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A Review Work on How to Differentiate the Longhorn Grasshoppers *Ruspolia differens* and *Ruspolia nitidula* (Orthoptera: Tettigoniidae)

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

The record of potential characters differentiating the longhorn grasshoppers *Ruspolia differens* Serville, 1838 and *Ruspolia nitidula* Scopoli, 1786 in the family Tettigoniidae of the order Orthoptera is somewhat unapparent, being randomly featured in the general literature of the individual species without joint synchronization. The present work systematically re-examines and re-organises these characters with a main goal to harmonizing the various records where the two species are interchanged, misdiagnosed or incorrectly named, and sensitizing future workers to overcome the oversights. The couple of insects are evidently sister species that are well distinguished from each other by their respective species-specific biology and biogeography. *R. differens* inhabits the Sub-Saharan African region; the species has a swarming phase and colour polymorphism with six morphs, and a distinct sex dimorphism with males having longer antennae and a unique pair of metathoracic flaps. On the other hand, *R. nitidula* is exclusively solitary, greenish and Palearctic ranging in Asia, Europe and Northern Africa. Generally, each species is morphologically, behaviourally, genetically and thus taxonomically distinct from its counterpart.

Keywords: Longhorn grasshoppers; Orthoptera; Ruspolia differens; Ruspolia nitidula; Tettigoniidae.

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1. INTRODUCTION

The longhorn grasshopper *Ruspolia differens* ("*nsenene*" in *Luganda* or "*senene*" in Kiswahili), belongs to the subfamily Copiphorinae (coneheads) of family Tettigoniidae in the order Orthoptera. It is a well-studied insect with clearly known biology and biogeography. Since the year 1838 when the species was first described, it has been documented with not less than ten scientific names also referred to as synonyms, including *Conocephalus differens* Serville 1838, *Homorocoryphus nitidulus subsp. vicinus* Walker, F. 1869, *C. vicinus* Walker, F. 1869, *C. exiguus* Stål 1876, *C. albidonervis* Redtenbacher 1891, *C. lemur* Redtenbacher 1891, *C. longipennis* Redtenbacher 1891, *C. melanostictus* Karny 1907 and *C. mediotessellatus* Karny 1915 [1-6].

According to the documented records, *R. differens* has no synonymic relationship with the large conehead, *R. nitidula* (synonym *H. nitidulus nitidulus*); however, the two species have been widely interchanged, misdiagnosed, incorrectly named and probably mistreated by various workers due to lacking clear-cut information on their differences. [7] described the "Commercialization of *R. nitidula* (Nsenene Grasshoppers) in central Uganda" justifying that the species was cosmopolitan in East Africa, as if it was *R. differens*. Likewise, [8] reported the "Nutritional composition, quality, and shelf stability of processed *Ruspolia nitidula* (edible grasshoppers)" justifying the species as a delicacy in Uganda and many other East African tribes, although it has never been reported in East Africa. The misconceptions contradicted subsequent workers, including [9] and [10] who resultantly treated *R. differens* and *R. nitidula* as two sympatric species in East Africa, as earlier perceived by [8]. The overall scenario has prompted the present study to re-examine and re-organise the key differences existing between the two species with a main goal to harmonizing the documented shortcomings and sensitizing future workers to overcome the confusion.

2. MATERIALS AND METHODS

Interest in the present study was motivated by the anomalous oversights in diagnosis of *R. differens* by various previous workers in relation to *R. nitidula* [7-10]. Consequently, the study had to review the biogeographical affiliations and key morphological, behavioural and molecular characters of both species as documented in literature. The characters were used to validate the major differences existing between the two species in a systematic and comprehensive form to facilitate their distinction. The biogeographical analysis focused on the documented respective geographical ranges of these insects [1-4,11,12]. The morphological analysis involved the examination of colour patterns and anatomic morphometrics of each species in relation to the other; whereas the analysis of behaviour focused on the aggregation status of the respective species in line with the existing environmental conditions as appearing in literature [4-6,13-16]. The genetic differentiation was inferred from various molecular phylogenetics involving the two species [17,18].

3. RESULTS AND DISCUSSION

3.1 Nomenclature

The name *Ruspolia differens* is accepted by the International Code of Zoological Nomenclature (ICZN) with ten recognized synonyms (as appearing in the introduction), with no synonymic relationship to the sister species *R. nitidula*.

3.2 Biogeographical Variation

The existing literature clearly evidences that *R. differens* is exclusively native in Sub-Saharan Africa including the Eastern African region where it is widely edible, unlike *R. nitidula* which is a Palearctic species exclusively occurring in Asia, Europe and Northern Africa [1-4,10-12]. Hence, the Sub-Saharan African species which has recently been reported as *R. nitidula* is actually *R. differens* with its diverse synonyms as addressed in the introduction.

3.3 Colour Variation

The available records concur with the general observation that *R. differens* exhibits unique colour polymorphism with six morphs (green, brown, purple-stripped green, purple-stripped brown, purple suffused green and purple suffused brown), unlike *R. nitudula* which is essentially green [4,11-15].

3.4 Anatomic Variation

Ruspolia differens is well-known to comprise sex dimorphism whereby the male adults have much longer antennae (about 1.5 times) than the females and have a pair of tongue-like metathoracic flaps located at the dorsal side of the proximal base of the hind wing along the

Radius vein while the females only have paired budlike nodules appearing somewhat like the underdeveloped equivalents of the male flaps [6,12-16]. Both features distinguish *R. differens* from other tettigoniids including *R. nitidula*.

3.5 Behavioural Variation

The records are also evidencing that *R. differens* is exceptional among the longhorn grasshoppers due to its distinct swarming phase occurring during wet seasons in relation to the non-swarming phase which occurs during dry seasons; the swarming phase is widely edible especially in Africa where the species occurs [4,5,11-16]. On the other hand, *R. nitidula* is well-known to exist in solitary phase only.

3.6 Genetic Variation

The various molecular studies such as those involving the 16S and 18S rRNA partial sequences have clearly demonstrated that *R. differens* and *R. nitidula* are a distinct pair of sister species of longhorn grasshoppers in the subfamily Copiphorinae of the family Tettigoniidae and order Orthoptera [17,18]. The couple comprises different species which cannot be named or treated interchangeably as previously done by a number of workers [7-10].

4. CONCLUSION

The longhorn grasshoppers *Ruspolia differens* and *Ruspolia nitidula* are two different species which are well distinguished from each other by their respective species-specific biogeography and biology. Whereas *R. differens* is a Sub-Saharan African species well-known by its unique swarming phase, colour polymorphism and male-biased sex dimorphism of longer antennae and unique metathoracic flaps, *R. nitidula* is exclusively solitary, greenish and Palearctic ranging in Asia, Europe and Northern Africa.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. International Trust for Zoological Nomenclature, ITZN. Official lists and indexes of names in Zoology. Bulletin of Zoological Nomenclature: International Code of Zoological Nomenclature; 2006. Available:http://www.ICZN.org (Retrieved 31 October 2017)
2. Ingrisch S. Feedback to catalogue of life: Annual checklist on the classification of *Ruspolia differens* (Serville, 1838) Catalogue of Life (2009); 2007. Available:http://osf2.orthoptera.org/Ruspolia differens (Retrieved 31 October 2017)
3. ZipcodeZoo. Animals: *Ruspolia differens*; 2008. Available:http://www.zipcodeZoo.animals/Ruspolia differens (Retrieved 31 October 2017)
4. Matojo ND, Njau MA. Plasticity and biosystematics of swarming of the conehead *Ruspolia differens* Serville (Orthoptera: Conocephalidae) in North-west Tanzania. International Journal of Integrative Biology (IJIB) 2009, ISSN 0973-8363. 2010;9(2):97-103.
5. Kinyuru JN, Kenji GM, Muhoho SN, Ayieko M. Nutritional potential of longhorn grasshopper (*Ruspolia differens)* consumed in Siaya District, Kenya. Journal of Agricultural Science and Technology. 2010;12:32–46.
6. Matojo ND, Jacob G. Yarro. Anatomic morphometrics of the “Senene” Tettigoniid *Ruspolia differens* Serville (Orthoptera: Conocephalidae) from North-West Tanzania. ISRN Entomology. 2013;2013:1-12. Article ID: 176342
7. Agea JG, Biryomumaisho D, Buyinza M, Nabanoga N. Commercialization of *Ruspolia nitidula* (Nsenene grasshoppers) in central Uganda. African Journal of Food Agriculture Nutrition and Development. 2008;8(3):319-332.
8. Ssepuuya, Geoffrey, Ivan Muzira Mukisa, Dorothy Nakimbugwe. Nutritional composition, quality, and shelf stability of processed *Ruspolia nitidula* (edible grasshoppers). Food Sci Nutr. 2017;5(1): 103–112.
9. Aman Paul, Michel Frederich, Roel Uyttenbroeck, Séverin Hatt, Priyanka Malik, Simon Lebecque, et al. Grasshoppers as a food source? A review. Biotechnol. Agron. Soc. Environ. 2016;20(S1):337–352.
10. Fombong Forkwa Tengweh, Mik Van Der Borght, Jozef Vanden Broeck. Influence of freeze-drying and oven-drying post

blanching on the nutrient composition of the edible insect *Ruspolia differens.* Insects. 2017;8(102):1-14.
11. Bailey WJ. Species isolation and song types of the genus *Ruspolia* Schulthess (Orthoptera: Tettigonioidea) in Uganda. J Nat Hist. 1976;10(5):511-528.
12. Bailey WJ. A review of Australian Copiphirini (Orthoptera: Tettigoniidae: Conocephalinae). Austr. J. Zool. 1979;27: 1015-49.
13. Bailey WJ. A review of the African species of the genus *Ruspolia* Schulthess (Orthoptera, Tettigonioidea). Bulletin de Inst. Fr. Afr. Noire Ser. A. 1975;37:171-226.
14. Bailey WJ, McCrae AWR. The general biology and phenology of swarming in the East African tettigoniid *Ruspolia differens* (Serville) (Orthoptera). J Nat Hist. 1978;12:259–288.
15. McCrae AWR. Characteristics of swarming in the East African bush-cricket *Ruspolia differens* (Serville) (Orthoptera, Tettigoniidae). J. E. Afr. Nat. Hist. Soc. 1982;178:1-8.
16. Matojo ND, Yarro JG. Variability in polymorphism and sex ratio of the conehead *Ruspolia differens* Serville (Orthoptera: Conocephalidae) in North-west Tanzania. International Journal of Integrative Biology (IJIB), ISSN 0973-8363. 2010;9(3):131-136.
17. Hemp C, Heller KG, Kehl S, Warchaowska-liwa E, Waegele W, Hemp A. The Phlesirtes complex (Orthoptera, Tettigoniidae, Conocephalinae, Conocephalini) reviewed: Integrating morphological, molecular, chromosomal and bioacoustics data. Systematic Entomology. 2010;35(3)554–580.
18. Matojo ND, Keneth M. Hosea. phylogenetic relationship of the longhorn grasshopper *Ruspolia differens* Serville (Orthoptera: Tettigoniidae) from Northwest Tanzania based on 18S ribosomal nuclear sequences. Journal of Insects. 2013;2013: 1-5. Article ID: 504285

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