

A review of the genus *Popa* Stål 1856 (Insecta Mantodea)

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It is suggested that *Mantis undata* Fabricius 1793 does not belong to the genus *Popa* Stål 1856 as believed until now, but to the Indian genus *Ambivia* Stål 1877 (n. comb.). The systematic position of the species of *Popa* is re-examined and a single species, *Popa spurca* Stål 1856 (= *P. undata* auct. nec Fabricius) is recognised. The species is differentiated into two subspecies, one being *Popa spurca spurca* Stål 1856 (= *P. stublmanni* Rehn 1914, *P. batesi* Sauss. & Zehnt. 1895) (n. syn.) widespread throughout all Africa south of the Sahara, except in the east which is populated by the other subspecies, *P. spurca crassa* (Giglio-Tos 1917).

KEY WORDS: Mantodea, Vatiidae, *Popa*.

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INTRODUCTION

It is difficult to distinguish between the species ascribed to the genus *Popa* Stål 1856 on the basis of the characters that have been used so far in the systematics of this genus, because there is great intraspecific character variability in specimens from the same geographic area. These characters are: number and size of the lobes on the femurs and tibiae of the median and posterior legs, shape and length of the pronotum, ratio of the length between the anterior coxae and pronotum.

This variability is easily reflected in the description of the five nominal species of this genus. In his review of the Vatiinae (1914) and in his monograph (1927), GIGLIO-TOS did not clarify, but increased, the existing confusion. In fact, in his review this author noted the great variability of the characters used, but did not include the following species: *Popa spurca* Stål 1856 (= *P. batesi* Sauss. & Zehnt. 1895 = *P.*

servillei Giglio-Tos 1907), South Africa, Kilimandjaro, Madagascar; *Popa undata* (F. 1793), Ethiopia, Somalia, Uganda, Kenya, South Africa; *Popa stublmanni* Rehn 1914, Northern Zaire.

Furthermore, in his ensuing monograph (1927) the author not only maintained the same three species, but separated *P. batesi* (= *P. servillei*) from Madagascar from *P. spurca*, he added *P. crassa* Giglio-Tos from Nyassaland described in 1917 on a single female.

Between 1927 and 1952 the species of the genus *Popa* were reported for other areas, and according to the literature, the present day distribution seems to be as follows.

P. spurca Stål 1856: Katanga, Ethiopia, Kilimandjaro, Kenya, Madagascar, South Africa (typical area: Port Natal);

P. batesi Sauss. & Zehnt. 1863: Madagascar, South-West Africa (typical area: Imerina, Madagascar);

P. undata (F. 1793): Kamerun, Guinea, Ghana, Angola, Ethiopia, Somalia, Kenya, Uganda, Matengo (NE Lake Nyassa), South Africa (typical area: Tranquebar, India);

P. stublmanni Rehn 1914: Zaire, Uganda (typical area: Ituri).

P. crassa Giglio-Tos 1917: Nyassaland (typical area: Nyassaland).

Thereafter, LA GRECA (1952) placed *P. spurca* Stål 1856 in synonymy with *P. undata* (F. 1793) as he believed that the two most common species in Africa belonged to only one species.

Nevertheless, reports of different species in the same territories, and above all the difficulty in distinguishing between the species, undermine the determinations reported in the literature up to now and call for reexamination of the species of the genus *Popa*.

I was able to conduct this study as I had the opportunity to examine numerous specimens (more 100) from various African regions (Nigeria, Zaire, Ethiopia, Somalia, Kenya, Tanzania, Zimbabwe, Natal, South Africa).

SYSTEMATICS OF THE GENUS *POPA* STÅL 1856

In 1793 FABRICIUS described *Mantis undata* on material from Tranquebar (village on the southern coasts of Madras, India). In 1863 BATES attributed material from Madagascar to this species, transferring it to the genus *Popa* instituted by STÅL in 1856. From then on all authors have followed BATES' opinion for African material: STÅL (1871), SAUSSURE (1871, 1872), WOOD-MASON (1889), GIGLIO-TOS (1914, 1927) and others.

Meanwhile, STÅL described the species *P. spurca* for southern Africa in 1856 and the new species *Ambivia popa* for India in 1877. As can be deduced by its name, the latter closely resembles a *Popa*. It is strange that STÅL, who was fully aware of the ambiguity of the presence of *Popa undata* in both Africa and India, did not suspect that his species of *Ambivia* was none other than the *Mantis undata*. Besides, in a period when there were no biogeographic problems, none of the authors paid attention to the discordances between typical Indian localities and the localities of

following reports. Only GIGLIO-TOS (1914) attributed this difference to an error in the labels since the species had not been sighted in India thereafter.

His opinion was tacitly accepted by all the authors studying this species.

While there is no proof of mistaken labels (the type specimen of *M. undata*, which I have looked for, has probably gone missing), BATES may have made an incorrect generic attribution of *M. undata* which has been handed down in the literature. WERNER (1908) made the inverse error, he cited the presence of *P. undata* for Ceylon (Sri-Lanka), but as GIGLIO-TOS rightly observed (1914) the previous author's description clearly denoted material belonging to the genus *Ambivia*, and not to *Popa*. As I have examined material of *Ambivia*, I realise how easy it is to make this mistake. In fact, the two genera are very similar and even the distinction between Vatidae (to which *Popa* belongs) and Mantidae (to which *Ambivia* belongs) was recognized only as late as 1877 by STÅL. Thus, it is understandable that BATES (1863) made an incorrect decision as he was not aware of the importance of the carena of the posterior tibiae for differentiation between the two.

In addition at that time, the genus *Ambivia* Stål 1877 had not yet been instituted.

In conclusion, I believe that there was not a name-tag error (as suspected), but a clear mistake in generic attribution. Therefore, *Mantis undata* must no longer be ascribed to the *Popa* but to the genus *Ambivia* (n. comb.). This means that: (a) *Popa undata* auct. nec. Fabricius becomes a synonym of *P. spurca* Stål 1856 (n. syn.) which once again becomes a valid name for the most common species in Africa; (b) *Ambivia popa* Stål 1877 becomes a synonym of *Ambivia undata* (F. 1793) (n. syn.).

Careful assessment of the descriptions reported by the various authors and observations of the material in my possession has convinced me of the identity of *P. batesi* Sauss. & Zenht. with *P. spurca* Stål.

According to SAUSSURE & ZEHNTNER (1895), the characters which distinguish *P. batesi* from *P. spurca* are: males, the marked length of the pronotum and the anterior coxae which do not reach the posterior tip of the pronotum; females, the numerous whitish venules forming a rich mosaic pattern on the metathoracic wings. In his review of the Vatinæ, GIGLIO-TOS (1914) considered *P. batesi* a synonym of *P. spurca*, but subsequently in his monograph (1927) he rehabilitated the former, stressing that the latter may be a form of *P. spurca*: "Peut-être il ne s'agit pas d'une véritable espèce mais d'une variété locale de *P. spurca*".

PAULIAN (1957) was not aware of the identity established between *P. spurca* and *P. undata* by LA GRECA (1952), and in his "Faune de Madagascar" he claimed that *P. batesi* was distinct from *P. spurca*. However, he was not able to demonstrate appreciable differences between their copulatory apparatus: "Les genitalia de ces deux espèces paraissant pratiquement identiques".

Examination of the material in my possession revealed that in several males specimens attributable to *P. spurca*, the pronotum is the same size as the one observed in the typical *P. batesi* specimen and the coxae do not reach the base of the pronotum in many others. Moreover, the metathoracic wing fenestrations in the females are not valid diagnostic characters because they vary greatly. In fact, there is a different degree of development in these fenestrations in females from the same geographic area.

In conclusion, considering the explicit statement made by the authors of *P. batesi* "Il sera difficile de dire si les deux *Popa* ici décrites sont réellement des espèces

différent...”, I believe that *P. batesi* Sauss. & Zenht. 1863 can be correctly considered a synonym of *P. spurca* Stål 1856 (n. syn.).

In addition, the institution of *P. stublmanni* Rehn 1914 seems to be unfounded since examination of the copulatory apparatus of the specimens from Ituri (Zaire), a typical area for this species, reveals no differences that allow me to attribute them to populations other than those which populate Nigeria, the other regions of Zaire, Zimbabwe and southern Africa. Therefore, I believe that *P. stublmanni* should be considered as a synonym of *P. spurca* (n. syn.).

Finally, GIGLIO-TOS (1917) described *P. crassa* on a female from Nyassaland. He based his description mainly on the development of tubercles on the head, the length of the tegminae and the presence of a small dorsal lobe at the tip of the posterior tibiae, in addition to the median lobe. I compared a female from Lake Nyassa (typical area for *P. crassa*) with other females ascribable to *P. spurca*, but was not able to detect any distinguishing characters in the shape of the two types. Moreover, I observed the presence of a preapical lobe on the dorsal margin of the posterior tibia, as observed in *P. crassa*, in female specimens ascribed to 13 *P. spurca* from Zaire, Zimbabwe and Lake Victoria.

Thus, I believe that the above-mentioned findings show that this species cannot be separated from *P. spurca* and that it should be considered as its synonym (n. syn.).

Examination of the male copulatory apparatus of all the *Popa* in my possession revealed the existence of the two very, different structural models, distinctly separated from each other. Therefore, I believe that they must belong to two different races; one (*P. spurca spurca* Stål 1856) living all over western, central and southern Africa, and the other [*P. spurca crassa* (Giglio-Tos 1917)] present in eastern Africa from Ethiopia to Malawi-Tanzania.

The dividing line between the two areas is the Rift Valley.

Popa spurca spurca Stål 1856

Popa spurca STÅL 1856: 169 (Port Natal).

Theocytes undata SERVILLE 1839: 152 (Cape of Good Hope).

Mantis undata; CHARPENTIER 1843: 38 (Cape of Good Hope).

Popa undata; BATES 1863 (non Fabricius): 480 (Madagascar); SAUSSURE 1871: 309 (Cape of Good Hope).

Popa spurca; SAUSSURE 1871: 309.

Popa undata; SAUSSURE 1872: 79.

Popa spurca; SAUSSURE 1872: 79; BOLÍVAR 1889: 85.

Popa undata; WESTWOOD 1889: 26; WOOD-MASON 1889: 307; SAUSSURE & ZEHNTNER 1895: 233 (Madagascar).

Popa batesi SAUSSURE & ZEHNTNER 1895: 230 (Madagascar: Imerina) (n. syn.).

Popa undata; KIRBY 1899: 353 (Transvaal).

Popa undulata (sic!) BURR 1900: 37.

Popa undata; BRUNN 1901: 228 (Quilimane).

Popa spurca; KIRBY 1904: 308.

Popa servillei GIGLIO-TOS 1907: 3 (Madagascar).

Popa stublmanni REHN 1914: 26 (Zaire: Ituri) (n. syn.).

Popa spurca; GIGLIO-TOS 1914: 84 (Madagascar; South Africa).

Popa undata; GIGLIO-TOS 1914: 85 (Natal).

Popa stublmanni; GIGLIO-TOS 1914: 87.

Popa spurca; WERNER 1915: 86 (Katanga); REHN 1927: 51 (Natal; Transvaal); GIGLIO-TOS 1927: 631 (partim).

Popa batesi; GIGLIO-TOS 1927: 631.

Popa stublmanni; GIGLIO-TOS 1927: 632.

- Popa undata*; GIGLIO-TOS 1927: 632 (partim).
Popa undata; WERNER 1928: 24 (Kamerun: Uam-Gebiet, Bosum).
Popa undata; SJÖSTEDT 1930: 35 (Zaire: Ituri).
Popa batesi; SJÖSTEDT 1930: 35.
Popa undata; BEIER 1955: 264 (Cape prov.: Albany District).
Popa spurca; BEIER 1955: 264 (Cape prov.: Upington, Victoria East); PAULIAN 1957: 92 (Madagascar).
Popa batesi; PAULIAN 1957: 92 (Madagascar).
Popa undata; ROY 1964: 786 (Costa d'Avorio: Adiopodoumé), 1965: 605 (Guinea: Sérédou); RAGGE & ROY 1967: 639 (Ghana: Legon); ROY 1968: 339 (Zaire: Sibiti); BEIER 1968: 252 (Guinea: Guéckédou); ROY 1975: 151 (Lamto); ROY & LESTON 1975: 309 (Ghana: Accra, Legon).

Material examined. Zaire: Kilo (Kibali-Ituri), 18.X.1930, 1 ♂ (leg. G. du Soleil) (Mus. Tervuren); Kilo (Kibali-Ituri) I.1940, 2 ♂♂ (leg. R.F. Maristes) (Mus. Tervuren); Biukwa (Kibali-Ituri), 2.II.1929, 1 ♀ (leg. A. Collart) (Mus. Tervuren); Nioka (Kibali-Ituri), IV.1934, 3 ♀♀ (leg. J. Lersey) (Mus. Tervuren); Nioka (Kibali-Ituri) XI.1934, 1 ♀ (leg. H.J. Brédo) (Mus. Tervuren); Mayidi (Bas Congo), 1942, 1 ♀ (leg. Rév. P. Van Eyen) (Mus. Tervuren); Elisabethville (Haut-Katanga), 1932, 1 ♂ (leg. De Loose) (Mus. Tervuren); Rivankuwi (Sud Lac Kivu), IV.1948, 1 ♂ (leg. J.V. Leroy) (Mus. Tervuren); Lubero (Nord Lac Kivu), 1928, 1 ♀ (leg. M.me Van Riel) (Mus. Tervuren); Rutshuru, 8.II.1938, 1 ♀ (leg. J. Ghesquière) (Mus. Tervuren); Kinda (Kasai), 6.X.1914, 2 ♂♂ (leg. L. Charliers) (Mus. Tervuren).

Burundi: Bugari, 1948, 1 ♂ (leg. Dames de Marie) (Mus. Tervuren).

Congo: Karemi, V.1912, 1 ♀, (leg. Dr Bayer) (Mus. Tervuren); Nioha, IV.1934, 1 ♀ (leg. J. Leroy) (Mus. Tervuren); Niooda, IV.1934, 1 ♂ (leg. J. Leroy) (Mus. Tervuren).

Malawi: Ematumbi (Lisingine), XII.1931, 1 ♀ (leg. Colizza) (coll. La Greca).

Nigeria: Ibadan, 29.V.1959, 4 ♂♂; Ibadan (University, College) III.1958, 2 ♂♂ (leg. Ene) (coll. La Greca).

Zimbabwe: Harare, Waterfalls, 4-10.II.1989, 1 ♀ (leg. Naskrycki) (coll. La Greca); Gatooma (Sud Zimbabwe, 1943-1946, 1 ♂, 2 ♀♀ (leg. De Vendiclis) (coll. La Greca).

Natal: Unbetveni, 7.VII.1950, 1 ♂ (coll. La Greca).

The tibiae of some of the males examined are equipped with a lobe, others have a slighted lobated tibia, while yet others are devoid of a lobe. Almost all the females present posterior tibiae with a central and a subapical lobe, the latter being practically absent in one female from Ituri and markedly reduced in some others.

The average length/breadth ratio of the pronotum is 4.29, ranging from a minimum of 3.70 to a maximum of 5.12. Similarly, the ratio between the metazone/prozone length varies from a minimum of 2.77 to a maximum of 3.27.

The colouring of the anal area of the metathoracic wings varies little in males, being smoky, not too dark, with a dense network of narrow but not overly slender, transverse hyaline venules. The distal process of the ventral phallomere of the male copulatory apparatus is a short and falciform (Fig. 1). The phalloid apophysis of the left phallomere (Fig. 2) has a rounded tip and protrudes slightly over the wide, underlying, densely spined, membranous lobe.

This subspecies is widespread throughout Africa south of the Sahara, from Senegal to South Africa, except in eastern Africa. I attribute the Madagascar population (which I have not been able to observe) to this subspecies because of the presence of *P. spurca* in Natal and Zimbabwe.

Popa spurca crassa (Giglio-Tos 1917)

Popa crassa GIGLIO-TOS 1917: 73 (Nyassa) (n. syn.).

Popa undata; REHN 1901: 287 (Somalia: Sheikh Husein, Gallaland, Tug Lomo); KIRBY 1902: 94 (Mt Elgon); WERNER 1907: 245 (Gondokoro), 1908: 123 (Abessinien).

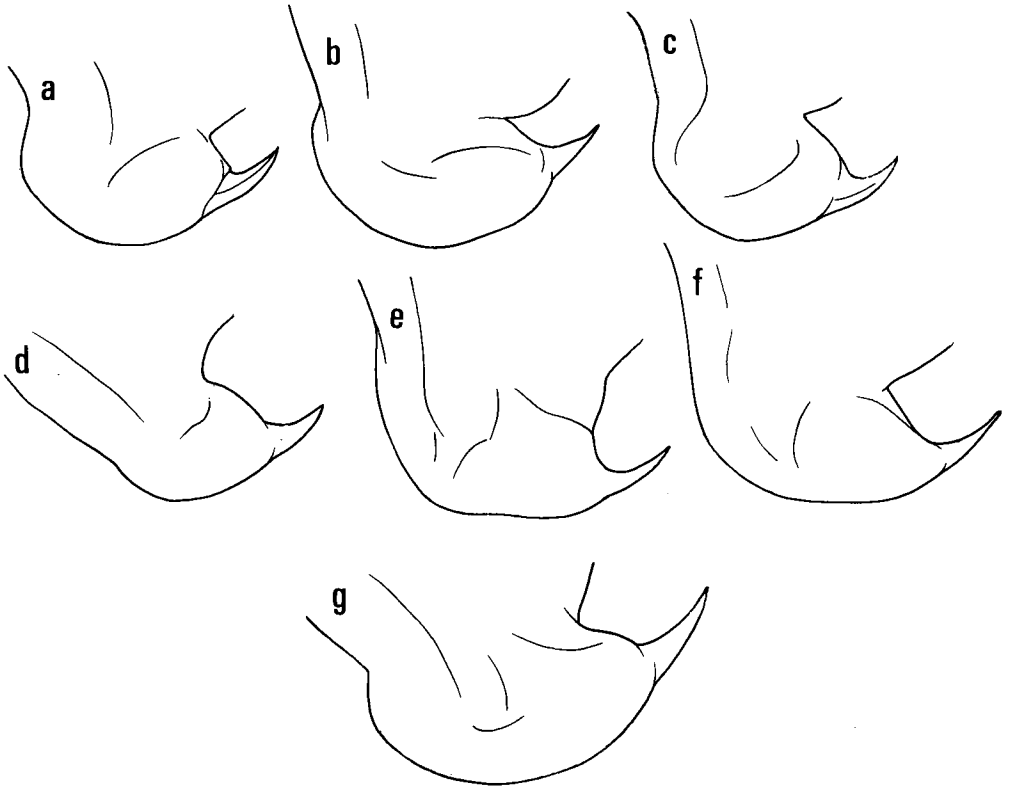


Fig. 1. — Distal process of the ventral phallomere of *P. spurca spurca* Stål: (a) Kilo, (b) Bugari, (c) Rivankuwi, (d) Ibadan, (e) Gataoma, (f) Elisabethville, (g) Umbetveni.

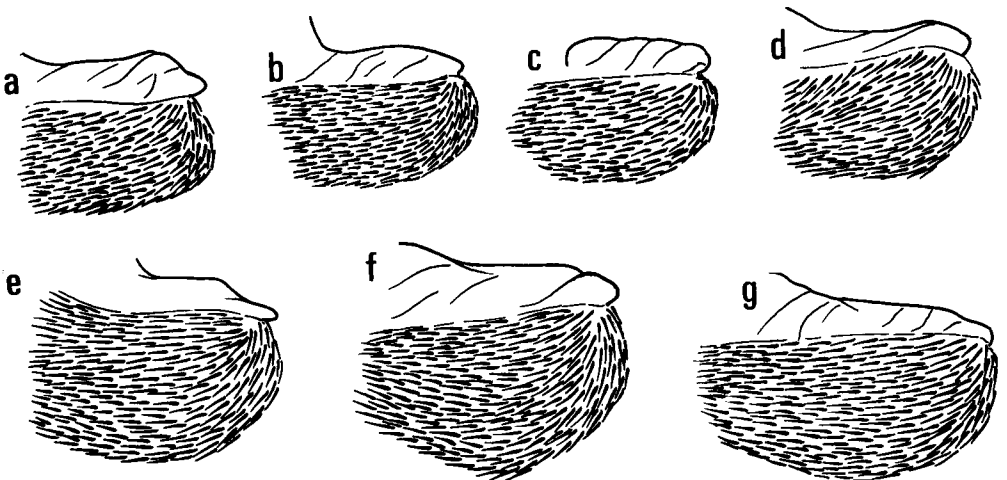


Fig. 2. — Phalloid apophysis of *P. spurca spurca* Stål: (a) Kilo, (b) Bugari, (c) Rivankuwi, (d) Ibadan, (e) Gataoma, (f) Elisabethville, (g) Umbetveni.

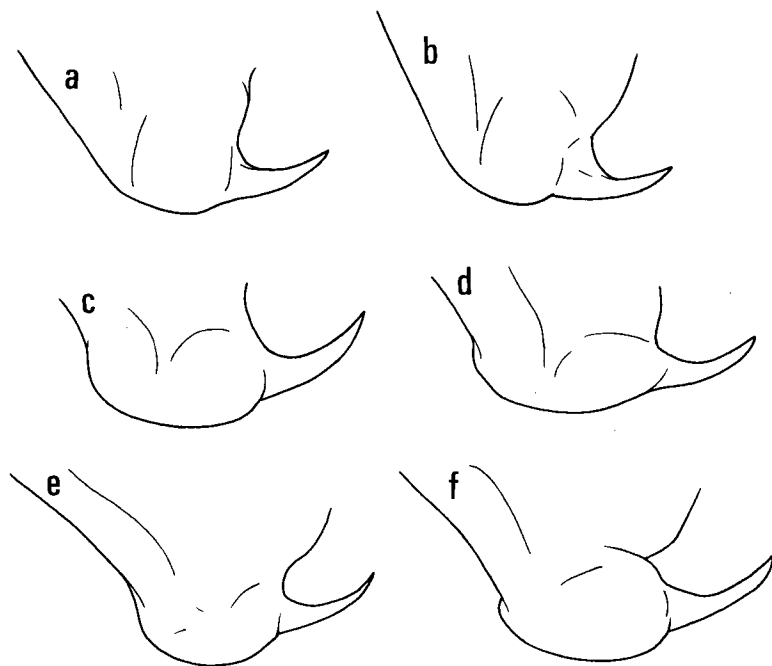


Fig. 3. — Distal process of ventral phallomere of *P. spurca crassa* (Giglio-Tos): (a-b) Dorfù, (c) Migiurtinia, (d) Hargeisa, (e) Giuba, (f) Sabaki.

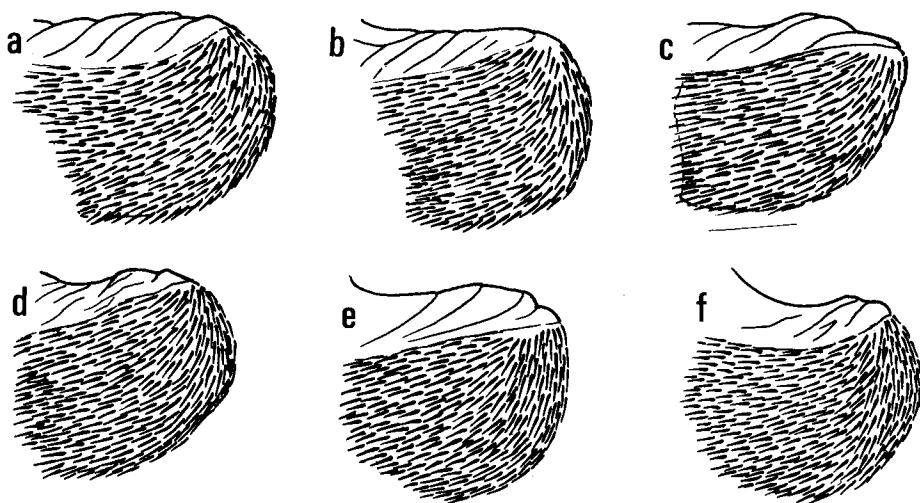


Fig. 4. — Phalloid apophysis of *P. spurca crassa* (Giglio-Tos): (a-b) Dorfù, (c) Migiurtinia, (d) Hargeisa, (e) Giuba, (f) Sabaki.

Popa spurca; WERNER 1908: 124 (Tadelga).

Popa spurca; SJÖSTEDT 1910: 71 (Kilimandjaro).

Popa undata; GIGLIO-TOS 1914: 85 (Ethiopia: Dire Daona; Somalia: Bardera; Kenya: Mombasa, Farmaca; Uganda: Kiatume); CHOPARD 1921: 28 (East-Africa: Guasso Nyro); GIGLIO-TOS 1927: 632 (partim).

Popa spurca; GIGLIO-TOS 1927: 631 (partim).

Popa crassa; GIGLIO-TOS 1927: 632.

Popa undata; BEIER 1930: 460 (Kenya: Eb Urru, Kabete), 1937: 379 (Uganda: Turkana).

Popa spurca; CHOPARD 1938: 114 (Kenya).

Popa undata; BEIER 1941: 123 (Kenya: Matengo); KEVAN 1950: 199 (Kenya: Emali), 1952: 226 (Kenya: Narok); LA GRECA 1952: 49 (Somalia: Hargeisa); KEVAN 1954: 469 (Kenya: Damassa, Moyale); BEIER 1954: 187 (Kenya: Mt Elgon); LA GRECA 1956: 318 (Somalia: Gardo, Burtinle); BEIER 1961: 4 (Ethiopia: Gamu-Gofa).

Popa crassa; MARSHALL 1975: 313.

Popa undata; LOMBARDO 1988a: 109 (Somalia: Afgoi, El Da), 1988b: 157 (Somalia: Hargeisa, Hauaccio, Mil Mil, Sheikh Husein).

Material examined. Etiopia: Neghelli, 1441 m, VI.1938, 1 ♂ (leg. Nicotra) (Mus. Trieste); Gemu Gofa (Arba Mintch), 1570 m, 15.XI.1973, 1 ♂ (leg. Brignoli, Consiglio, Cottarelli, Vigna) (Mus. Roma); Gabredarre, V.1936, 1 ♂ (leg. Lomi) (Mus. Trieste); Galla Sidamo (Iago Ciamo), 13.III.1938, 1 ♀ (Sped. Brunelli; leg. Vatova) (Mus. Trieste).

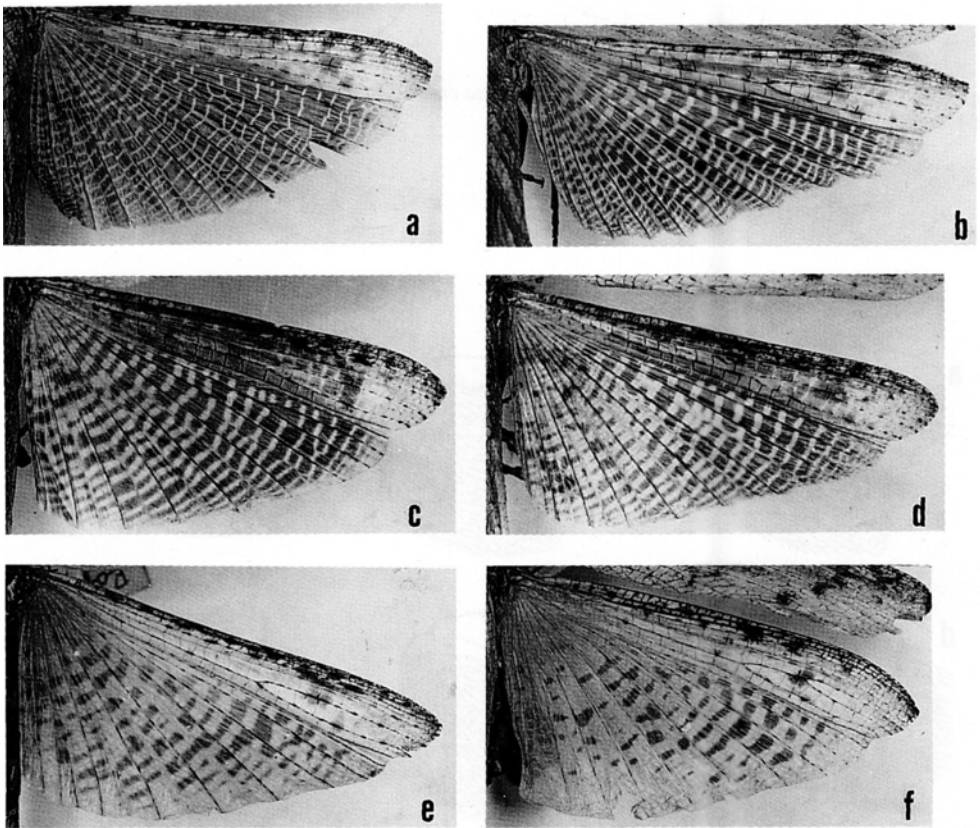


Fig. 5. — Variability of transverse venations of the anal area of the wings of *P. spurca crassa* (Giglio-Tos): (a-b) Giuba, (c) Ogaden, (d) Gabredarre, (e) Dorfù, (f) Sabaki.

Ogaden: Uarandab, V.1936, 4 ♂♂ (leg. Lomi) (Mus. Trieste).

Eritrea: Dorfù, 20.III.1938, 2 ♂♂ (leg. Vaccaro) (coll. La Greca).

Somalia: Afgoi, VI.1977, 8 ♂♂ (leg. Simonetta) (Mus. Firenze); El Da, 6-7.XII.1982, 1 ♂ (leg. S.B.S.) (Mus. Firenze); Hargeisa, 1949, 1 ♂ (coll. La Greca); Mandera, VIII.1942, 1 ♂ (coll. La Greca); Bur Tindle, 5-8.VI.1953, 1 ♂ (leg. Scortecchi) (Mus. Genova); Giuba, 1923, 2 ♂♂ (leg. Patrizi) (Mus. Genova); Afmedu, 2-10.VIII.1962, 1 ♂ (leg. S.B.S.) (Mus. Firenze); Bud Dinsor, 17.III.1923, 1 ♂ (leg. S.B.S.) (Mus. Firenze).

Kenya: Mombasa, VI.1989, 1 ♂ (leg. Ehrmann) (coll. Lombardo); Lower Tana (Sabaki), IV.1932, 1 ♂ (leg. Turner) (coll. La Greca); Kaimosi, IV.1932, 1 ♂, 1 ♀ (leg. Turner) (coll. La Greca).

Tanzania: Ukerewe (Terr. Tanganika), 1 ♂, 2 ♂♂ (leg. Father Conrad) (coll. La Greca).

In this subspecies the lobes on the median and posterior legs present the same variability observed in the examples of the nominal subspecies. Moreover, the sizes and relative ratios are similar to those in the typical subspecies. As previously mentioned, the only differences concern the shape of the copulatory apparatus, i.e. this case possesses a longer and more slender distal process of the ventral phallomere (Fig. 3) and the tip of the falloidal apophysis (Fig. 4) does not extend over the spined membranous lobe (all this is more stocky than in the nominal subspecies).

Among the material I examined, I observed that the hyaline transverse vein margins of the anal areas of the wings tend to spread and merge together, determining a marked reduction in the smoky appearance. This is so reduced that specimens from Migiurtinia, Ogaden and West of the Giuba present sparse, transversal spots and the whole anal area becomes hyaline (Fig. 5). However, this fact does not seem to have racial value, since two specimens from West of the Giuba present a similar situation to the typical one (i.e., slightly margined transversal veins).

The species is typical of eastern Africa from Ethiopia to Tanzania.

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