolas pers. obs.). These differences in distribution may reveal differences in the ecological preferences of these forest-dwelling taxa. No explanation, either historical or ecological, can be given however for the moment.

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