

RICE GRASSHOPPERS OF THE GENUS *HIEROGLYPHUS* AND THEIR NEAREST ALLIES.

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Species of the genus *Hieroglyphus* are well known in India as serious pests of rice, sugar-cane, *Sorghum*, and some other crops, but in nearly all economic entomological publications one species only, *H. banian*, F. (= *furcifer*, Serv.) is regarded as being noxious. It is obvious, however, from some of the earlier descriptions and figures that there is more than one injurious species, but the exact status of each one of them could not be established even in more recent economic publications owing to the very unsatisfactory state of the systematics of this group, which made correct identification of species uncertain even for a specialist and quite impossible for an economic entomologist. It is true that comparatively recently I. Bolivar (1912) and J. Carl (1916) published more or less comprehensive papers on the genus, but these papers are not revisions, as the authors did not include all the known species and hardly touched questions of synonymy; moreover, Carl's paper, though published four years after that of Bolivar, was written without any reference to the latter, which resulted in the same species being described twice under different names, thus increasing the confusion. Further, both these authors based their papers on insufficiently extensive material, so that they were unable to appreciate the range of variation in the species.

The purpose of this paper is, therefore, to give a critical study of all the known species of the genus *Hieroglyphus* and of two more genera closely allied to it and liable to be confused with it. To make the paper of more practical use for field entomologists, all the most important characters used to separate the species are figured, so that identification of specimens by the keys should not be difficult.

The bulk of the material on which the paper is based has been received from the collection of the Agricultural Research Institute, Pusa, owing to the courtesy of Mr. T. Bainbrigge Fletcher, to whom my thanks are due. I am much obliged also to Mr. Y. Ramachandra Rao, who sent me material from the Coimbatore Agricultural College; to Prof. Dr. Richard Ebner, and to the authorities of the Wiener Staats-museum for lending me material from that Museum, including co-types of one of Brunner v. Wattenwyl's species; to Dr. Candido Bolivar for sending me for study the type of one of I. Bolivar's species; and to Dr. W. Lundbeck, of the Zoological Museum in Copenhagen, who sent me a co-type of *H. banian*, Fabr.

The three genera belonging to the group under revision may be separated from all other Acridians by the following combination of characters:—

Prosternum armed with a straight conical spine. Mesosternal lobes with the hind inner angles rounded. Pronotum cylindrical, without lateral carinae, without or with but a feeble and incomplete middle carina, with 3–4 transverse sulci, which are mostly very deep (in *Parahieroglyphus* feeble, but distinct). Hind femora with the upper middle keel not prolonged into a tooth at the apex. Hind tibiae with the upper margins (*i.e.*, between the spines) rounded, not expanded; with a rigid outer apical spine close to the two movable outer apical spurs. Lower valves of the ovipositor with 1–2 large teeth, but not serrate. General coloration green, yellowish, or brownish, with or without black marks on pronotum, sternum and hind knees, tibiae and tarsi.

Key to the Genera.

- 1 (2). Upper surface of the pronotum only feebly convex (fig. 1 D); transverse sulci feeble, but distinct, cutting all the keels. Cerci of the male very large, divided into three vertical lobes; male subgenital plate small, obtusely conical, not longer than its basal width. Subgenital plate of the female with its apex divided into three lobes *Parahieroglyphus*, Carl.
- 2 (1). Upper surface of the pronotum strongly convex; transverse sulci deep (figs. 1 A, 1 C).
- 3 (4). Median keel of the pronotum low, but quite distinct throughout, interrupted by the transverse sulci, but nowhere obliterated (fig. 1 C). Cerci of the male with their basal part thick and cylindrical, strongly recurved, projecting vertically above the supra-anal plate (fig. 2, C, D). Male supra-anal plate broader than long (fig. 2, C). Female subgenital plate with the apex trilobate (fig. 2 B) .. *Hieroglyphodes*, gen. nov.
- 4 (3). Median keel of the pronotum altogether or partly obliterated, or else very feeble (fig. 1 A). Male cerci more or less cylindrical throughout, directed backwards or obliquely upwards, but never recurved, with the apex simple, truncate, bifurcate or appendiculate. Male supra-anal plate longer than it is broad (fig. 1 E, F). Female subgenital plate with the apex not divided into three lobes (fig. 2 A) .. *Hieroglyphus*, Krauss.

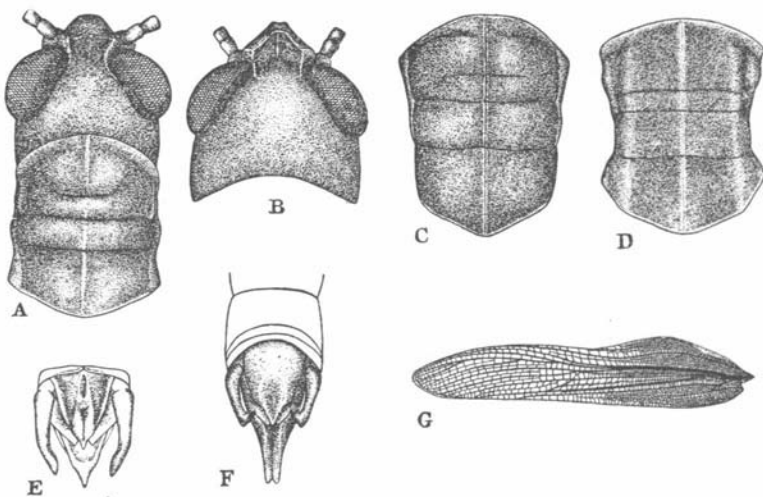


FIG. 1. A, *Hieroglyphus banian*, F.; B, *H. africanus*, sp. n.; C, *Hieroglyphodes assamensis*, g. & sp. n.; D, *Parahieroglyphus bilineatus*, Bol.; E, *H. annulicornis*, Shir., male genitalia; F, *H. daganensis*, Kr., male genitalia from above; G, *H. annulicornis*, Shir., elytron.—All figures $\times 4$.

Genus ***Parahieroglyphus***, Carl.

1912. *Hieroceryx*, I. Bolivar, Trab. Mus. Madrid, no. 6, pp. 50, 59 (*nomen praecuratum*.)

1916. *Parahieroglyphus*, Carl, Rev. Suisse Zool., xxiv, no. 6, p. 482.

Genotype: *Hieroceryx bilineatus*, Bol.

Though Bolivar's name for the genus is four years older than that of Carl, it must give way to the latter, as the name *Hieroceryx* has been used already in 1896 by Tosquinet for a genus of Hymenoptera (Mem. Soc. Entom. Belg., V, p. 267).

The genus is somewhat aberrant from the two others owing to its pronotum being distinctly compressed laterally and flattened above, which makes its transverse section not circular, as in the two other genera, but almost quadrangular, though there are no lateral keels and the upper surface of the pronotum forms widely rounded angles with the lateral lobes.

Only two species are known in this genus, but one of them, having been described from a single female, is not easily recognisable, as the best specific characters are to be found in the male cerci; as I know this species only from a hitherto undescribed male, I cannot be quite sure of its specific determination, but I refrain from describing this male as new, until its identity has been definitely cleared up by a study of both sexes. There is no doubt that additional undescribed species will be discovered, but I should like to warn all future students against describing species from specimens of one sex only, and especially from females.

Key to the Species.

- 1 (2). Front in profile straight. Vertical diameter of an eye twice as long as the horizontal one. Male cerci with the first (anterior) lobe as high as the middle one. Lateral lobes of the female subgenital plate about half as broad as the middle one and reaching beyond its middle.—N. and N.E. India 1. *P. bilineatus*, I. Bol.
- 2 (1). Front in profile convex. Vertical diameter of an eye less than twice as long as the horizontal one. (? Male cerci with the anterior lobe much shorter than the middle one).—S. India .. 2. *P. colemani*, I. Bol.

1. *Parahieroglyphus bilineatus*, I. Bol. (fig. 1, D).

1912. *Hieroceryx bilineatus*, I. Bolivar, Trab. Mus. Madrid, no. 6, pp. 60, 61.

1914. *Hieroglyphus bilineatus*, Kirby, Fauna Brit. India, Acrid, p. 202.

1916. *Parahieroglyphus bilineatus*, Carl, Revue Suisse Zool., xxiv, no. 6, p. 483, pl. ii, figs. 2-5.

The species was given by Saussure the manuscript name *Hieroglyphus bilineatus*, and sent under it to different museums, with the result that it has been three times redescribed since by as many authors, but always under the same name. The British Museum has also a male and a female of it from Saussure, labelled in his own writing.

Kirby's note, on H. Maxwell-Lefroy's authority (l.c. p. 203), that this species is only a micropterous form of *Hieroglyphus banian*, is, of course, a serious mistake; his description of the male cerci as "obtuse" is also very far from being correct.

As I have before me only four specimens of this insect, I am not in a position to estimate the extent of its variability. There is no doubt, however, that some of its characters must be subject to individual variation; this is to be expected with regard to general dimensions and coloration, while the venation of elytra, which Bolivar uses as a specific character differentiating *P. bilineatus* from *P. colemani*, is also not constant, not being the same even on the right and left elytra of one specimen.

Specimens studied.—Indes orient., 1 ♂, 1 ♀ (from Saussure); India, 1 ♂; Dehra Dun, Ollenbach, x.06, 1 ♀ (Pusa Coll.).

Geographical distribution.—J. Carl, who described this species from the original series of Saussure, gives the locality as "Indes orientales, Himalaya," and it seems that the species belongs to Northern India, though the lack of records from the Indian peninsula proper may be due simply to insufficient exploration.

2. *Parahieroglyphus colemani*, I. Bol.

1912. *Hieroceryx colemani*, I. Bolivar, Trab. Mus. Madrid, no. 6, p. 61.

1914. *Hieroceryx colemani*, Coleman, Journ. Bombay N.H. Soc., xxiii, p. 175, plate, fig. 3.

As I have already mentioned, the species has been described from a single female, and I have before me a single male, which makes its specific identification rather uncertain. There is, however, no doubt whatever that my male is specifically distinct from *P. bilineatus*, since the difference in the cerci is very conspicuous; other differences from *P. bilineatus* indicated in the key agree with the characters used by Bolivar to separate the latter from *P. colemani* and with the figure given by Coleman, so that I refer my specimens to that species, although with some doubt.

Specimen studied.—Surat, Bombay, x. 1903, 1 ♂ (received from Pusa).

Geographical distribution.—Bolivar described the species from Anavatti, in the Shimoga district of Mysore; my male is from Surat, so that the species may be restricted to the Indian peninsula.

Economic importance.—According to Coleman (*l.c.* p. 174) this insect has been found in small numbers associated with *Hieroglyphus banian* in rice-fields at Anavatti.

3. *Parahieroglyphus* sp.

There are in the Pusa material two females from Pardi, Bombay, 23.ix.1904, which are clearly not *P. bilineatus*, but which I hesitate to identify with *P. colemani* either. They are distinctly larger in size than is the female of the latter species, according to Bolivar's description, while in the shape of the head and the eyes, they agree with it, so far as can be judged by description. From *P. bilineatus* they differ in the shape of the subgenital plate, which has the lateral lobes very narrow and not longer than half of the middle lobe. I abstain from describing the species as new until the male is known.

Genus *Hieroglyphodes*, nov.

More like *Hieroglyphus* than *Parahieroglyphus*, but more closely related to the latter. Head large and thick, strongly reclinate. Frontal ridge sulcate throughout, with the margins feebly divergent downwards. Fastigium of the vertex distinctly sloping, forming an acute rounded angle with the frontal ridge; with a bow-shaped transverse sulcus, and a feeble longitudinal carina between the eyes. Pronotum cylindrical, slightly narrowed posteriorly; the transverse sulci well developed, three of them cutting the median keel, which is low but well developed throughout; the metazona distinctly longer than half the prozona; hind margin obtusely angulate. Posternal spine acutely conical. Mesosternal lobes subtransverse; their interspace X-shaped, constricted before the middle and strongly widened posteriorly, but the lobes not touching each other even in the male. Metasternal lobes touching each other in the male and narrowly separated in the female. Elytra abbreviated, of the same shape as in *Parahieroglyphus*. Abdomen in the male with the apex recurved; supra-anal plate rotundato-trapezoidal, with several complicatedly curved obtuse ridges; cerci inflated basally, strongly recurved, with the incrassate apex lying on the anal plate; subgenital plate short, strongly recurved. Subgenital plate of the female trilobate apically.

Genotype: *Hieroglyphodes assamensis*, sp. n.

1. *Hieroglyphodes assamensis*, sp. n. (figs. 1 C, 2 B, C, D).

♂. Head thicker than pronotum and distinctly longer than prozona of the latter. Frontal ridge in profile slightly convex. The foremost part of the fastigium (*i.e.*, that in front of the transverse impression) about half as broad again as long. Eyes

large, prominent; their longest diameter about twice as long as the shortest one; the latter is almost twice as long as the subocular distance; the distance between the eyes somewhat broader than the frontal ridge at the clypeus. Pronotum coarsely punctured throughout, more densely in the metazona; lateral lobes trapezoidal, with the fore margin very oblique, straight, fore angle very obtuse, lower margin obtusely angulate behind its middle, hind angle about 90° , hind margin vertical in its lowest portion and oblique in the rest. Elytra extending a little beyond the second tergite, lancet-shaped, with the apex curved downwards; radial veins straight; reticulation fairly dense, sub-obliterate. Wings rudimentary.

General coloration dirty olive-brown (probably more or less greenish in life). Antennae blackish below, and brown with the apex blackened above. Cheeks with a black streak starting from the hind lower margin of the eye and running obliquely towards the hind angle of the cheek, but disappearing half-way. Pronotum with the first sulcus black on the lateral lobes only; the second sulcus is black on the sides of the disc, with the middle portion not coloured; the third sulcus is black throughout, except in the middle of the disc, and its lower end is connected by a black line with the lower end of the first sulcus; the last sulcus is black throughout, except the lower ends of lateral portions. Mesopleurae with black oblique streaks. Abdominal tergites with their hind margins narrowly darkened. Front and middle legs with outer spots at the apices of the femora, and also bases and apices of tibiae, black. (Hind legs in the type broken.) Elytra with short black streaks at the base of radial veins.

♀ (paratype). Twice as large as the male. Fastigium of the vertex more than twice as broad as long. Distance between the eyes almost half as broad again as the frontal ridge at clypeus. Hind femur with a round spot at the base of the knee, both inwardly and outwardly, and a narrow margin on the knee above, black. Hind tibia with the base, apex and a line along the lower side, black. Hind tarsus without black parts.

	♂ (type).	♀ (paratype).
Length of body	27 mm.	41 mm.
„ „ head	4.5	5.5
„ „ pronotum	6	8
„ „ elytra	8	10.5
„ „ hind femora	—	19

Described from one male and one female from Cachar, Assam (British Museum).

Genus **Hieroglyphus**, Krauss.

1877. *Hieroglyphus*, Krauss, Abhandl. Akad. Wiss. Wien, Mat.-Nat. Classe, lxxvi(1), p. 41.
 1878. *Hieroglyphus*, Stål, Bih. Svensk. Akad. Handl., v (4), pp. 48, 93.
 1912. *Hieroglyphus*, I. Bolivar, Trab. Mus. Madrid, no. 6, p. 50.
 1914. *Hieroglyphus*, Kirby, Fauna Brit. Ind., Acrid., pp. 192, 201.
 1918. *Hieroglyphus*, I. Bolivar, Trab. Mus. Madrid, no. 34, p. 11.

Genotype: *Hieroglyphus daganensis*, Krauss.

The genus was established by Krauss to include a species from Senegal, *H. daganensis*, as well as the well known *H. banian*, F. (= *furcifer*, Serv.). One year later (1878) Stål described a third species from China, *H. tarsalis*, which is, however, conspecific with one previously described, *Oxya concolor*, Walker, as also is Brunner von Wattenwyl's *H. citrinolimibatus*, described in 1893. T. Shiraki in 1910 published a description of a species from Formosa, under the name of *Oxya annulicornis*, and this has been since twice redescribed by Bolivar (*H. formosanus*, 1912) and Carl (*H. tonkinensis*, 1916). Two more species have been added by Bolivar in his

revision of the genus, *H. tonkinensis* (*nec* Carl !) and *H. nigrorepletus*, the latter having been also twice redescribed by Kirby (1914) under *H. bettoni* and by Carl (1916) under *H. vastator*. One more Indian species, *H. oryzivorus*, has been published by Carl, and one new one from Abyssinia is described in this paper, which brings the total number of species of the genus *Hieroglyphus* up to eight, all of which are known to me, mostly by typical specimens. As, however, the majority of known species is represented in collections by very poor series of specimens, I believe that the number of species which remain still undiscovered may be not inconsiderable, and extensive collecting ought to give good results.

The geographical distribution of the genus is very peculiar and worth a few remarks. The majority of the known species occur in the plains of India, but the entire area occupied by the genus extends farther eastwards, through Burma and Assam, to Southern China and Formosa, while, on the other hand, there are already two species known from subtropical Africa. The presence of these species in Africa is the more puzzling in that although they are both very closely related to two Oriental species (indeed, so closely that they may be regarded as but geographical races of these species), there is no evidence of the Oriental and African areas inhabited by the genus being in direct connection. This latter seems to me even hardly possible at all, since, so far as the biology of representatives of this genus is known, they inhabit damp localities, with rich vegetation of grasses, reeds, etc. (not trees or shrubs), such as marshy grassland, rice and cane fields; conditions of this kind are very common both in India and in the subtropical belt of Africa extending from Senegal and Northern Nigeria right across the continent to the Eastern Sudan, but not in the south-western part of Asia, separating those two areas, which bears more or less desert conditions throughout.

The best characters for separating species of *Hieroglyphus* are to be found in the shape of the male external genitalia, and particularly that of cerci; accordingly it is sometimes not easy to identify a species from the female sex only, although in some cases the female genitalia also present good specific characters. The relative length of the elytra is not a specific character at all, since at least three species occur regularly in two different forms, macropterous and brachypterous, respectively; it is very interesting to note that there are no transitional forms between the two extremes known, and an experimental study of the causes of brachypterism should be worth the trouble.

The structure of the sternum is of considerable systematic importance, but it is not altogether constant in every species. Especially noteworthy is the variability of the sternum in the most common species, *H. banian*, in which the variations in the sternum are accompanied by variations in the coloration, general habitus, size, and the shape of the head, so that two forms of the species may be distinguished; but the real significance of these forms, as well as the causes of their appearance, are by no means clear (see below, under *H. banian*). In the other species the material available is insufficient to permit conclusions to be drawn regarding the limits of variation.

Key to the Species.

- 1 (6). Cerci of the male simple (fig. 1 E). Subgenital plate of the female with two longitudinal denticulate or granulate carinae (fig. 2 A). Pronotum distinctly rugosely punctured.
- 2 (5). Male cerci scarcely longer than the anal plate and not reaching the apex of the subgenital plate, which is as long as its basal width, obtusely conical. Elytra without a false vein in the discoidal area. Pronotum more coarsely punctured. Lateral margins of the fastigium of vertex broad, punctured, with more or less distinct foveolae (fig. 1 B).

- 3 (4). Frontal ridge with the sulcus disappearing about half-way between the base of antennae and the top, so that the apex of the ridge is flat, punctured. The transverse sulci of the pronotum, particularly the hind one, broader. Hind tarsi above with not more than the basal half black or brown. Subgenital plate of the female with the carinae not very distinct, granulate.—Sudan, Kamerun 1. *africanus*, sp. n.
- 4 (3). Frontal ridge sulcate throughout, up to the very top. The transverse sulci of the pronotum narrower. Hind tarsi black above except not more than the apical third. Subgenital plate of the female with distinct denticulate carinae (fig. 2 A).—Burma, Sylhet, Surat 2. *concolor* (Walk.).
- 5 (2). Male cerci distinctly longer than the supra-anal plate and reaching the apex of the subgenital plate (fig. 1 E), which is longer than its basal width, with the apex attenuate. Elytra with distinct false veins in both discoidal and interulnar areas. Pronotum less coarsely punctured. Lateral margins of the fastigium of vertex narrow, scarcely punctured, not impressed. First joint of the hind tarsi with only its base black. Female subgenital plate with the carinae granulate.—S. China, Formosa, India 3. *annulicornis* (Shir.).
- 6 (1). Male cerci apically obliquely truncate (fig. 2 E), appendiculate (fig. 1 F) or bifurcate (fig. 2 F). Female subgenital plate without any longitudinal carinae. Pronotum smooth or not coarsely punctured.

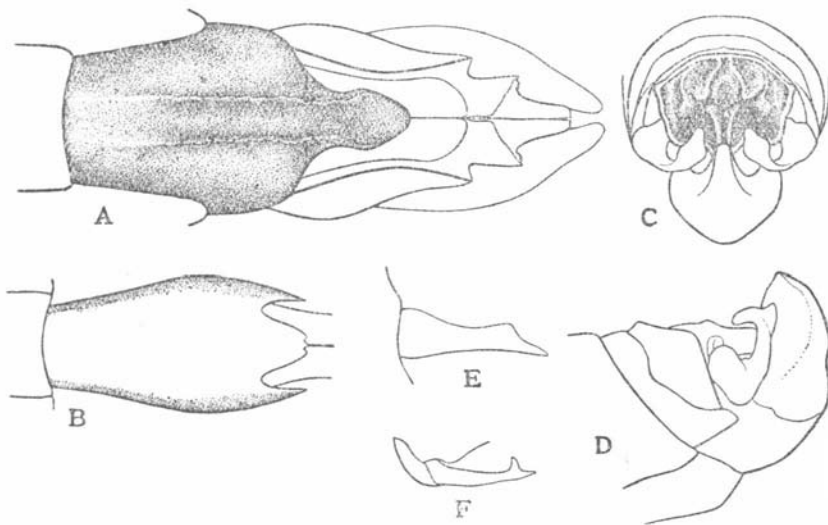


Fig. 2. A, *Hieroglyphus concolor*, Walk, female genitalia from below; B, *Hieroglyphodes assamensis*, g. & sp. n., female subgenital plate from below; C, D, *H. assamensis*, male genitalia; E, *Hieroglyphus nigrorepletus*, Bol., male cercus; F, *H. banian*, F., male cercus.—All figures $\times 3.5$.

- 7 (8). Male cerci obliquely truncate (fig. 2 E). Pronotum in profile slightly convex or straight; its disc distinctly broadened posteriorly and unicolorous; lateral lobes convex between sulci, which are broadly filled with black; a black line runs along the upper margin of each lobe and the lower ends of the first and third sulcus are also connected by a black line.—India 4. *nigrorepletus*, Bol.

- 8 (7). Male cerci appendiculate or bifurcate. Pronotum in profile not convex ; its disc scarcely widened posteriorly ; no black line along the upper margin of its lateral lobes.
- 9 (12). Male cerci bifurcate (fig. 2 F). Pronotum not at all or scarcely selliform, with the hind sulcus perfectly straight. Head not or only slightly thicker than pronotum and, seen in profile, not strongly prominent above it. Mesosternal interspace not strongly constricted in the middle (fig. 3 C, D).
- 10 (11). Male cerci with both branches alike, rounded (fig. 2 F). Fastigium of the vertex not longer than broad in the male, transverse in female.—
India 5. *banian* (F.).
- 11 (10). Male cerci with the inner branch broad, depressed, truncate. Fastigium of the vertex in the male longer than broad (female unknown).—
Tonkin 6. *tonkinensis*, Bol.
- 12 (9). Male cerci appendiculate (fig. 1 F). Pronotum distinctly selliform. Head distinctly thicker than pronotum and considerably prominent above it ; the hind sulcus distinctly arched. Mesosternal interspace strongly constricted in the middle (fig. 3 A).
- 13 (14). Male subgenital plate distinctly sulcate above, with the apex emarginate (fig. 1 E).—Senegal, N. Nigeria 7. *daganensis*, Krauss.
- 14 (13). Male subgenital plate not sulcate, with the apex truncate.—India 8. *oryzivorus*, Carl.

1. *Hieroglyphus africanus*, sp. n. (fig. 1 B).

♂. Of medium size for the genus. Front strongly reclinate ; its ridge with the sulcus slightly widened in the middle and gradually narrowed towards both the clypeus and the fastigium, which it does not reach, disappearing half-way between the base of antennae and the margin of the fastigium of vertex, so that the uppermost portion of the frontal ridge is not sulcate, slightly convex, punctured. Fastigium of the vertex scarcely sloping, with the bow-shaped transverse sulcus well developed ; the portion in front of the sulcus about half as broad again as long, rotundato-pentagonal, with the surface flat and an indistinct longitudinal carinula in front ; lateral margins of the fastigium thick, with distinct, obliquely placed, narrow, coarsely punctured temporal foveolae. Pronotum strongly cylindrical, very coarsely punctured ; transverse sulci deep and broad, straight on the disc ; median keel scarcely perceptible. Mesosternal lobes as long as broad, with the interspace gradually narrowed in the middle. Metasternal lobes contiguous. Elytra without false veins in the discoidal and interulnar areas. Supra-anal plate longer than its basal width, with a median sulcus in its basal half. Cerci not longer than the supra-anal plate, thick, gradually narrowed and slightly decurved posteriorly, with the apex indistinctly obliquely truncate internally. Subgenital plate obtusely conical, short, not longer than its basal width.

Greenish yellow, with the hind tibiae pale green and the following parts black : antennae, except two basal joints ; sulci of the pronotum ; a transverse fascia on the inner side of the hind femora just before the knee, and a small spot corresponding with it on the outer side ; a post-basal ring, the inner side of the apex and points of spines of the hind tibiae ; the basal half of the first joint of the hind tarsi, the very base of the second and margins of the pulvillus.

♀ (paratype). Differs from the male in the frontal part of the fastigium of vertex being rounded in front and more than twice as broad as long, and in the lesser development of the black markings, only the last pronotal sulcus being blackened, while the

hind tarsi are marked with brown instead of black ; the head above, metazona of the pronotum and hind femora above, reddish ; hind tibiae faintly bluish. Subgenital plate with the carinae not very distinct, granulate.

				♂ (type).	♀ (paratype).
Length of body	..	..	..	40 mm.	54 mm.
„ „ pronotum	..	..	..	9? (hind angle broken off)	13·5
„ „ elytra	..	..	..	26	32·5
„ „ hind femur	..	..	..	22	27·5

The type is from Atbara, Sudan (British Museum) ; the paratype from Adamane, Kamerun (Brunner von Wattenwyl's collection in the Wiener Staats-museum).

This new species, unfortunately represented by two specimens only, is very closely related to the Oriental *H. concolor*, from which it is separated by only a few characters of uncertain value. It is not impossible that further study of long series of both species may result in the necessity of uniting them, but I believe that, even in that case, they may be regarded as distinct geographical races (subspecies). The differences between the male and the female of the new species are scarcely more than individual, and I do not hesitate in regarding them as conspecific, which makes the range of distribution of the species to extend right across the subequatorial belt of Africa.

2. *Hieroglyphus concolor* (Walk.) (fig. 2 A).

1870. *Oxya concolor*, Walker, Cat. Derm. Salt. Brit. Mus., iv, p. 646.

1878. *Hieroglyphus tarsalis*, Stål, Bih. Sven. Akad. Handl., v (4), pp. 48, 93.

1893. *Hieroglyphus citrinolimbatus*, Brunner v. Wattenwyl, Ann. Mus. Genova, xxxiii, p. 154.

1910. *Hieroglyphus concolor*, Kirby, Syn. Cat. Orth., iii, p. 397.

1910. *Hieroglyphus citrinolimbatus*, Kirby, l.c., p. 397.

1912. *Hieroglyphus concolor* = *tarsalis*, Bolivar, Trab. Mus. Madrid, no. 6, p. 54.

1912. *Hieroglyphus citrinolimbatus*, Bolivar, l.c., p. 54.

1914. *Hieroglyphus citrinolimbatus*, Kirby, Fauna Brit. Ind., Acrid., pp. 202, 205.

1914. *Hieroglyphus concolor*, Kirby, l.c., p. 202, 205.

1916. *Hieroglyphus tarsalis*, Carl, Revue Suisse Zool., xxiv, no. 6, pp. 478, 479.

1916. *Hieroglyphus citrinolimbatus* Carl, l.c., pp. 478, 479.

1918. *Hieroglyphus concolor*, Bolivar, Trab. Mus. Madrid, no. 34, p. 22.

1918. *Hieroglyphus tarsalis*, Bolivar, l.c., p. 29.

1918. *Hieroglyphus citrinolimbatus*, Bol., l.c., p. 30.

As I have had the opportunity of comparing cotypes of *H. citrinolimbatus*, Br. Watt., with the types of *Oxya concolor*, Walk., and also of comparing the latter with the good description of *H. tarsalis*, Stål, I do not hesitate in regarding all the three species as identical. The only reason for separating *citrinolimbatus* is that it has the pronotum very narrowly margined with yellow, which character is, however, obviously of no specific value, since it varies even in the small series of specimens before me.

The general coloration of this species varies from greenish-yellow to brownish-yellow ; the transverse sulci of the pronotum are very narrowly, or not at all, blackened ; the coloration of the hind tarsi (see the key to species) is very characteristic. The size is very variable, as the following dimensions show :—

		♂♂		♀♀
Length of body	..	30–45 mm.	..	46–60 mm.
„ pronotum	..	7–10 „	..	13–16 „
„ elytra	..	22–32 „	..	33–45 „
„ hind femur	..	16–22 „	..	25–? „

Specimens examined.—N. India, 1 ♂, 1 ♀ (Walker's types; Brit. Museum); Himalaya, 1 ♂, 1 ♀ (cotypes of *H. citrinolimbatus*, Br. Watt.; Wiener Mus.); Sikkim 1, ♂ (named by Brunner v. Wattenwyl as *H. citrinolimbatus*; Wiener Mus.); Kasal Mandvi, Surat, Bombay, 5.x.1903, 1 ♂ (Pusa Coll.).

Other reliable records for this species are Sylhet (typical locality for *H. tarsalis*, St.), and Bhamo, Burma (typical locality for *H. citrinolimbatus*, Br. Watt.); while that from China (Stål, *l.c.*), besides being very indefinite, wants confirmation. Kirby's record from Kanara, Bombay, refers to the next species.

Economic importance.—The specimen from Pusa collection taken at Kasal Mandvi, Surat, is labelled "crops," as are also several specimens of *H. oryzivorus* taken simultaneously, so that there is certain reason to suspect this species as a pest. Kirby's suggestion (Fauna Brit. India, p. 205) that it is commoner than *H. banian* is quite inexplicable, since he has not seen more than the two type specimens.

3. *Hieroglyphus annulicornis* (Shir.) (fig. 1 G).

1910. *Oxya annulicornis*, Shiraki, Acrididen Japans, pp. 53, 57, figs. 12 a, b, c.
 1910. *Oxya annulicornis*, Matsumura, Ztschr. Wiss. Insektenbiol., vi, Heft 3 25.iii.1910), p. 102 (*nomen nudum*!).
 1910. *Oxya annulicornis*, Matsumura, Die Schädli. u. nützli. Insekten vom Zukerrohr Formosas, p. 2, pl. iv, fig. 4 (28.vii.1910).
 1911. *Oxya annulicornis*, Matsumura, Mem. Soc. Ent. Belg., xviii, p. 129.
 1912. *Hieroglyphus formosanus*, Bolivar, Trab. Mus. Madrid, no. 6, pp. 54, 55.
 1913. *Oxya annulicornis*, Matsumura, Thousand Insects of Japan, Addit. i, p. 19, pl. iii, fig. 4.
 1916. *Hieroglyphus tonkinensis*, Carl, Revue Suisse Zool., xxiv, no. 6, pp. 478, 479 (*nec H. tonkinensis*, Bol. 1912!).
 1918. *Hieroglyphus annulicornis*, Bolivar, Trab. Mus. Madrid, no. 34, pp. 29.
 1918. *Hieroglyphus formosanus*, Bolivar, *l.c.*, p. 29.

Though Shiraki himself has described the insect as *Oxya annulicornis*, Mats. (n. sp.), it appears that he only adopted for it the manuscript name by Matsumura, who twice (1910 and 1911) described it as a new species, but apparently the first of these descriptions was published after that of Shiraki, as the paper of the latter author though marked on the cover 1910, bears on p. 87 the date of 4th May 1909, while Matsumura's first description appeared on 28th July 1910. It is not impossible, of course, that the date quoted from Shiraki refers to the completion of his manuscript, and in this case the question of authorship can be settled only by finding out the exact date of publication of Shiraki's paper, which may be possible in Japan. In the meantime, I adopt the authorship of Shiraki, as Matsumura's description is very incomplete and unsatisfactory.

The species forms a kind of link between two groups, that of *H. concolor* and *H. africanus*, on the one hand, and the rest of the genus on the other, but it belongs obviously to the first group. It is easily recognised by the very long cerci and apically attenuate subgenital plate of the male (fig. 1 G), while the female also may be always identified by the presence of two granulate carinae on its subgenital plate. In the coloration of the hind tarsi it agrees with *H. banian*, but is quite distinct from both this and *H. concolor*, while it occupies an intermediate position between these two species with regard to the punctuation of the pronotum. The series before me is insufficient to judge of the variability of the species in coloration, but so far as it goes, only the hindmost sulcus of the pronotum, and on the disc only, is narrowly filled with black, while the third sulcus is just a little darkened, and the remaining ones are unicolorous with the pronotum. With regard to the dimensions, the Chinese specimens are fairly uniform, but differ in size from both Indian and

Formosan specimens, according to Shiraki's figures; it is not impossible that this difference in dimensions may be characteristic for subspecies, but it cannot be stated definitely until more extensive series are studied. The dimensions of specimens from different localities are as follows:—

	<i>W. China.</i>		<i>Formosa</i> (after Shiraki).		<i>India.</i>
	♂	♀	♂	♀	♂
Length of body ..	35	49-55	40-42	61-65	41
„ pronotum ..	8	11.5-12	8.8-5	12-12.1	8.5
„ elytra ..	25	34-36	28-30	38-41	32
„ hind femur	18	20-23	18-19	27.8-28	19

Specimens examined.—Amoy, China, 1 ♀; Chung-King, Sze-Chuen Prov., W. China, 2 ♂♂; Hongkong, 1 ♀; “Can.” (probably Kanara, India), 1 ♀ (all in Brit. Museum); Pusa, Bihar, India, 26.vii.1916, 16.vii.1919, 2 ♂♂ (Pusa Coll.).

Other localities whence the species has been recorded are Formosa (Shiraki, Matsumura, Bolivar) and Than Moi, Tonkin (Carl).

Economic importance.—According to Matsumura, the species is a pest of sugarcane in Formosa, damaging also *Canna indica*. No record of its being a pest in India is available, but this may be due simply to insufficient investigations.

4. *Hieroglyphus nigrореpletus*, Bol. (fig. 2 E, 3 B).

1891. ||*Hieroglyphus furcifer*, Indian Museum Notes, ii, p. 30 (partly), figure.
 1906. ||*Hieroglyphus furcifer*, Maxwell-Lefroy, Mem. Dep. Agr. India, i, no. 1, pl. x, fig. 8.
 1906. ||*Hieroglyphus furcifer*, Maxwell-Lefroy, Ind. Ins. Pests, p. 120 (partly), fig. 138.
 1907. ||*Hieroglyphus furcifer*, Maxwell-Lefroy, Mem. Dep. Agr. India, i, no. 2, p. 120, fig. 4.
 1909. ||*Hieroglyphus furcifer*, Maxwell-Lefroy, Ind. Ins. Life, p. 87 (partly), fig. 27.
 1912. *Hieroglyphus nigrореpletus*, Bolivar, Trab. Mus. Madrid, no. 6, pp. 54, 56.
 1914. *Hieroglyphus nigro-repletus*, Coleman, Journ. Bombay N.H. Soc., xxiii, pp. 172-174, plate, figs. 1, 2.
 1914. *Hieroglyphus nigrореpletus*, Fletcher, Some S. Ind. Insects, p. 531, fig. 425.
 1914. *Hieroglyphus bettoni*, Kirby, Fauna Brit. Ind., Acrid., pp. 202, 203, figs. 118, 119.
 1916. *Hieroglyphus vastator*, Carl, Revue Suisse Zool., xxiv, no. 6, pp. 478, 479, 481.
 1918. *Hieroglyphus nigrореpletus*, Bolivar, Rev. R. Acad. Cien. Madrid, xvi, seg. ser., p. 397.
 1918. *Hieroglyphus nigrореpletus*, Bolivar, Trab. Mus. Madrid, no. 34, p. 29.

This is undoubtedly the most easily recognisable species of the whole genus, and there is no excuse for the existing confusion regarding it in the economic and systematic literature. Especially noteworthy is the peculiar shape of the pronotum, as well as the coloration of the latter, not to mention the shape of the male cerci (fig. 2 E). The numerous figures of this species existing in the Indian literature, and quoted above, render its identification very easy, provided that the necessary corrections in accordance with the foregoing quotations are made in the legends to the figures.

The species is liable to considerable individual variation which, however, does not affect its principal characteristics. First of all, there are two distinct forms of the species with regard to the development of the elytra and wings. In the brachypterous form (f. *brachyptera*, Bol.) the elytra are scarcely longer than half the abdomen, and the wings are rudimentary; while the macropterous form has the elytra extending well beyond the apex of the abdomen and the wings perfectly

developed. The macropterous form seems to be far less common than the brachypterous one, and I am inclined to think that the latter is typical for the species, and that macropterism occurs only incidentally as an atavistic mutation, the ancestral form having been, no doubt, macropterous. It is quite remarkable that there are no intermediate forms between the two extremes.

As regards the variability of this species in other respects, there are the usual differences in this genus in the general coloration, which may be either more green, or more brown; it is not impossible that a change of the general coloration may occur during individual life, as is known for several species of locusts.

The characteristic black design of the pronotum is also variable to a certain extent. In the most richly marked specimens, there is a thick black fascia along the upper margin of the lateral lobes, while another fascia connects the lower ends of the first and the second sulci, which, together with the hindmost one, are also broadly marked with black. It is very characteristic for the species that the sulci on the disc of the pronotum are never black, except in some most heavily marked specimens, in which they may be somewhat blackened laterally, adjoining the lateral fascia, but never for their whole length. The black vertical marks on the lateral lobes may disappear more or less completely, but the longitudinal fasciae are very constant and, even when the whole lobe is unicolorous, there may be detected a trace of a fascia, in the form of black spots in the sulci along the upper margin of the lobe.

The extent of variations in size is also not inconsiderable, as the following table of dimensions shows:—

				♂♂		♀♀
Length of body				30-42	..	38-48
„ pronotum				7.5-10	..	8-12.5
„ elytra in the macropterous form				31-37	..	39
„ elytra in the brachypterous form				12-16	..	10-16
„ hind femur				17.5-20	..	16.5-26

Geographical distribution.—The distribution of this common insect in India is by no means sufficiently known, but the available information, gathered both from literature and from collections, seems to indicate that it is a more southern species, which is widely spread over the Indian peninsula and hardly reaches further north than Allahabad and Pusa; Kirby's record from Assam (Cachar) is incorrect, as it refers to two insects in the British Museum which are described in this paper as *Hieroglyphodes assamensis*. I do not think it necessary to give a detailed list of localities whence the species is known.

Economic importance.—Although in all the earlier records this species is confused with others, under the name of *H. furcifer*, in some cases it is not difficult to make an exact identification of the species from the figures. Thus, it was *H. nigrореpletus* which, possibly in company with some other species, caused damage to rice and other crops in some parts of the Bombay Presidency and of the Central Provinces in 1890, as the insect figured in Vol. ii of the Indian Museum Notes (p. 30) unmistakably represents this species. It seems also that Saussure, to whom specimens collected in 1889 were sent for identification (*l.c.* i, p. 203), intended to describe this species as new, under the name of *H. cotesiana*, which, however, he never did;* and it is not improbable that *H. vastator* of Carl is based upon one of Saussure's intended types of *H. cotesiana*.

Later on, Maxwell Lefroy (see the references under synonymy), who never separated *H. nigrореpletus* from *H. banian* (= *furcifer*), gave some rather indefinite records on their joint activities as pests of rice and some other crops; the actual status of each

* H. M. Lefroy's statement (Indian Ins. Life, p. 87) that "a species (*H. cotesii*)" was described obviously refers to this case and is incorrect.

species cannot, of course, be ascertained from these records. T. B. Fletcher (S. Ind. Insects, p. 531) was first to record this species under its proper name, as a minor pest of *Andropogon sorghum* and *Setaria italica* in Madras. The Proceedings of the Second Entomological Meeting at Pusa, repeat the same information (pp. 181, 201), while in those of the Third Meeting (p. 308) the species is recorded also from rice.

The Pusa collection contains some specimens labelled as actually taken on various crops, and these add maize to the list of plants attacked by *H. nigrореpletus* (Dohad, Bombay, 8.ix.03); while there are also fairly long series of specimens from Allahabad, United Provinces, 29.vii.1910, and Partabgarh, Un. Prov., 16.ix.1909, and some other localities, but without more precise information as to the crops affected.

This scanty information seems to indicate that *H. nigrореpletus*, though common enough, is hardly a serious pest of rice and is probably more closely connected with the crops growing under less moist conditions, such as *Setaria* and *Andropogon*. The bionomics of this species may therefore be considerably different from those of *H. banian*, at least as regards its habitat.

5. *Hieroglyphus banian* (F.) (figs. 1 A, 2 F, 3 C, 3 D).

- 1798. *Gryllus banian*, Fabricius, Entom. System., Suppl., p. 194.
- 1839. *Acridium furcifer*, Serville, Ins. Orthopt., p. 677, pl. 14, fig. 12.
- 1842. *Oxya furcifera*, De Haan, Temminck, Verhand., Orthopt., p. 155.
- 1891. *Hieroglyphus furcifer*, Indian Museum Notes, ii, p. 30 (partly, but not the figure!).
- 1906. *Hieroglyphus furcifer*, Maxwell-Lefroy, Ind. Ins. Pests, p. 119 (partly), fig. 137.
- 1907. *Hieroglyphus furcifer*, Maxwell-Lefroy, Mem. Dep. Agr., India, i, no. 2, p. 120 (partly), fig. 3.
- 1909. *Hieroglyphus banian*, Maxwell-Lefroy, Ind. Ins. Life, p. 87 (partly), pl. vii.
- 1910. *Hieroglyphus banian*, Kirby, Synon. Cat. Orth., iii, p. 396.
- 1911. *Hieroglyphus banian*, Coleman & Kuhni Kannan, Dept. Agric. Mysore, Entom. Ser., Bull. No. 1.
- 1912. *Hieroglyphus banian*, Main, Agric. Journ. India, vii, p. 246, pl. xxx.
- 1912. *Hieroglyphus banian*, Bolivar, Trab. Mus. Madrid, no. 6, p. 53.
- 1914. *Hieroglyphus banian*, Kirby, Fauna Brit. Ind., Acrid., p. 202, 204.
- 1914. *Hieroglyphus banian*, Fletcher, S. Ind. Ins., p. 531, pl. 1, figs. 1, 2, 3.
- 1916. *Hieroglyphus furcifer*, Carl, Rev. Suisse Zool., xxiv, no. 6, pp. 478, 479.
- 1918. *Hieroglyphus banian*, Bolivar, Rev. R. Acad. Cien. Madrid, xvi, seg. ser., p. 396.
- 1918. *Hieroglyphus* sp., Bolivar, ., l.c., p. 397.
- 1918. *Hieroglyphus banian*, Bolivar, Trab. Mus. Madrid, no. 34, p. 28.

Some slight doubts that existed concerning the identity of *Gryllus banian*, F., and *Acridium furcifer*, Serv., on account of the first-named species having been described from a female only and very insufficiently, have been dispelled after my examination of one of the original cotypes of the Fabrician species.

With regard to the individual variability of this species, which I have been able to study in a very long series of specimens, it can be positively stated that the assumption made by Lefroy in all his books (see references under synonymy) that it occurs in both macropterous and brachypterous forms, is incorrect and due to the confusion of *H. banian* with *H. nigrореpletus*. This fact was first established by Coleman (Jl. Bombay Nat. Hist. Soc., xxiii, 1914, p. 172), who distinguished *H. nigrореpletus* from *H. banian* and sent it to Bolivar for description.

The extensive series of this species studied by me may be divided into two sufficiently well defined groups. One consists of the insects of smaller average size, with

the fastigium of the vertex shorter, the pronotum with the sulci black, and the metazona more coarsely punctured than in the other group; this is systematically the typical form of the species, since the cotype of *Gryllus banian*, F., studied by me belongs here. The other group, which I propose to regard temporarily (see below) as a variety, may be characterised as follows :—

Var. **elongata**, nov. (fig. 3 C). Distinctly larger and more slender than the typical form. Face more reclinate. Fastigium of the vertex in the male distinctly widened anteriorly, its portion in front of the transverse impression slightly longer than its maximum width. Pronotum unicolorous, with the transverse sulci just slightly darkened, but not black. Mesosternal interspace in the male strongly narrowed in the middle, where it is not half as broad as anteriorly or posteriorly (compare figures 3 C and 3 D); hind margins of the mesosternal lobes oblique in relation to the median line. Male cerci slightly more incurved than in the typical form. In the female (paratype) the mesosternal interspace is also distinctly constricted in the middle, though less so than in the male, its minimal width being subequal to one-half of the maximal (in the typical form the mesosternal interspace of the female is very feebly constricted); the mesosternal lobes are about as long as broad, while in the typical form they are decidedly transverse.

The type of the new variety is from Faridpur, Bengal, 30.viii.1909, whence come also two male and five female paratypes; further paratypes are from Cuttack, Bengal, 23.xi.1905, 5 ♂♂; Khurda, ii.xi.1913, 8 ♀♀; Shahganj, United Provinces, 9.xi.1904, 6 ♂♂; Pusa, Bihar, various dates, 1 ♂, 4 ♀♀; Goalundo-Gauhati, Brahmaputra River, vii.1919, 1 ♀; 1 ♂ from India, without locality.

Dimensions of the typical form and of the new variety are as follows :—

	Typical form.		Var. <i>elongata</i> .	
	♂♂	♀♀	♂♂	♀♀
Length of body ..	28-34	34-44	35-44	40-54
„ „ pronotum ..	5-6	6-9	6.5-8	8-10
„ „ elytra ..	20-27	24-34	27-34	32-43
„ „ hind femur ..	15-16.5	18-22	18-20.5	24-28

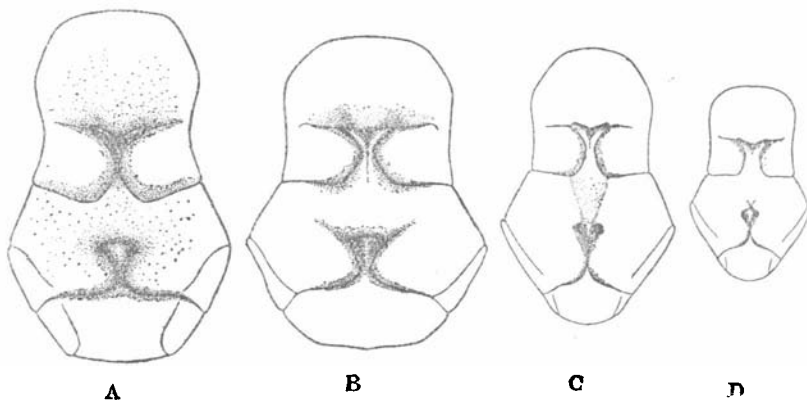


Fig. 3. Sternum of different species of *Hieroglyphus*: A, *H. daganensis*, Kr., ♀; B, *H. nigrorepletus*, Bol., ♀; C, *H. banian*, F., var. *elongata*, nov., ♂; D, *H. banian*, F., typical form, ♂.—All figures $\times 4$.

There is no doubt that the *Hieroglyphus* sp. mentioned by Bolivar (Rev. R. Acad. Cien. Madrid, xvi, p. 397, no. 79) and briefly described by him without a specific name is our var. *elongata*. The typical series of this variety from Faridpur has been also mentioned as distinct from the typical form by Fletcher (Proc. Third Entom. Meeting at Pusa, p. 309).

The exact relation of the var. *elongata* to the typical form is uncertain. I cannot regard it as distinct specifically, in spite of the important differences in the mesosternum, because there are before me some specimens which are transitional between the two forms in this respect; there are also clear transitions in other characters, notably in the coloration of the pronotum, which often has blackened sulci in specimens morphologically identical with var. *elongata*. The most interesting point is that different lots of specimens, each including only individuals taken in the same locality and on the same date, exhibit a remarkable constancy of characters in each lot, and a not less remarkable difference in the complex of characters from other lots. Thus a long series of specimens from Pusa, vi.1908, represent most typical examples of *H. banian*; another series from the same locality, vi.1906, consists of specimens also typical, but on the average somewhat larger; all insects from Ballia, Bengal, 14.ix.1907, on sugar-cane, are of about the same size as the previous lot, but decidedly more slender; specimens from South Mysore, ix.1903, are as large as var. *elongata*, and with the sulci of the pronotum hardly blackened, but heavily built and in the structure of mesosternum nearer to the typical form; the Faridpur series of var. *elongata* consists of specimens decidedly larger than that from Cuttack, or from Khurda; specimens of the latter series are also remarkable by the more saddle-shaped pronotum; while all specimens from Shahganj, though agreeing in all respects with var. *elongata*, show distinctly blackened sulci; and so forth. These facts suggest that *H. banian* is a species which is liable to considerable variations, probably, in connection with some peculiarities of local and seasonal conditions, and the var. *elongata* is only an extreme form, connected with the opposite extreme by transitions. If this suggestion is correct (which may be proved by an extensive study of very long series of specimens collected in various localities and in the same locality in different years, on the one hand, and by breeding experiments under different conditions on the other), then var. *elongata* and other minor varieties may be regarded as morphae, or ecological forms; but in the meantime the indefinite term "variety" is preferable. The study of the variability of *H. banian* may prove to be of great economic importance, as it is not impossible that periodical increases in the number of these grasshoppers leading to an invasion of crops, are connected with morphological variations of the insect, as is the case with some of the swarming locusts.*

Geographical distribution.—*H. banian* is, probably, the most common of the species of this genus in India and distributed all over the plains, but the north-western, northern and north-eastern limits of its area are yet very inadequately known; it seems that it does not extend either into the north-western provinces or into Assam, though the lack of records from these parts may be due simply to the fact that these insects have not been searched for there. I think it needless to give here a complete list of localities.

Economic importance.—The bionomics of this species are fully described in the valuable bulletin of Coleman and Kuhni Kannan (see reference under synonymy). The chief plants affected during its invasions are rice and sugar-cane, but other crops, such as sorghum, maize, or *Setaria*, as well as grasses, are also eaten.

6. *Hieroglyphus tonkinensis*, Bol.

1912. *Hieroglyphus tonkinensis*, I. Bolivar, Trab. Mus. Madrid, no. 6, p. 54.

1918. *Hieroglyphus tonkinensis*, I. Bolivar, l.c., no. 34, p. 29.

This species must not be confused with *H. tonkinensis* of Carl, described in 1916, which is conspecific with *H. annulicornis*, Shir. (see above).

The principal difference of this species, of which the type and only known specimen has been studied by me, from *H. banian* consists in the shape of the male cerci, as the other characters given by Bolivar are not constant in *H. banian* as I have already

* See my paper on the genus *Locusta* with a theory of the periodicity of locusts, in Bull. Ent. Res., xii, 1921, pp. 135-163.

shown. As regards the cerci, the difference is also somewhat doubtful, as the type of *H. tonkinensis* has only the right cercus left, and its shape may be due to malformation of the inner tooth following some injury to it during moulting. Since, however, no specimens of *H. banian* are known from Tonkin, or from China in general, I prefer to keep *H. tonkinensis* separate until further material is available.

The type is from Hanoi, Tonkin.

8. *Hieroglyphus daganensis*, Krauss (fig. 1 F, 3 A).

1877. *Hieroglyphus daganensis*, Krauss, Sitz. Akad. Wiss. Wien, lxxvi (i), p. 42, pl. i, fig. 6.

1878. *Hieroglyphus daganensis*, Stål, Bih. Sven. Akad., v (4), p. 93.

1910. *Hieroglyphus daganensis*, Kirby, Syn. Cat. Orth., iii, p. 396.

1916. *Hieroglyphus daganensis*, I. Bolivar, Trab. Mus. Madrid, no. 6, p. 53.

1916. *Hieroglyphus daganensis*, Carl, Rev. Suisse Zool., xxiv, no. 6, pp. 478, 479.

1918. *Hieroglyphus daganensis*, I. Bolivar, Trab. Mus. Madrid, no. 34, p. 28, no. 1.

This species and the very closely related *H. oryzivorus* form a somewhat aberrant group within the genus, but I see no reason for separating them off, as the principal characters which may be considered of generic value are sufficiently uniform throughout all species included in it.

H. daganensis is remarkable for its very pale greenish coloration, with the hind femora straw-coloured on the outer side and more or less reddish below; hind tibiae pale blue; black marks on the lateral lobes of pronotum very sharp, the first and third sulcus being connected by a black line below, while the sulci on the disc are unicolorous.

Both macropterous and brachypterous forms are known; the former seems to be more common than the latter, which is known in the female sex only and has been named by Krauss var. *abbreviata*.

The dimensions are as follows:—

		♂♂		♀♀
Length of body		40-41	..	47-58
„ pronotum		8-8.5	..	9-11
„ elytra in macropterous form		31-32	..	34-40
„ „ brachypterous form	unknown	..		20-22
„ hind femur		19-20	..	21-25

Geographical distribution.—Originally described from Dagana, Senegal. I have studied 2 ♂♂ and 8 ♀♀ of the macropterous form from Argungu, N. Nigeria, 21.x.1910, and one female of f. *abbreviata* from Tuburi Marsh, French Central Africa, in the British Museum.

8. *Hieroglyphus oryzivorus*, Carl.

1916. *Hieroglyphus oryzivorus*, Carl, Rev. Suisse Zool., xxiv, no. 6, pp. 478, 479, 480.

This species is very intimately related to *H. daganensis*, the only significant difference between them being in the shape of the male subgenital plate, and this may prove to be not quite constant when longer series are studied. There seems to be, however, a more or less constant difference in the dimensions, *H. oryzivorus* being smaller on the average, and I think it may justify, when the distribution of both species is taken into consideration, at least their subspecific separation; in the meantime, and especially for the practical purposes of economic entomologists, it may be more convenient to treat them as separate species.

Carl described the species from two females only and he felt inclined to attribute to it the male figured by Lefroy (Mem. Dept. Agr. India, i, no. 1, pl. viii, fig. 4, pl. x, fig. 8) under the name of *H. furcifer*. There is no doubt, however, that fig. 8 of pl. x represents the male genitalia of *H. nigroripletus*, as has been indicated under that

species, while fig. 4 of pl. viii seems to me more like *H. banian* than *H. oryzivorus*. As I have before me several lots of the latter species, taken in different localities, in both sexes, there is no doubt whatever that the hitherto unknown males of it are named by me correctly, and the astonishing likeness of *H. oryzivorus* to *H. daganensis*, which attracted Carl's attention, becomes still more remarkable.

H. oryzivorus may be at once recognised amongst other Indian species by its saddle-shaped pronotum, but especially and more surely by the shape of the hind sulcus of the disc which is distinctly bow-shaped, with the convexity directed forwards, in this species, and perfectly straight in all the other species; this character is less conspicuous in the males owing to their small size, but the shape of the male genitalia, which are quite like those of *H. daganensis* (fig. 1 F) apart from the difference in the subgenital plate above referred to, renders a mistake out of the question. A minor, but very constant, feature of the coloration of *H. oryzivorus* is the complete lack of any black markings on the hind knees, tibiae and tarsi, except the black points of the tibial spines. Black markings on the pronotum may be more or less obliterated, but even in the most richly marked specimen the sulci are black on the lateral lobes only and never on the disc of the pronotum.

The dimensions are fairly variable, as may be seen from the following table :—

		♂♂		♀♀
Length of body		29-36	..	43-52
„ pronotum		5-6.5	..	7.5-10
„ elytra of macropterous form		21-24	..	34-40
„ „ brachypterous form	unknown	..	..	16-25
„ hind femur		16-17	..	19-24

As it is obvious from the table, *H. oryzivorus* occurs in both brachypterous and macropterous form, though the latter seems to be rare in the female sex, while, on the other hand, the only two known males are both macropterous.

Geographical distribution.—This species was originally described from Murshidabad (in Bengal) and “Bilaspia, Indes centrales,” which is probably Belaspur in the Central Provinces. The specimens from the Pusa collection studied by me are mostly from the Bombay Province: Pardi, 23.ix.1904; Khurda, 11.xi.1913; Kasal-Mandvi, 25.x.1903; Jhalod, Panch Mahals, 9.xi.1903; some are from the Central Provinces, Raipur, 13.x.1903; Mungeli, Belaspur, 25.x.1906; in the Coimbatore collection there are also specimens from S. India, so that the species seems to be fairly widely distributed throughout the Indian plains.

Economic importance.—Carl's original description was based upon two females, one of them labelled: “*Pha-pha*; détruit le riz dans le district de Bilaspia, Indes centrales” and the series before me from Raipur is also labelled as taken from rice, while that from Kasal-Mandvi bears the label “crops.” There is, therefore, no doubt that this species, alone or accompanied by others (*banian*, *nigrorepletus*, *concolor*), is destructive to rice and some other crops, but the exact economic status of each one of them remains yet to be studied on the spot, and I hope that this paper will render this problem easier than it used to be.