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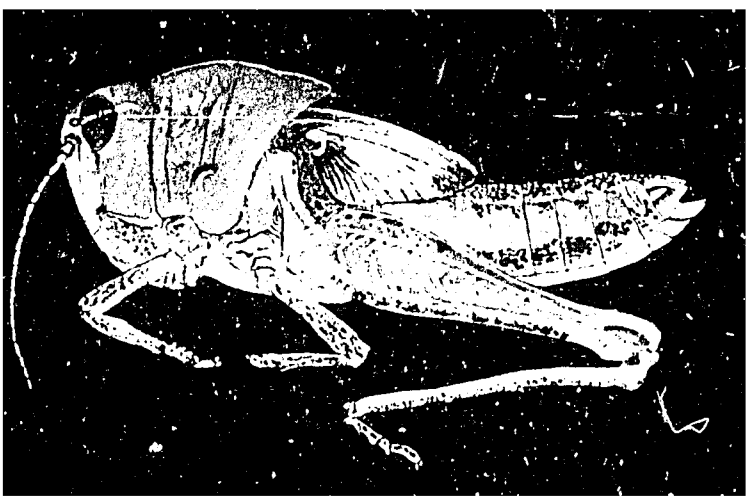

Nymphs of the Sahelian grasshoppers

An illustrated guide

by

G.B. Popov

Overseas Development Natural Resources Institute
1989

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Overseas Development Natural Resources Institute

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CONTENTS

Introduction

The Sahel covers an area from about 9°N to 20°N from the west coast of Africa across to Sudan in the east (in East Africa, Sahelian-type habitat extends north to about 24° and south into Tanzania, about 5°S). It covers sub-Saharan semi-desert, dry savannah and dry woodland, especially *Acacia*. It is characterised by regular, but unpredictable rainfall and frequent drought.

Accurate identification of the pest species is the first step that has to be taken by a plant protection or extension officer confronted with a case of crop damage. Grasshoppers and locusts are amongst the principal pests of food crops in Sahelian countries. There are now several well-illustrated guides and manuals that help with recognition of adult locust and grasshopper species, but there is as yet very little on the young nymphal (hopper) stages; a few papers have appeared in scientific journals, but they are not readily available. Yet much damage, especially to young crops and seedlings, is inflicted by hoppers and their recognition is highly desirable.

General comments

Survival strategies The first appearance of hoppers generally occurs soon after the onset of monsoon rains. They emerge either from eggs deposited in the ground the previous season by parent grasshoppers that subsequently died (dry-season survival strategy in the egg stage), or from eggs laid at the beginning of the rains by parents

that had survived the dry season as adults (dry-season survival in the adult stage). There is a third survival strategy, continuous reproduction, shown by species which are hardy and/or mobile and that can reproduce at any time by taking advantage of exceptional rains and localised habitats that remain moist through the dry season.

Number of generations Many species, of both egg and adult strategists have a single annual generation during the rains; they are univoltine. Some may be bi- or tri-voltine, producing a second, third and, exceptionally, even a fourth generation (for example, *Oedaleus senegalensis*). As a rule the continuous reproduction strategists will avail themselves of every opportunity to produce several generations.

Habitat choice Being flightless, hoppers show a closer association with their habitat than do the more mobile adults; the hoppers are also often more restricted in their choice of food plants. In some species there is a change of behaviour and of habitat during the course of hopper development; the younger hoppers are generally more sedentary and tend to be confined to the limits of the original habitat, while older nymphs are more mobile and tend to disperse.

There are also sometimes changes in feeding habits as hoppers become older, and particularly on reaching the adult stage, but here the information is limited to only a few better-known species.

Hopper development On eclosion from the egg, the 'vermiform larva' makes its way through the froth plug of the egg pod to the surface of the soil and there moults immediately to enter the first instar. The nymph then feeds, grows and, after a

few days, moults again to enter the second instar and so on, until after the final moult the adult stage is reached. The number of instars varies between four and nine, and may differ between species, between male and female in a given species, and even within the same sex of the same species. This is a complex phenomenon influenced by such factors as climatic conditions and phase. At each successive stage there is an increase in overall size and a progressive growth of, and structural changes in, various organs (Figs 1-3). There are also accompanying physiological changes, and often changes in coloration that may be considerable (see for instance the changes in *Acorypha glaucopsis* - no. 13). Moreover, while in some species the hoppers closely resemble the adults, in many others there are marked differences in form and coloration such that the hoppers may be totally unlike the adults, as, for instance in *Staurocleis magnifica* (no. 22). In many species there are different colour forms that are to some extent seasonal; varying between predominantly green during the wet season and predominantly brown during the dry season, while geophilous species that closely harmonise with the colour of their substrate, may exhibit an almost infinite variety of colour patterns (nos. 2, 3 and 51). In polymorphic species there is a wide range of colour forms between the extreme gregarious and solitarious phases, which is characteristic for each species and more or less distinctive for each individual instar (nos. 37a and 37b).

Thus a complete identification handbook would need to provide a full range of descriptions and illustrations for all the variants of every instar in each species - an undertaking outside the scope of this guide and indeed beyond the limits of our present knowledge.

Inevitably, therefore, this is no more than a simplified introduction to the recognition of the hoppers of some 78 better-known locust and grasshopper species of the Sahel.

Some practical recommendations

The identification of nymphs, particularly of young ones, is not always easy. While in some species, e.g. *Acorypha glaucopsis, Gastrimargus* spp. *and Calephorus compressicornis,* the young nymphs are distinctive and are easy to recognise, in many others, especially in closely related species, for instance those of the *Catantops* group, the young nymphs are similar and are not easy to distinguish. In such cases the only sure solution is to collect nymphs on several occasions at intervals of several days from the same site to obtain a complete series of all instars, including adults.

To facilitate identification, users are advised to take into account all characters concerning the species: its general appearance, morphology, coloration, behavioural characteristics, habitat and food preferences.

The data provided in this guide can be enriched by the users' personal field observation and experience to record any new and interesting finding.

A reference collection of nymphs is as useful as one of adults as an aid to identification and in training. Unfortunately nymphs are difficult to prepare and preserve as dry specimens and are even more prone to discoloration than adults. To

remedy this, in addition to date, locality, habitat and collector, it is recommended that some information on the coloration of the specimen at the time of capture, in particular on any striking colour feature, is recorded on the specimen labels. If, as is often the case, there are several colour forms, these should be included among the series of specimens collected. The killing of specimens and their preparation should follow the same procedure as for adults (see Lecoq and Mestre, 1988), but special care should be taken since nymphs are more delicate than adults. This should give satisfactory results, at least for the older nymphs of the larger species, especially if care is taken to select specimens in the middle of the instar, with well-hardened cuticle, but well before it softens again prior to the next moult.

The young nymphs are difficult to handle and are best kept in tubes in a preserving liquid such as 75% alcohol (methyl preferable to ethyl) or 4% formalin.

Hopper identification

To identify hoppers using this guide, specimens should be compared with the illustrations, descriptions and data presented for each species.

The majority of illustrations were made from specimens freshly collected in the field. Preference was given to older nymphs in which the characters were more developed. As a rule only one instar is represented, but where there are marked differences, several may be given. In addition some use is made of colour photographs

and of drawings of structural details to assist with identification. Unless otherwise stated, all illustrations are by the author.

The data for each species are given by means of symbols. These symbols have appeared in Lecoq (1988), and are reproduced here with the permission of the author, the Departement de Formation en Protection des Végétaux Centre AGRYHMET, the Ministry of Foreign Affairs of the Netherlands and of GERDAT/PRIFAS. The terminology used in the descriptions will be found in the keys.

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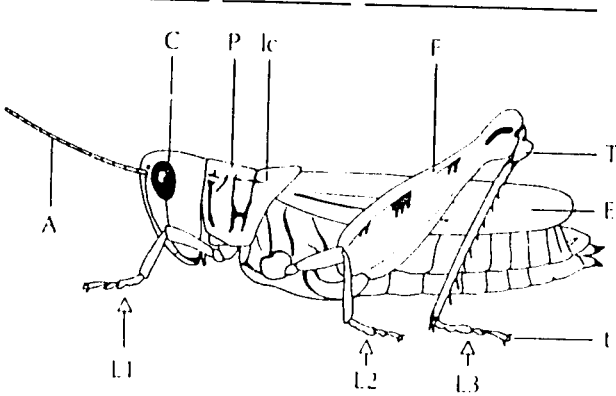
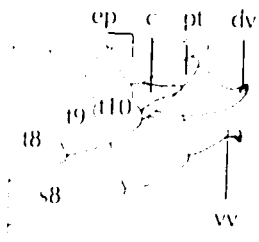
Grasshopper Morphology

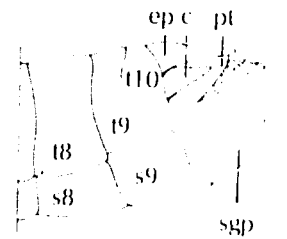


A	antenna	L2	mid leg
C	compound eye	L3	hind leg
E	elytron	P	pronotum
F	femur	T	tibia
lc	lateral carina	t	tarsus
L1	fore leg		

APEX OF ABDOMEN:

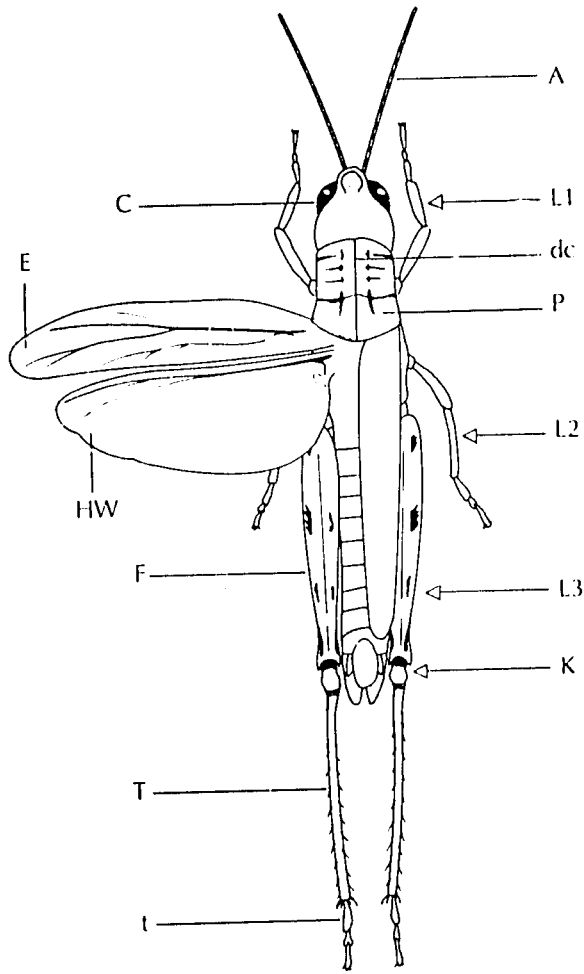


FEMALE ♀



MALE

c	cercus	s	abdominal sternites
ep	epiproct	t	abdominal tergites
dv	dorsal oripositorvalve	vv	ventral ovipositor valve (egg-laying organ)
sgp	subgenital plate		
pt	paraproct		

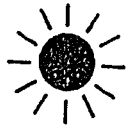


A	antenna	L1	fore leg
C	compound eye	L2	mid leg
dc	dorsal carina	L3	hind leg
E	elytron	P	pronotum
F	femur	T	tibia
HW	hind wing	t	tarsus
K	knee		

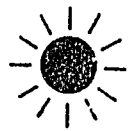
Extract from Lecoq (1988)

Life Cycle

Species with egg diapause; only caught during rainy season. Only eggs in soil survive dry season.



Species with adult diapause; caught as nymphs and adults during rainy season. Only adults survive dry season.



Species with continuous reproduction; caught all year as adults or nymphs.

4

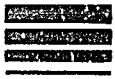
Generally assumed maximum number of generations per year.

Habitat Preference

Hygrophylous species, living primarily in wet habitats.

Mesophilous species, living primarily in moderately humid habitats.

Xerophilous species, living primarily in dry habitats.



Geophilous species, often found on bare ground.

Phytophilous species, often found in thick grass and forbs.

Arboricolous species, often found on trees and bushes.

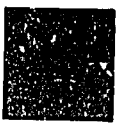
Food Preference

Graminivorous species, feed mostly on wild and cultivated grasses (monocotyledons).

Forbivorous species, usually feed on forbs (dicotyledons) rather than grasses.

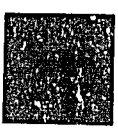
N.B. Combinations of symbols indicate intermediate categories. For example, a polyphagous species would have both symbols relating to food preference.

Coloration



All individuals predominantly green or at least some parts of body green.

All individuals predominantly brown, black, grey or yellow (or a mixture of these colours).



Individuals may be either predominantly green or predominantly brown.

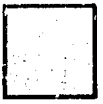
Vivid warning coloration indicating insect is poisonous to potential predators.

Economic Importance

Very important species.

Important species.

Moderately important species.



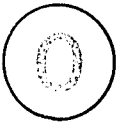
Unimportant species.

Number of Instars

♂ 5 – 6 ♀

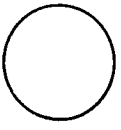
Males Females

Tendency to gregarisation



No tendency (never gregarious)

Only gregarious in nymphal stages

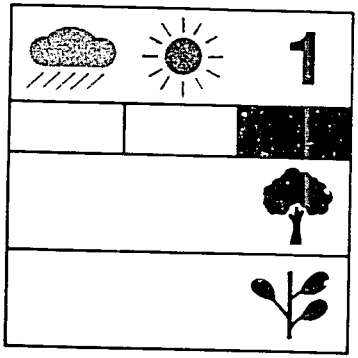


Slightly gregarious

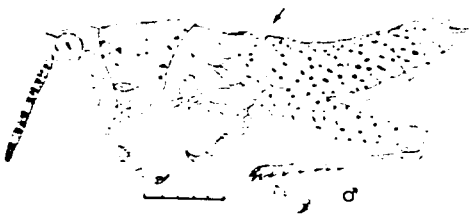
Strongly gregarious (locusts)

Species accounts

1. *Poekilocerus bufonius hieroglyphicus* (Klug, 1832)



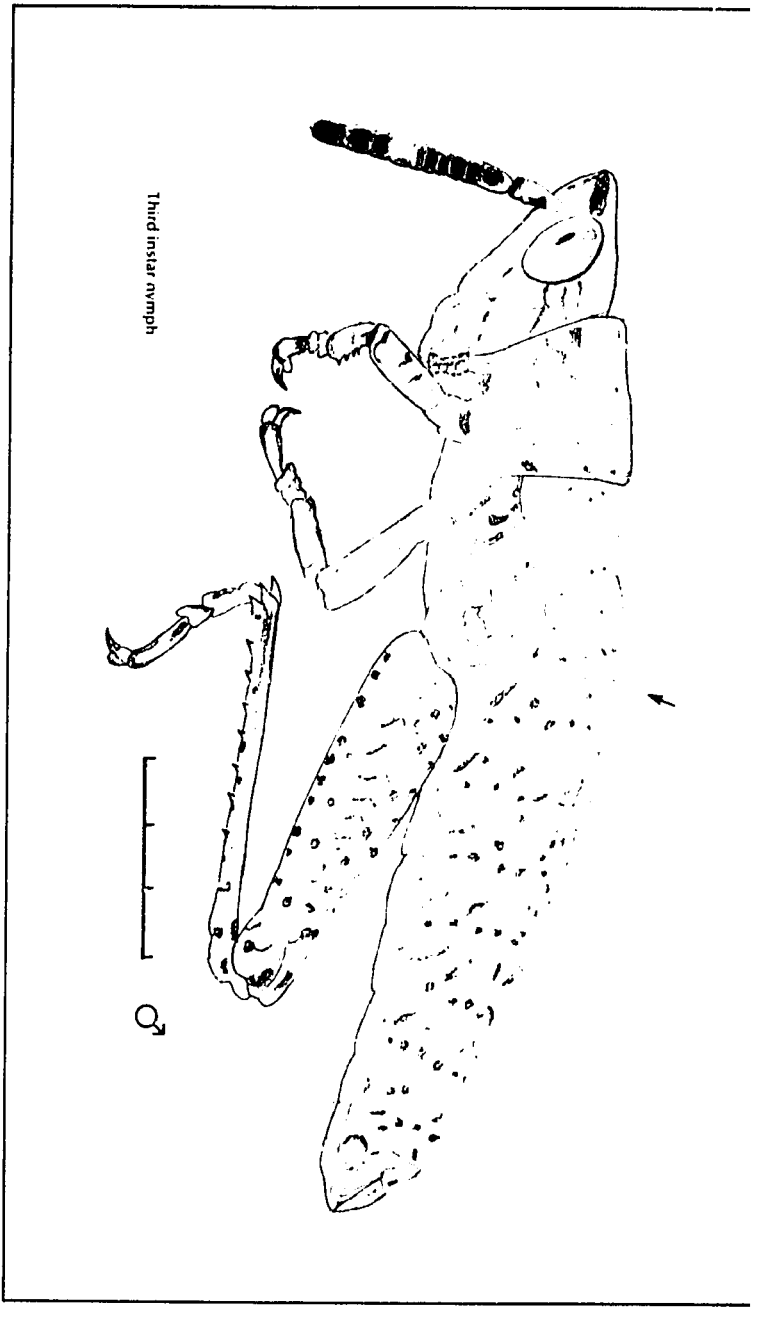
♂ 6- -8 ♀



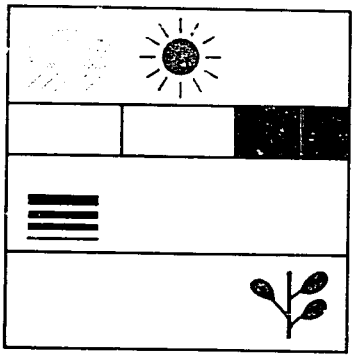
Third instar nymph

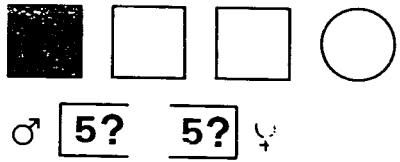
C. Group of young nymphs on *Calotropis*

The coloration is characteristic and resembles that of the adult. The species is associated almost exclusively with the shrub *Calotropis procera* and some other asclepiads such as *Pergularia*. The younger nymphs often occur in small groups (C). When attacked both the nymphs and the adults emit an evil-smelling toxic liquid that acts as a repellent. Found in the northern part of the Sahelian and in the Saharan zones.


Third instar nymph
♂

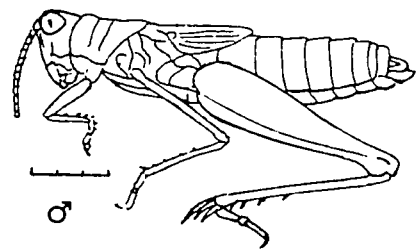
2. *Tenuitarsus sudanicus* Kevan, 1953





B. Details of hind tibia and tarsus

A. Fifth instar nymph

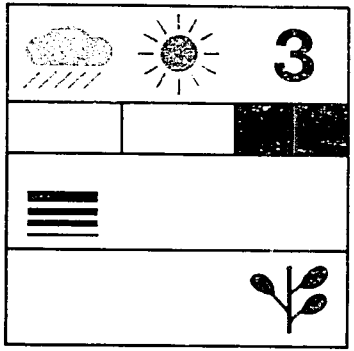


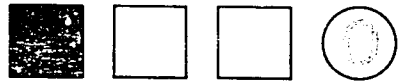
A species closely associated with sandy habitat: dunes and wadi beds. Superficially resembles *Chrotogonus senegalensis* (no. 3) from which it differs by its elongate and slender legs and hind spurs (B), and absence of black spots on the underside.

Last instar nymph

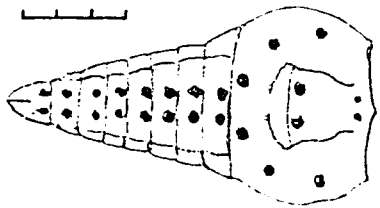
3. *Chrotogonus senegalensis* Krauss, 1877

3





♂ 5-6 5-7 ♀

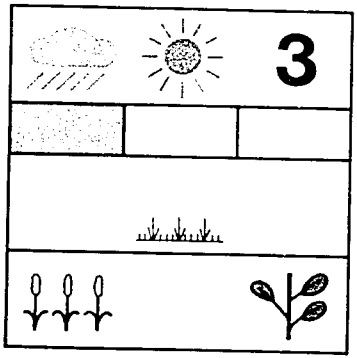


View of the black spots on the underside

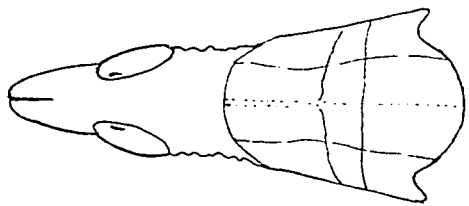
A strictly geophilous species, often found in vegetable gardens where it may cause slight damage. Easily recognised by its coloration, flattened body and the black spots on the underside.

♀
Last instar nymph

4. *Atractomorpha acutipennis* (Guérin-Méneville, 1844)



♂ 5 6 ♀

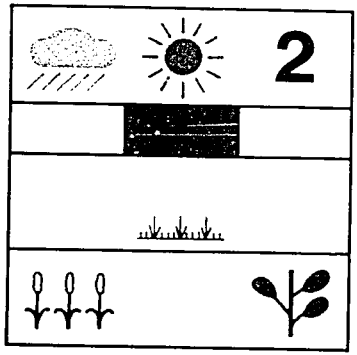


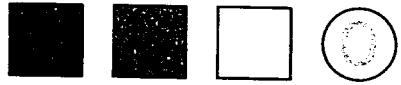
Dorsal view of head and pronotum

Easily distinguished from *Pyrgomorpha* species by its elongate, pointed head, the straight lower margin of the pronotal lobe and by its choice of very moist habitats.

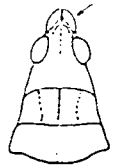
Last instar nymph

5. *Pyrgomorpha vignaudii* (Guérin-Méneville, 1849)





♂ 5 – 7? ♀



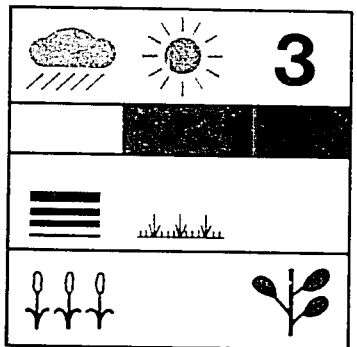
Details of head from above

Third instar nymph

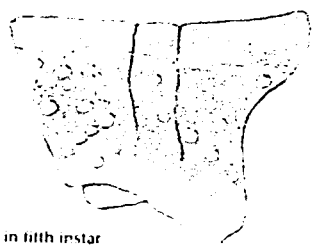
The younger nymphs of *Pyrgomorpha* species are difficult to separate, but later *P. vignaudii* can be differentiated from *P. cognata* by its larger size, more robust build and less prominent apex of the head. *P. vignaudii* is often (although not always) associated with communities of *Ipomoea* sp.

Last instar nymph

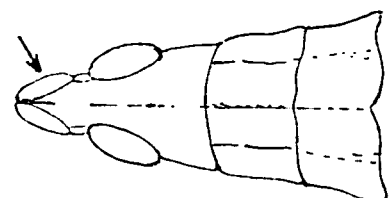
6. *Pyrgomorpha cognata* Krauss, 1877



♂ 5 - 6 ♀

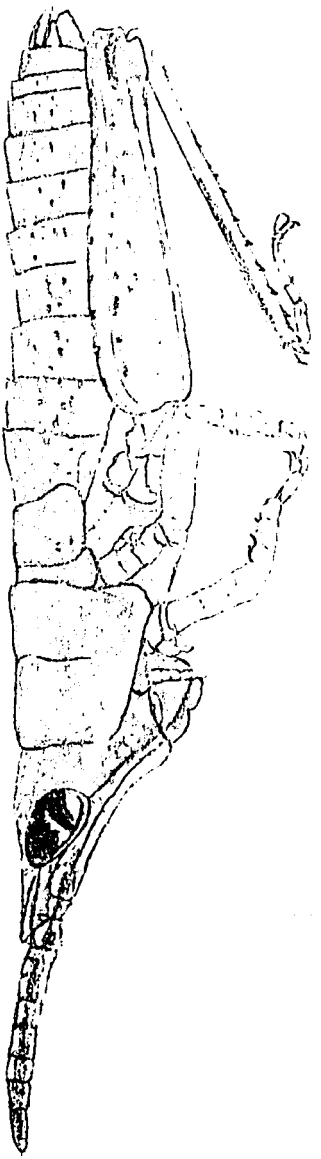


Pronotum in fifth instar



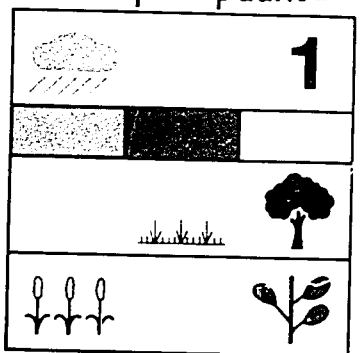
Third instar nymph, dorsal view of head

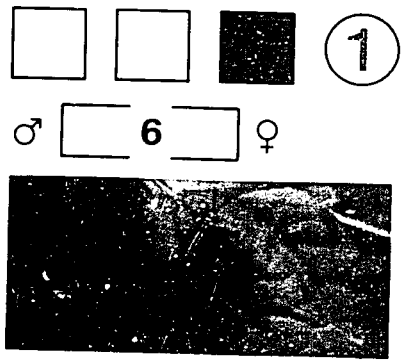
Common widespread species that occurs in a wide range of habitats throughout the Sahel. Young nymphs may be confused with *Atractomorpha* and especially with those of *P. vignaudii*, but older nymphs can by identified by the structure of the apex of the head and the pronotum.



7. *Zonocerus variegatus* (Linnaeus, 1758)

«le criquet puant»

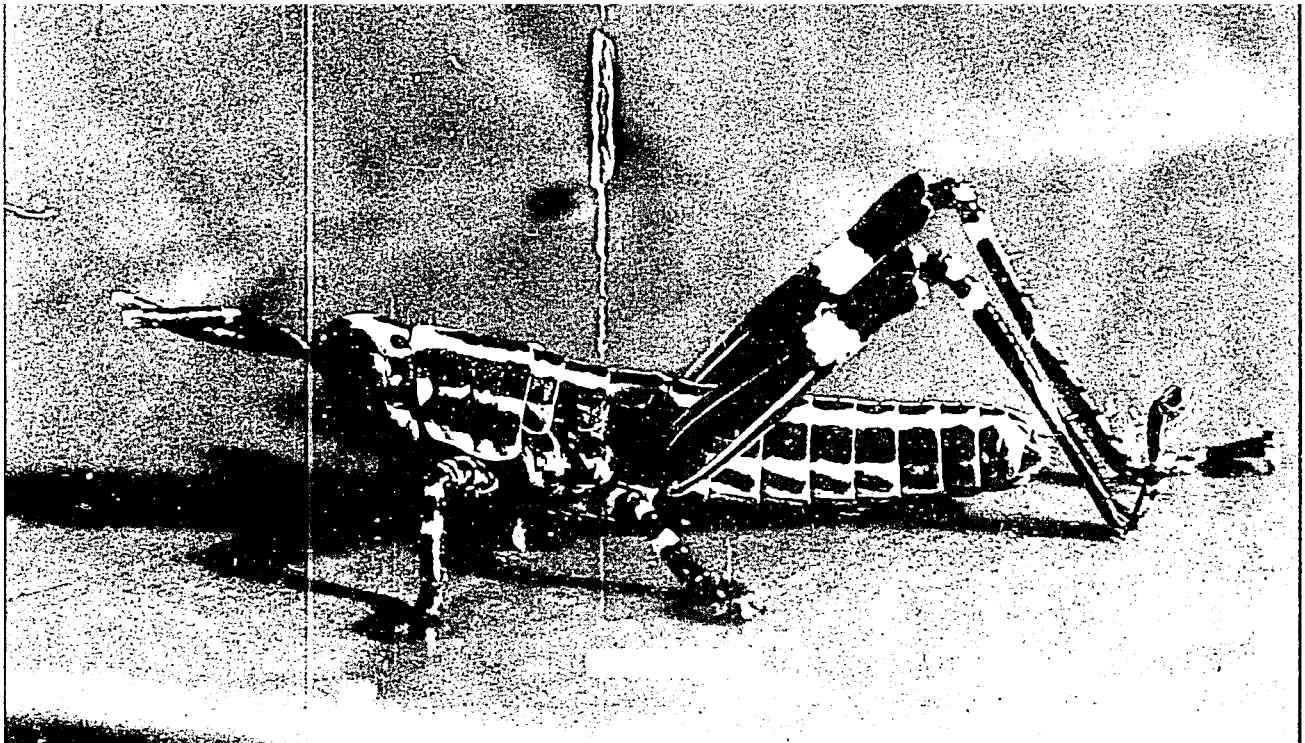




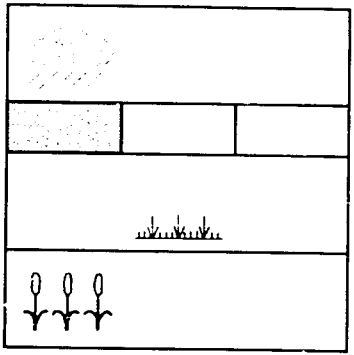
Concentrations of young nymphs on *Eupatorium odoratum*, a preferred food/shelter plant

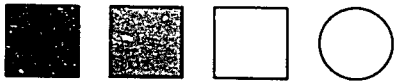
Older nymphs and adults

The variegated, or stinking, grasshopper is easily recognised by its striking coloration both in the adult and the hopper stage. As in most aposematic species, the young nymphs tend to aggregate in dense concentrations, which perhaps discourages potential predators.



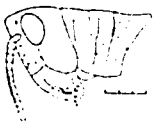
8-9. *Hieroglyphus daganensis* Krauss, 1877 and *H. africanus* Uvarov, 1922





♂ 6 - 7 ♀

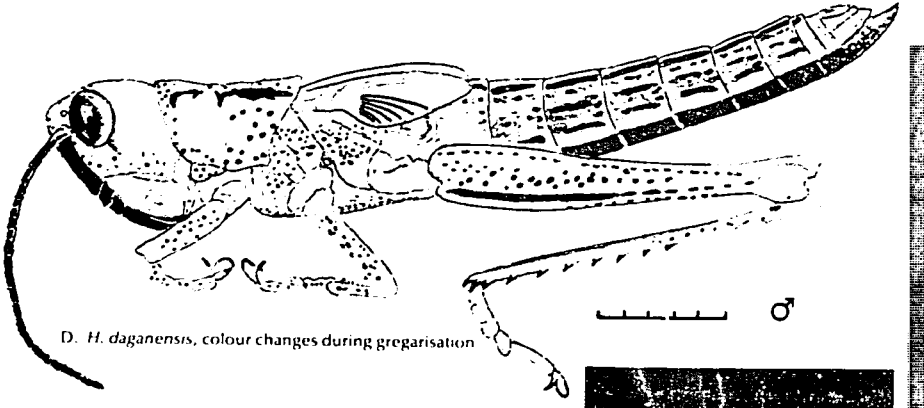
H. daganensis, young nymph



H. africanus, head and pronotum in the sixth instar

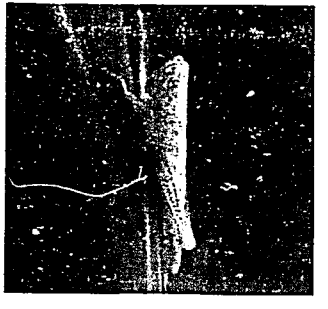
H. africanus, head and pronotum in the fourth instar

The nymphs of *H. daganensis* are recognised by their elongate, cylindrical bodies and disproportionately large inflated heads. Predominant coloration is green, more rarely yellowish, more or less finely speckled with black. *H. daganensis* exhibits some gregariousness and forms concentrations (sometimes together with *Orthochtha venosa* (no. 45)); this is usually accompanied by colour changes (C, D, E). The species is associated with moist grasslands; sometimes it causes damage to cereal crops, particularly rice and maize. *H. africanus* is a larger species with more prominent apex of head, a more swollen pronotum and narrower eyes, which are bright red in older nymphs and adults.



D. *H. daganensis*, colour changes during gregarisation

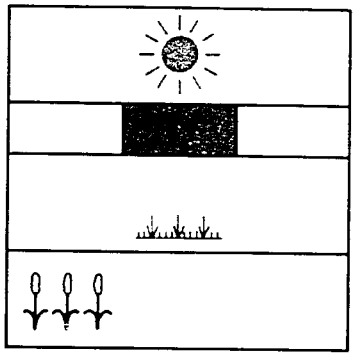
E. *H. daganensis*, colour changes during gregarisation



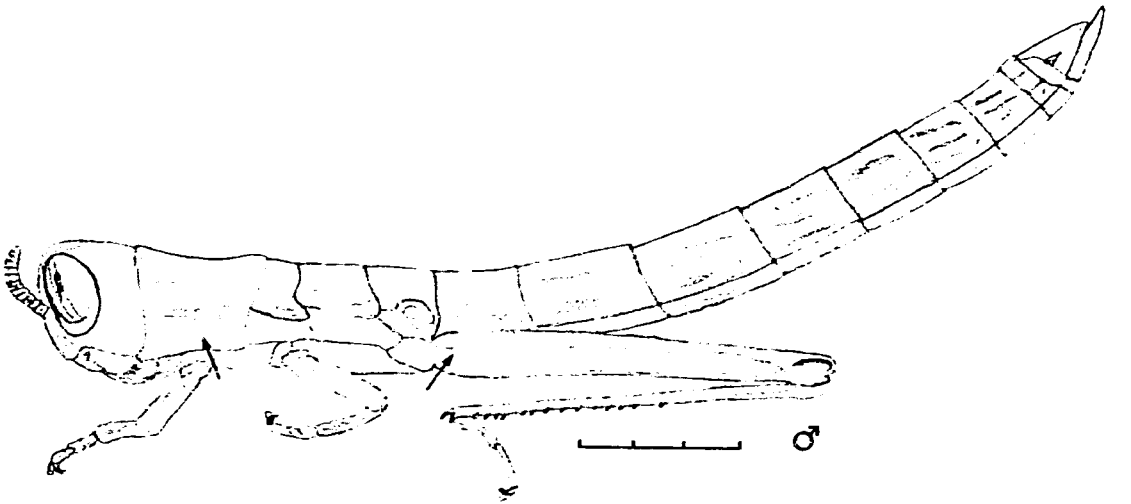
H. daganensis, a green nymph in its natural environment

C. *H. daganensis*, colour changes during gregarisation

10-11. Leptacris violacea (Karny, 1907) and *L. kraussi* (I. Bolivar, 1890)

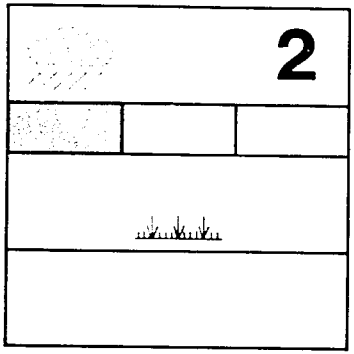


L. violacea is recognised by its very elongate abdomen, so that the hind knee only reaches the 5th abdominal segment. It is further characterised by very short antennae, especially in the younger nymphs and by the luminous mother-of-pearl lateral band. *L. violacea* is readily distinguished from *L. kraussi* by the prominent, pointed apex of the head in the latter.



L. violacea, third or fourth instar ♂ nymph

12. Oxya hyla Serville, 1831



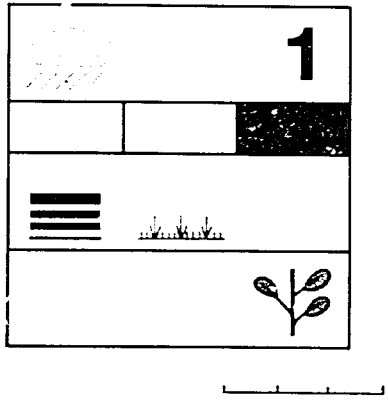
♂ 6 - 7 ♀

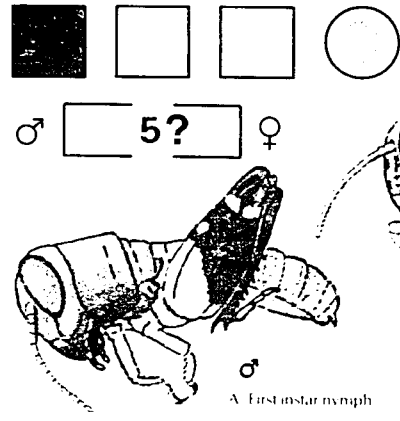
Nymph and adult compared

A hygrotypic species found in moist riverine and lacustrine grasslands. General coloration predominantly green, but sometimes brown (B). There are marked differences between the coloration of nymphs and adults (C). The spine on the lower external lobe of the hind knee is characteristic.

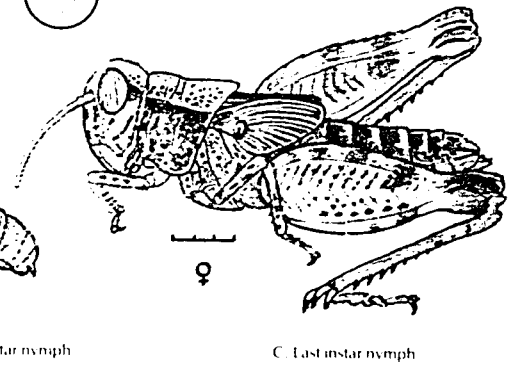
♂
Last instar nymph
Dorsal view of brown form

13. *Acorypha glaucopsis* (Walker, 1870)





A. First instar nymph

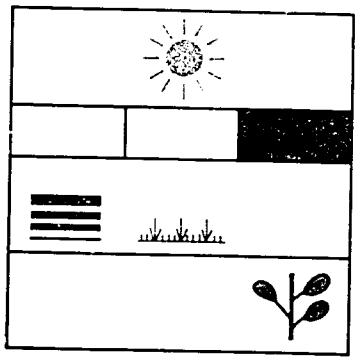


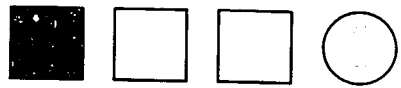
C. Last instar nymph

The nymphs of *Acorypha* species, like the adults, are recognised by their general robust build, broad hind femora and elongate spurs - characters well-expressed in all nymphal instars. In *A. glaucopsis* the early instars have a striking contrasting coloration (A). Later the contrast becomes less marked (B) and in the last instars it approaches that of the adult. However, the bright red coloration on the inner face of the femur, characteristic of the adults, does not appear in the nymphs. It is one of the first species to emerge following the rains.

B Third instar nymph

14. *Acorypha clara* (Walker, 1870)





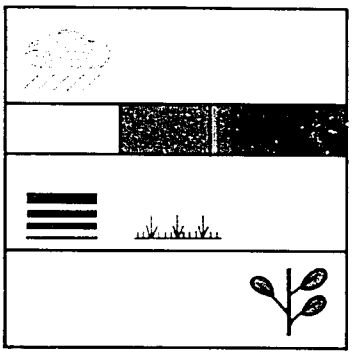
♂ 5 ? ♀

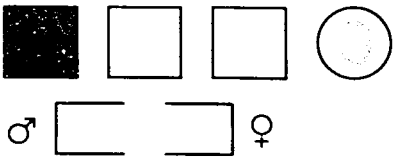
Fourth instar nymph

The coloration is characteristic. The nymphs are among the last to develop during the rains; thus although *A. glaucopsis* and *A. clara* to some extent share the same habitat (dry prairies and steppes) their nymphs seldom occur together.

Second instar nymph

15. Acorypha onerosa Uvarov, 1950

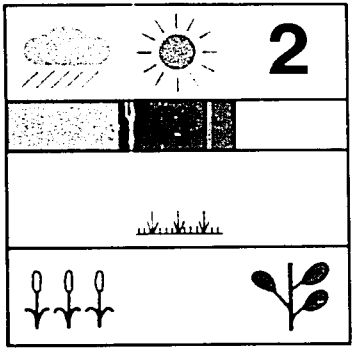


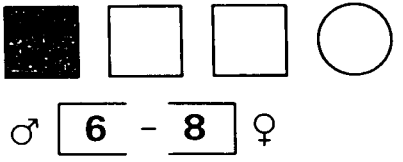


The nymphs of this species are recognised by their dark coloration and their preference for clay substrates.

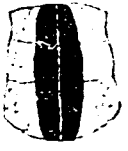
Third instar nymph

16. Eyprepocnemis plorans ornatipes (Walker, 1870)





D. Gregarious nymphs



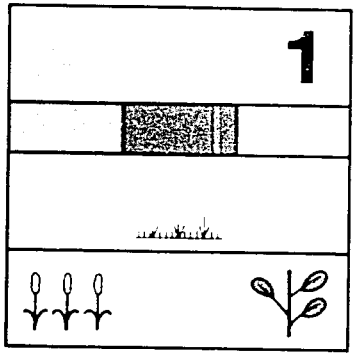
B. Pronotum, sixth instar

C. Hind femur, sixth instar

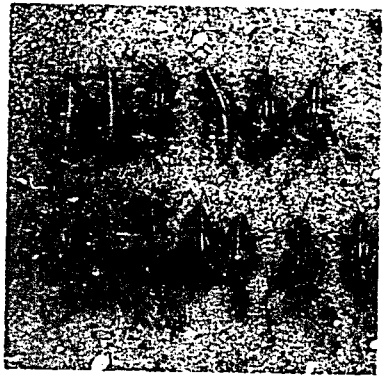
This species is associated with humid conditions on alluvial substrates. The characteristic blue and red coloration of the hind tibiae of the adult does not appear in the nymphs (A), but the brown dorsal band of the pronotum is well developed (B). High-density hopper concentrations sometimes contain dark specimens (D), but no gregarious tendencies are known in the adult. Sometimes in association with other species, *E. plorans* may cause damage to irrigated crops.

A. Sixth instar nymph

17-19. *Cataloipus fuscocoeruleipes* Sjöstedt, 1923, *C. cymbiferus* (Krauss, 1877) and *Jagoa gwynni* (Uvarov, 1941)



♂ 5 - 6? ♀

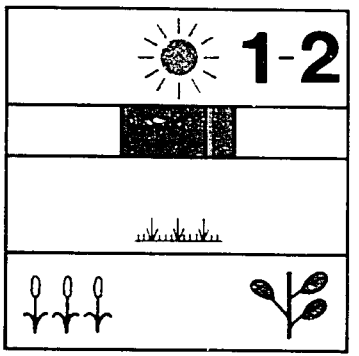


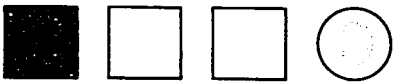
Comparison between *C. cymbiferus* below and *J. gwynni* above

The nymphs of *Cataloipus* are readily recognised by their characteristic build and their rusty-brown and charcoal-grey coloration (A and B), but it is not easy to differentiate between *C. fuscocoeruleipes* and *C. cymbiferus*, for the diagnostic white spots on the pronotal lobes that serve to separate the adults are not present in the nymphs. Moreover, details of coloration are sometimes masked by the dark pigmentation that develops at high densities. The two are in fact more readily separated by their habitat preferences and geographical distribution: *C. cymbiferus* being more xerotypic and having a more northerly distribution. *Jagoa gwynni* is more readily recognised by its heavier build and a narrower dorsal band.

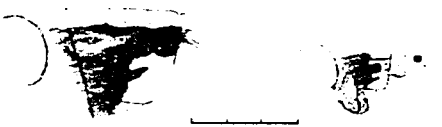
C. fuscocoeruleipes, fourth instar

20. *Tylotropidius gracilipes* Brancsik, 1895



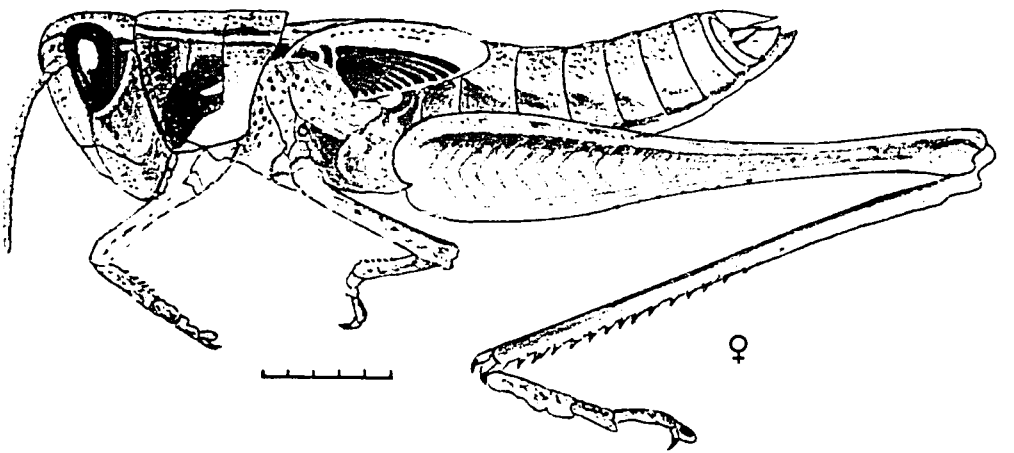


♂ 5 - 6? ♀



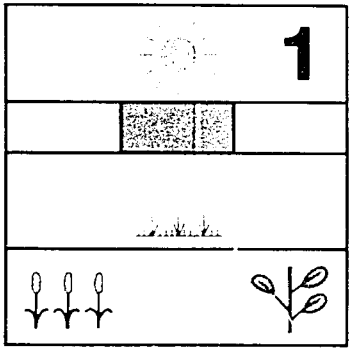
B. Pronotum detail of third instar nymph C. Pronotum detail of first instar nymph

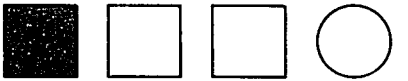
The nymphs of this species may be recognised by their elongate hind legs and by their coloration. The lateral pronotal carinae are parallel and the pattern on the lateral pronotal lobes, more or less constant in all the instars (A-C), are characteristic. Not to be confused with *T. didymus* (no. 21).



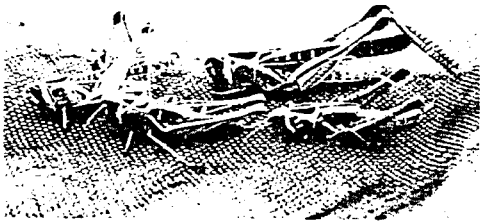
A. Fifth instar nymph

21. *Tylotropidius didymus* (Thunberg, 1815)



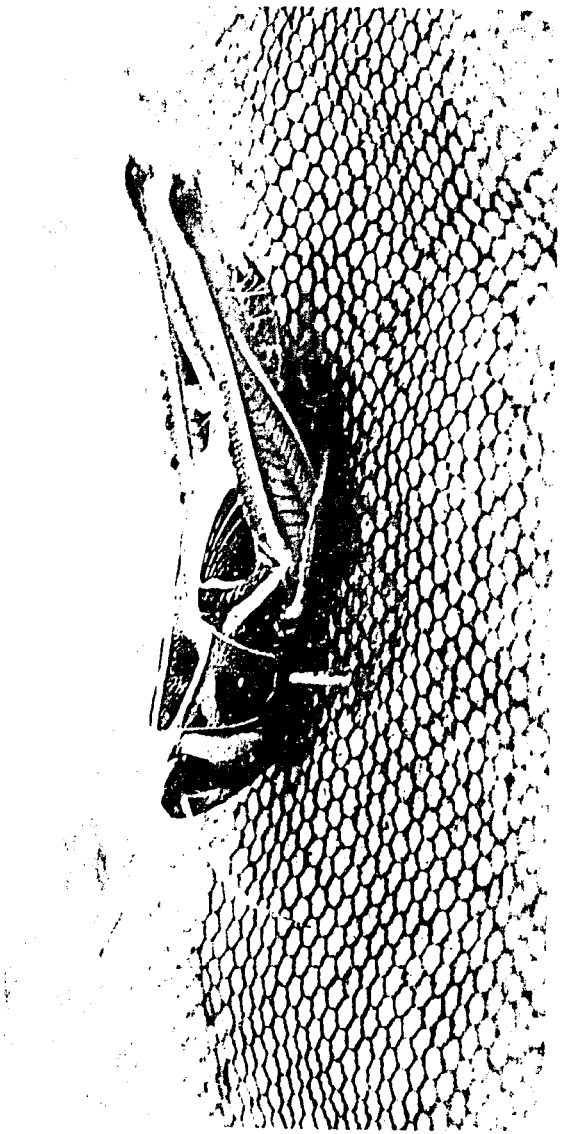


♂ 5 - 6? ♀

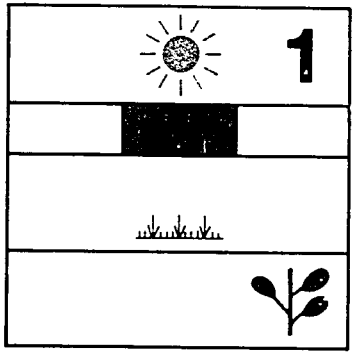


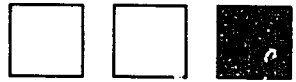
Adults and last instar nymphs

This species may be separated from *T. gracilipes* by its divergent lateral pronotal carinae and by a small white sclerotised spot in the middle of the lateral pronotal lobe. In *T. gracilipes* the spot occurs in the same place, but the whole lower posterior angle of the lobe is white. An additional character in *T. didymus* is the white longitudinal stripe on the outer face of the hind femur that occurs in both nymphs and adults.



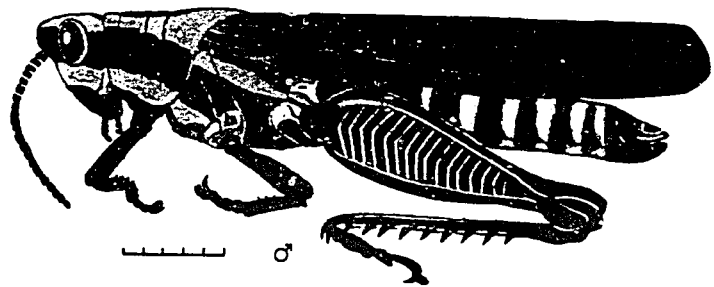
22. *Staurocleis magnifica* Uvarov, 1923





♂ 5-6? ♀

Adult



In this species the coloration of adults and nymphs is completely different. Young nymphs are green speckled with white all over, including the antennae; older nymphs have scattered yellow spots and the extremities of their legs and antennae become darkened.

Last instar nymph

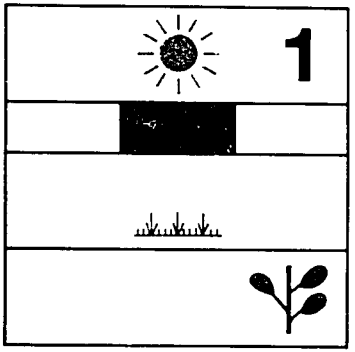
Catantops group of genera (23-29)

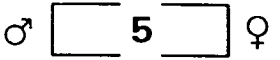
The nymphs of this group of genera present difficulties as they are superficially similar and lack good characters convenient for field identification, especially in younger instars.

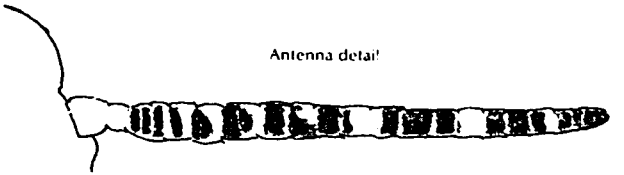
As a rule the general coloration is predominantly green in the younger, and predominantly sandy (buff or greyish) in the older instars, sometimes with a light or dark speckling. The dark pattern characteristic of adults begins to appear in the last instars and is more pronounced in males. The pigmentation of the antennae, which is to some extent characteristic, is shown for some species, but this is not an easy character for field use. The small black spot at the base of each wing pad appears in late instars in most species and is a useful character for the group as a whole.

23. *Catantops stramineus* (Walker, 1870)

3



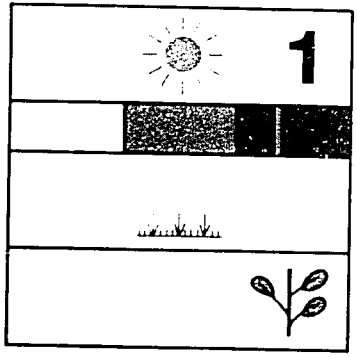


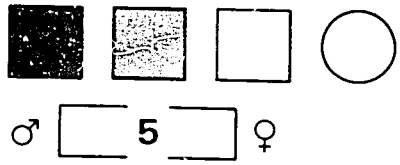


The nymphs of *C. stramineus* are recognised by their size and general appearance and the pigmentation of antennae.

Last instar nymph
♂

24. *Cryptocatantops haemorrhoidalis* (Krauss, 1877)





Young nymphs

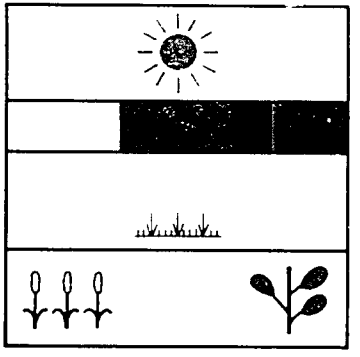
Nymphs of last instar

In *Cryptocatantops haemorrhoidalis* the dark pattern characteristic of adults becomes clearly apparent in older nymphs; note in particular the row of small black dots along the lower margin of the outer face of the hind femur. This is one of the most common species that shares the habitat of *Oedaleus senegalensis*, but while *O. senegalensis* predominates in grassland communities, *C. haemorrhoidalis* is dominant in sandy prairies bearing communities of forbs such as *Zornia* and *Indigofera* spp.

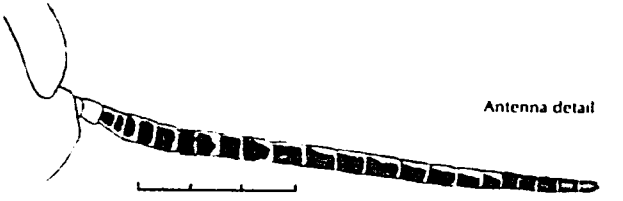

Nymph of last instar
♂
Antenna detail, last instar nymph

25. *Diabolocatantops axillaris* (Thunberg, 1815)

3



♂ 5-6 ♀

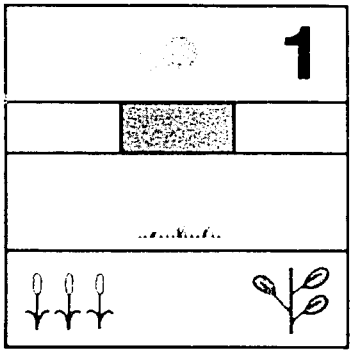


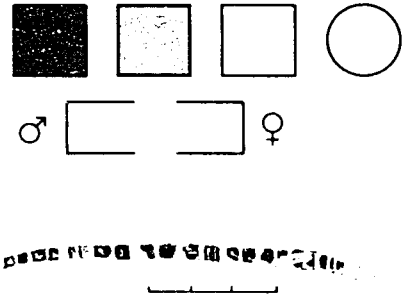
Antenna detail

The nymphs of *D. axillaris* are characterised by their larger size and the pigmentation of their antennae. This meso-xerotypic species occurs predominantly in communities of forbs and bushes. It is economically more important than other members of the *Catantops* group.

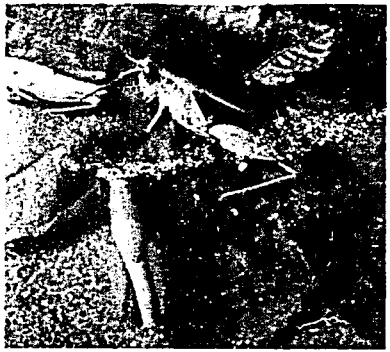
Last instar nymph

26. *Harpezocatantops stylifer* (Krauss, 1877)





Antenna, last instar nymph

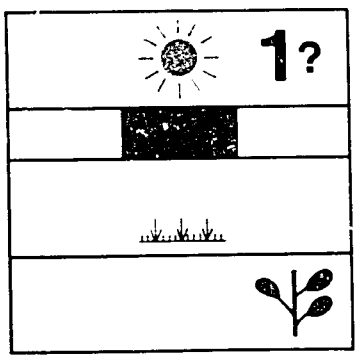


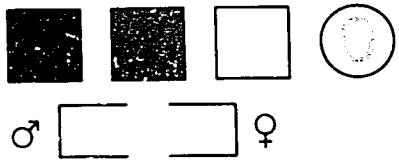
Last instar nymph compared with adult

The nymphs of this species have a generally more slender build and apically slightly compressed antennae; their coloration is as shown.

Last instar nymph

27. *Criotocatantops pulchripes* (Karny, 1915)

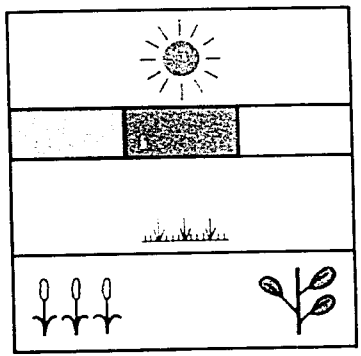


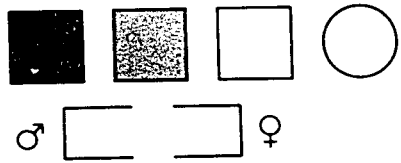


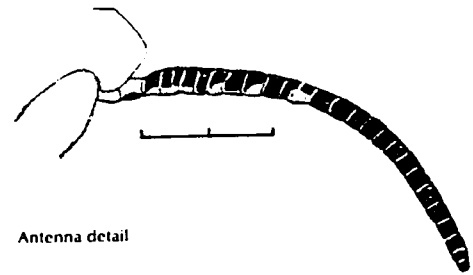
The young nymphs are dirty green with white and black speckling. Older nymphs are predominantly brownish and greyish and the beginnings of the dark adult pattern may be seen, especially in males.

Adult and nymphs of late instars, male on right, two females on left

28. *Catantopsis basalis* (Walker, 1870)





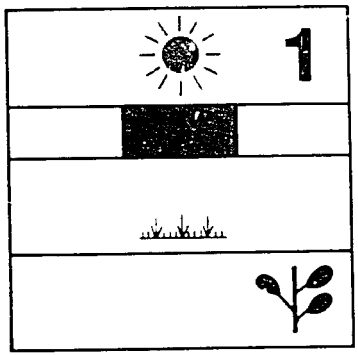


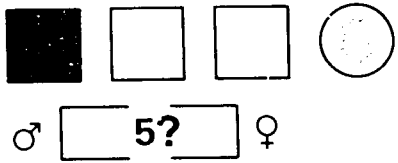
Antenna detail

The nymphs of this species are characteristically slender, densely speckled, have dark antennae and occur in very moist habitats.

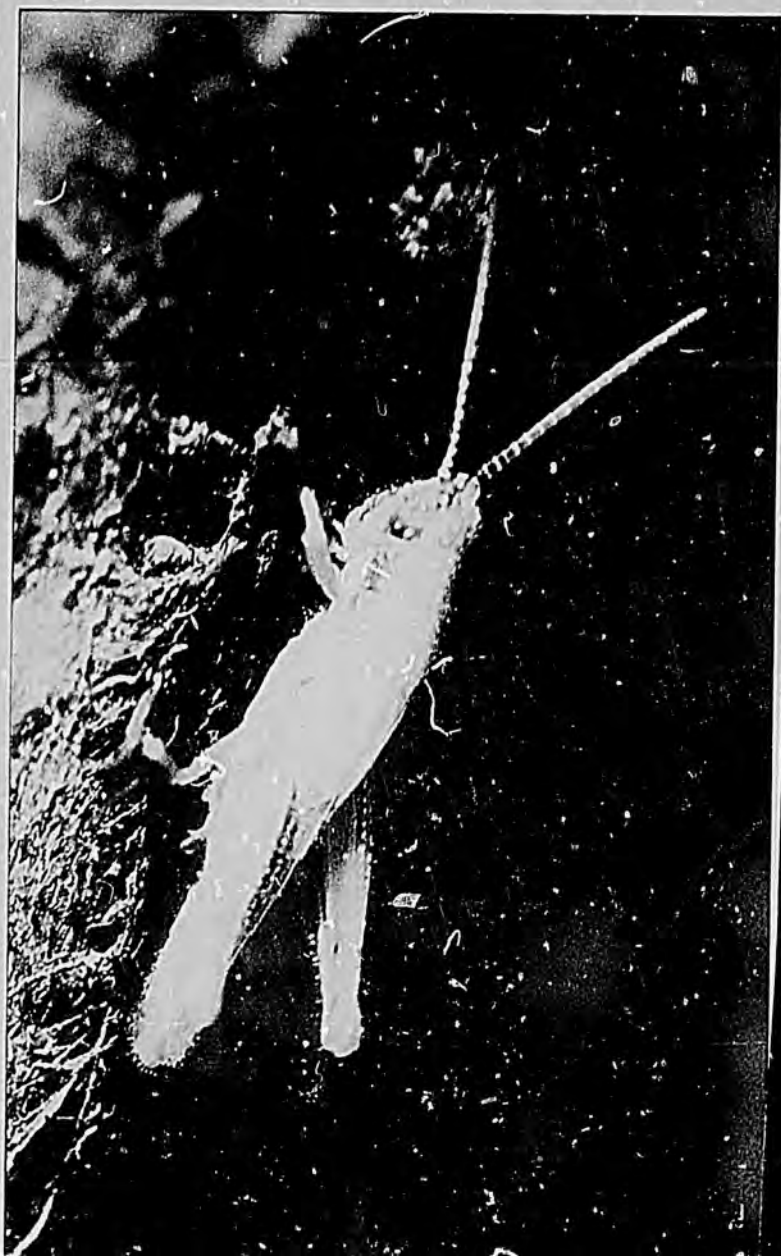
Last instar nymph

29. *Catantopsilus taeniolatus* (Karsch, 1893)

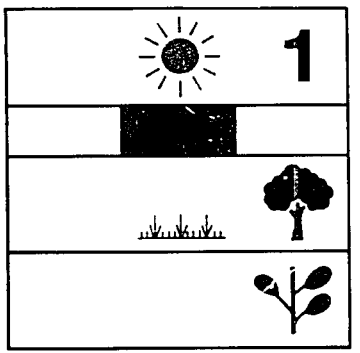


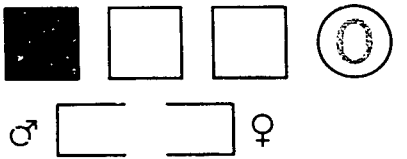


The nymphs of this species have the same characteristic olive-brown coloration tinged with pink as the adults. In all instars the body is densely speckled white; the cheeks and lateral lobes of the pronotum are darkened and edged with a white band below.



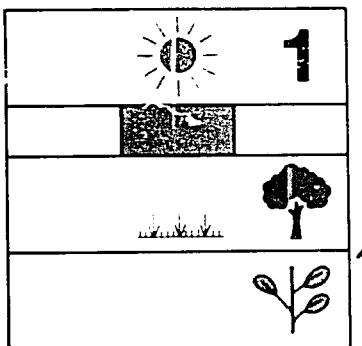
30. *Exopropacris modica* (Karsch, 1893)

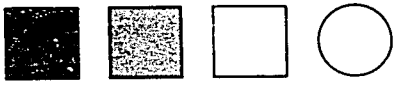


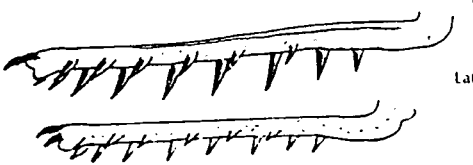


The nymphs of this species have a characteristic orange-brown coloration. The outer face of the hind femur has three large dark spots, joined by small black dots that sometimes coalesce into a black longitudinal band. In late instars the hind tibiae are pinkish.

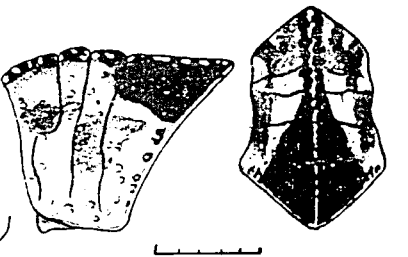
31. *Acanthacris ruficornis citrina* (Serville, 1838)







Hind tibia of late instar brown nymph of *Acanthacris* (above) and *Kraussaria* (below) compared

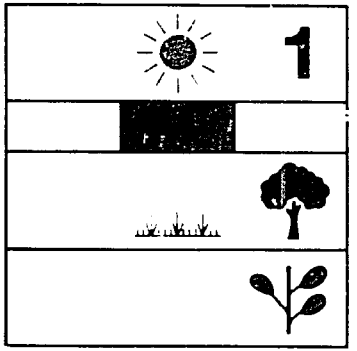


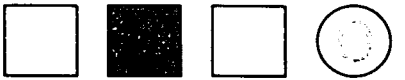
Lateral and dorsal view of pronotum in brown form

There are various colour forms: green, fawn and brown, the latter being particularly common among older nymphs, which often have a distinctive dark pattern (characteristic on the pronotum). Not to be confused with *Kraussaria* (no. 34), from which it differs by its longer tibial spines, and the coloration of the eye. In *Acanthacris* the eye stripes are dark brown on a fawn background and in *Kraussaria* blue, against a yellow background. (Note that the coloration can be verified only on live or freshly killed specimens, as it becomes quickly discoloured after death.)

Last instar nymph
♂

32. *Acridoderes strenuus* (Walker, 1870)



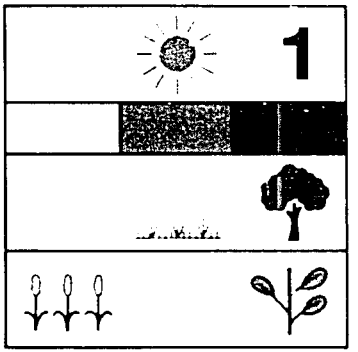


♂ 5 - 6? ♀

The nymphs of this species, as indeed of all Cyrtacanthacridinae, are laterally compressed. Ground coloration is greenish with a dark and light pattern (A). In young nymphs the median dorsal carina and the legs are orange-brown, but fade to green in later instars. Two black spots on the vertex of the head between the eyes are a useful identification character.

A. Nymph of penultimate instar and detail of head from above showing the dark spots

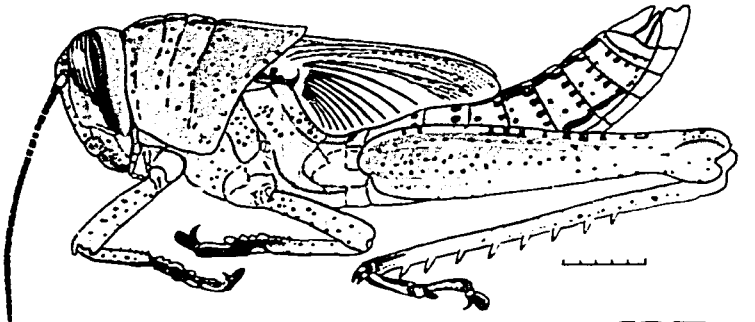
33. *Anacridium melanorhodon* (Walker, 1870)



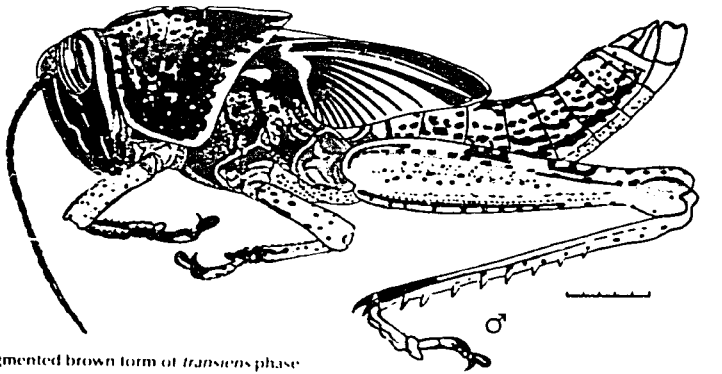
♂ 5 - 7 ♀

Ca Late instar green hopper with solitarious tendencies
Cb Typically gregarious late instar nymph
Cc Late instar nymph pigmented brown form of *transiens* phase

The young nymph of the Sahelian tree locust is green with fine black speckling on dorsal parts, with dark eyes and apically darkened antennae. In isolation, the dark coloration largely disappears; when gregarised, a wide range of colour forms develops (A, B, C, a-c). Following eclosion the first two instars remain in the ground vegetation near the hatching site, but older nymphs climb trees of their choice, *Balanites* or *Acacia* spp. for example.

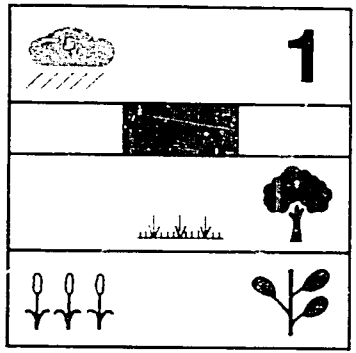


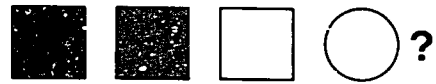
A. Late instar green hopper with solitarious tendencies



B. Late instar nymph pigmented brown form of *transiens* phase

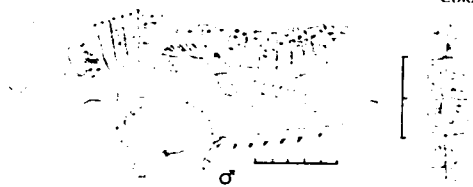
34. *Kraussaria angulifera* (Krauss, 1877)





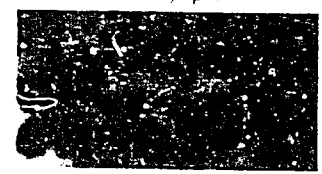
♂ 5 - 6 ♀

Colour variations in older nymphs



♂

Third instar with details of the eye and the pronotal crest

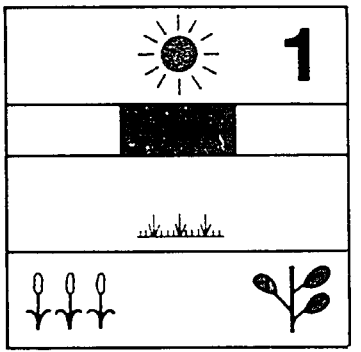


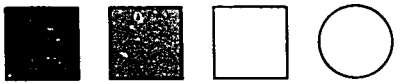
Last instar nymph

The nymphs of this species are robust, with an inflated pronotum covered in white tubercles; the blue eye stripes on a yellow background and the pink coloration of tibial spines are typical, as is the white line topping the median pronotal carina, lined with white dots. There are green and brown forms, the latter often with a more or less distinctive dark pattern; the darkest specimens are from the densest populations. This may imply some gregarious tendencies, but poorly developed. This species is locally a moderately serious pest in some parts of the Sahel.

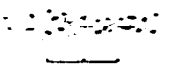
Last instar nymph

35. *Ornithacris cavroisi* (Finot, 1907)

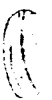




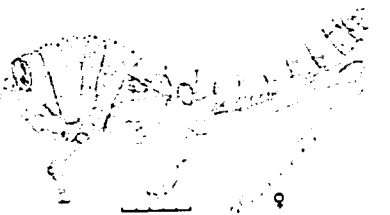
♂ 6 - 8 ♀



Detail of pronotal crest

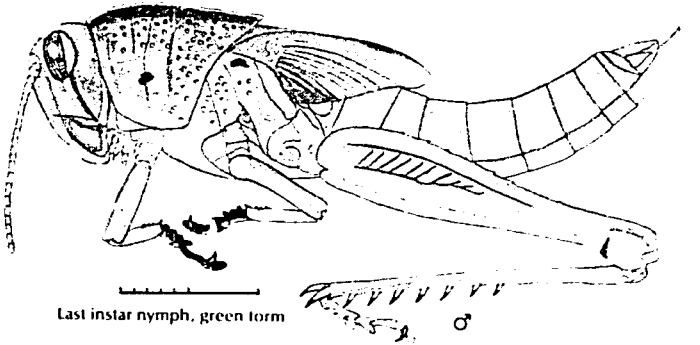


Eye



Third instar nymph

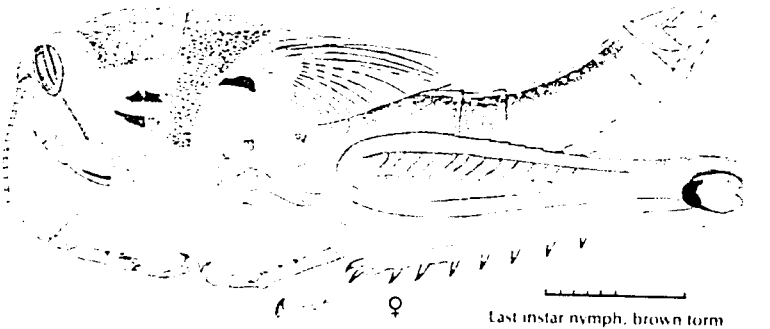
The nymphs of this species are laterally compressed; the median pronotal carina forms an arched crest, topped with white and lined with brown spots on each side. The general coloration is green and the hind tibiae pinkish. Brown forms exist among older nymphs, that resemble the adult in their coloration. Not to be confused with *Kraussaria* (no. 34), from which it differs in its general appearance, the arched pronotum and its coloration.



Last instar nymph, green form

♂

Last instar nymph, green form



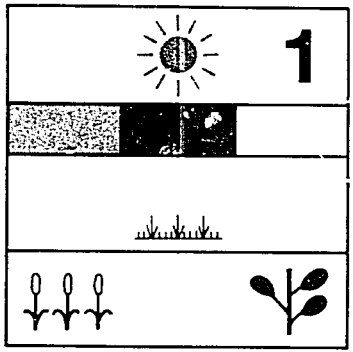
♀

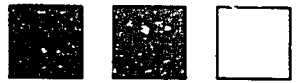
Last instar nymph, brown form

36. *Nomadacris septemfasciata* (Serville, 1838)

«le criquet nomade» red locust

1





♂ 6- -8 ♀

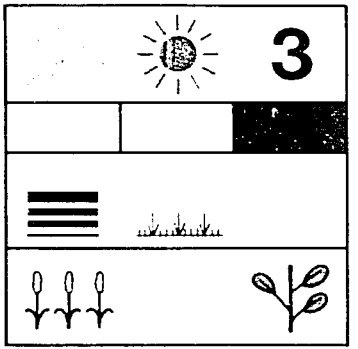
Penultimate instar of solitarious phase

In West Africa the red locust is known particularly from the Chad basin, the central Niger delta and the Cape Verde Islands, where its gregarisation is infrequent and does not lead to plagues. As in the desert and the tree locusts its nymphs show a wide range of colour forms in all instars from solitarious to gregarious, through numerous intermediate forms. These colour forms are typical of the species as is its choice of moist habitat, which corresponds to the wetter parts of the habitat of the migratory locust.

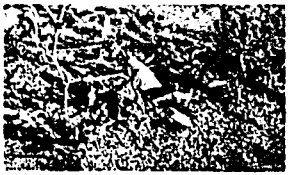
Last instar gregarious nymph

37a. Schistocerca gregaria (Forskål, 1775)

«le criquet pèlerin» desert locust



♂ 5 - 6 ♀



C

1. phase solitaire
solitarious phase

D

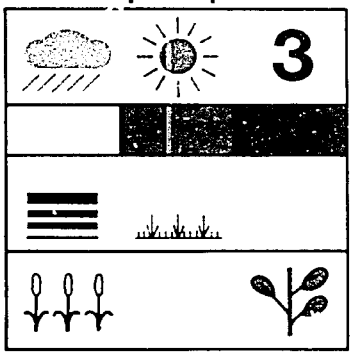
The desert locust is the most gregarious and economically the most important locust species. During recessions it occurs principally in the solitarious phase in its primary breeding areas (the Saharan ones in particular), where it lives the life of a nomad, normally moving from pasture to pasture as grass appears following sporadic rainfall. The young solitarious nymphs are a shade of green that harmonises with that of the food/shelter plant; as the vegetation begins to dry the nymphs may also turn brown (A, B, C, D). Not to be confused with nymphs of *Anacridium*, in which the eyes and the antennae are much darker.

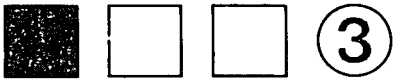
A

B

37b. Schistocerca gregaria (Forskål, 1775)

«le criquet pèlerin» desert locust





A group of late instar nymphs at the beginning of gregarisation

2. phase grégaire
gregarious phase

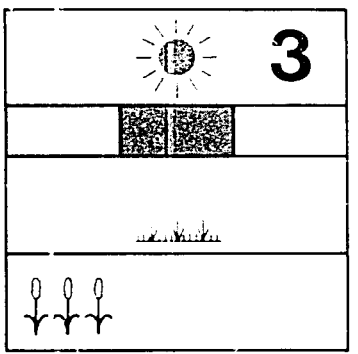
An example of colour changes in a gregarising population - solitarious on left, gregarious on right

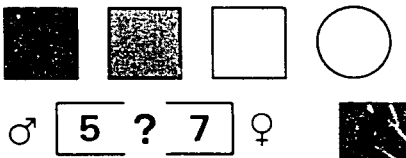
The process of transformation from the solitarious to the gregarious phase begins when the hopper density reaches a threshold of about 10-20/m^2. The process is a gradual one involving behavioural changes that lead eventually to the formation of mobile gregarious bands. This is accompanied by physiological changes, including colour changes at each moult. Once the gregarious phase is reached, the hoppers will find themselves in bands from the time of hatching – their colour will be almost entirely black (A).

A

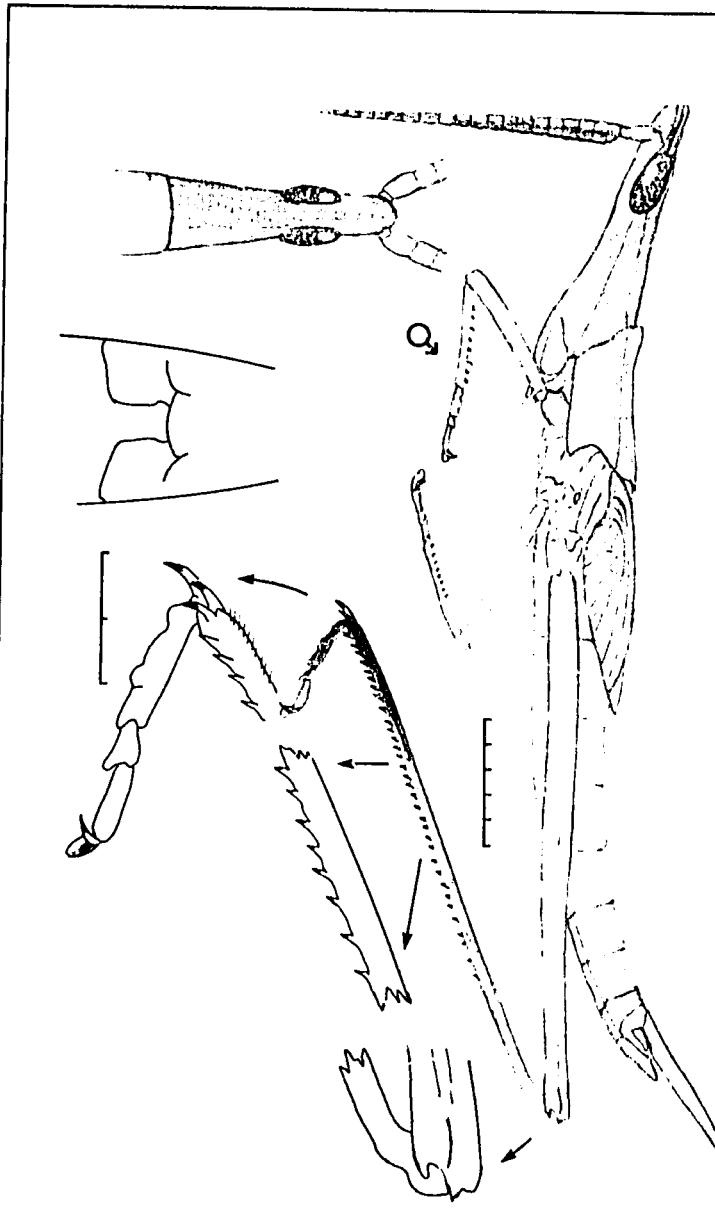
Last instar gregarious hoppers, when even the eyes are black and the eye stripes hardly visible

38. Acrida turrita (Linnaeus, 1758)

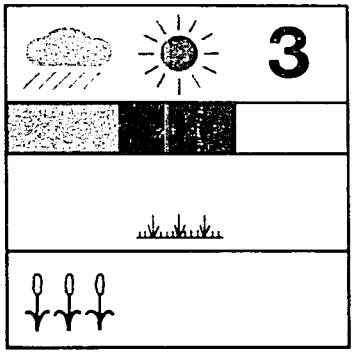


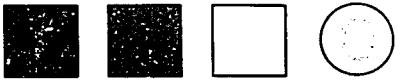


It is easy to recognise nymphs of *Acrida* species which resemble the adults, except that the supraanal plate of the nymph is elongate while that of the adult is short. The length of the supraanal plate can be used to separate *Acrida* nymphs from the otherwise superficially similar *Truxalis*: in *Acrida* the plate is approximately equal in length to the pronotum, in *Truxalis* it is markedly longer. It is however difficult to separate the species of *Acrida* even in the adult state. The general coloration is green, brown or a mixture.

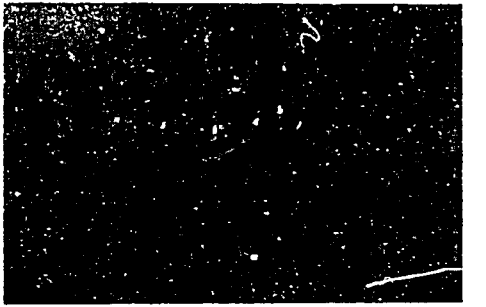


39-40. *Acrida bicolor* (Thunberg, 1815) and *A. sulphuripennis* (Gerstaecker, 1869)



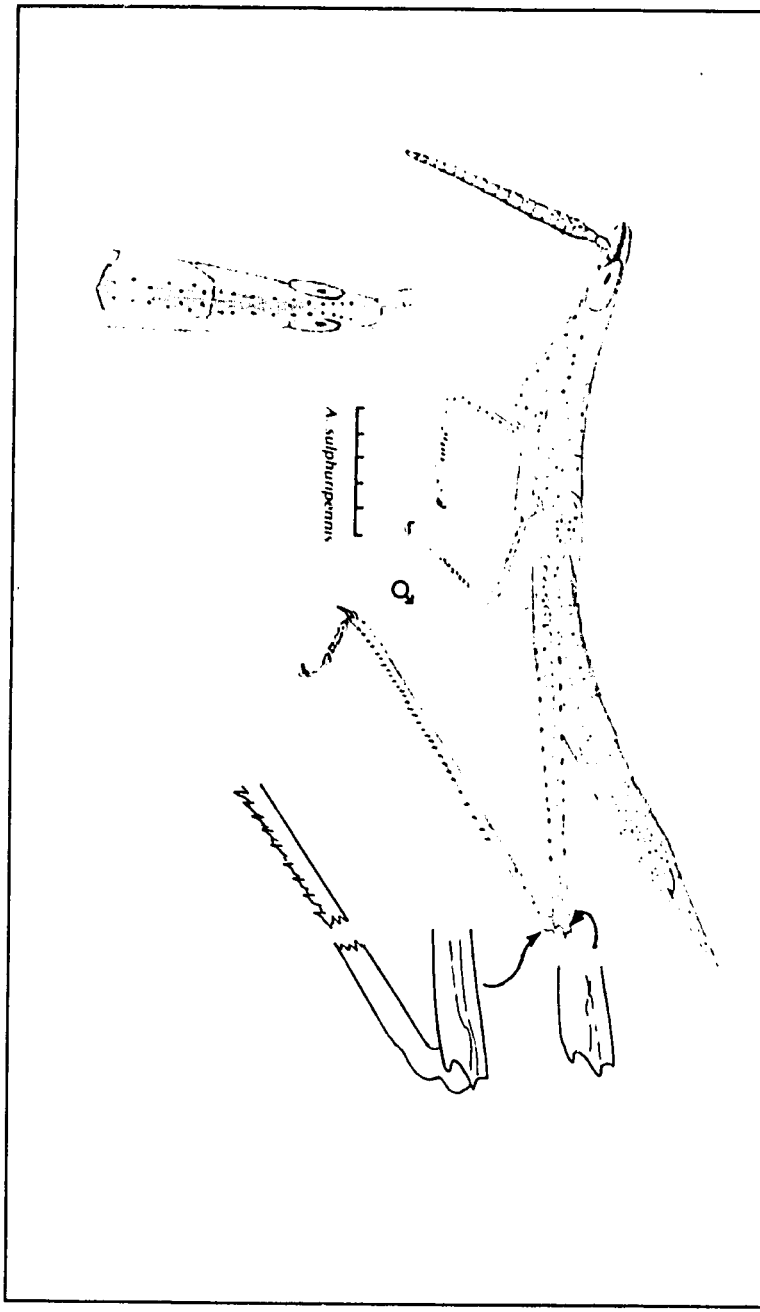


♂ 5 ? 7 ♀

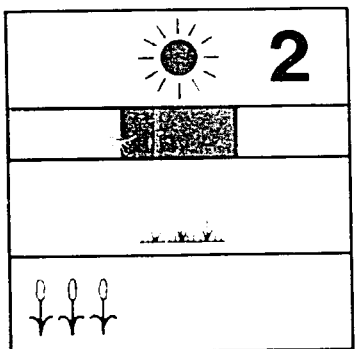


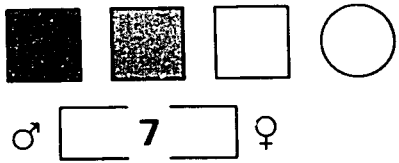
Acrida bicolor adult and nymphs

See comment under no. 38.


A. sulphuripennis
♀

41. *Duronia chloronota* (Stål, 1876)

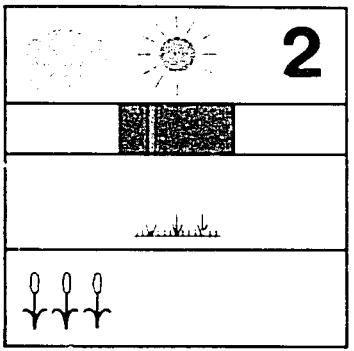




The coloration of the nymphs of this species is very variable: green, brown or mixed, with green or brown sides and a green, fawn, or even violaceous back. Such colour variation is also found in the nymphs of some other species, *Aiolopus thalassinus* (no. 50) for instance. *Duronia* is identified by the shape of its pronotum, with parallel lateral carinae and the centrally placed transverse sulcus.

Last instar nymph

42-43. Orthochtha ampla Sjostedt, 1931 and *O. nigricornis* (Karsch, 1893)

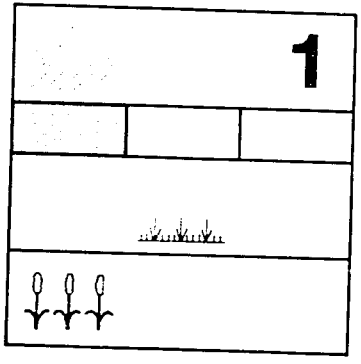


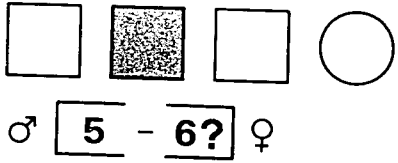
♂ **5** - **6** ♀

The general appearance and coloration of nymphs of a majority of *Orthochtha* species resemble fairly closely that of the adults. Those of *O. ampla* and *O. nigricornis* are recognised by the wide lateral black (or dark-brown) band, the green sides and a pale, sometimes slightly brownish back. The cerci never extend beyond the tip of the abdomen. However, it is only in the last instar that the two can be separated, when the lateral pronotal carinae become divergent in *O. ampla*.

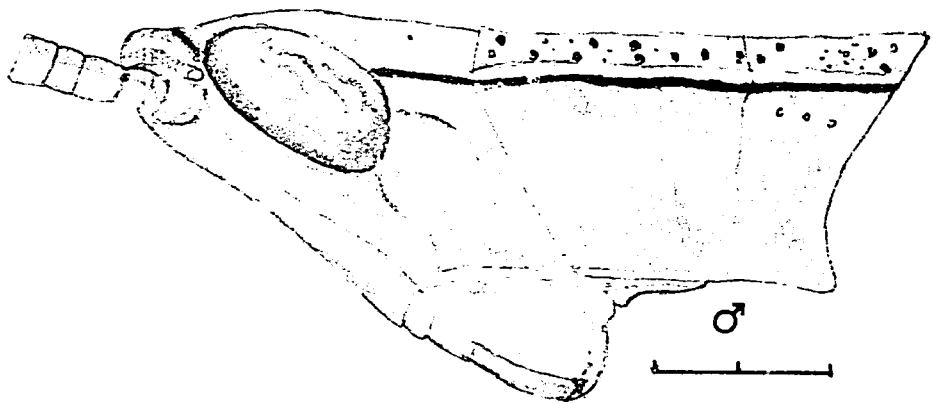
A. Last instar nymph, *O. ampla*

44. *Orthochtha sudanica* Popov and Fishpooi, 1988



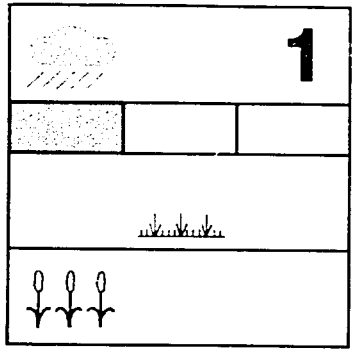


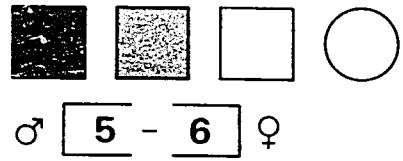
The general coloration of nymphs of this species is similar to those of the preceding species, the narrow lateral band is distinctive, as is the habitat, moist grasslands on clay soils, often in the company of *O. venosa* (no. 45).

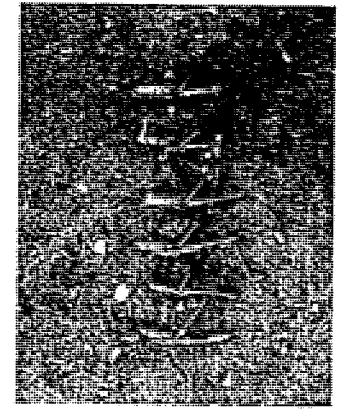


A. Late instar nymph, head and pronotum

45. *Orthochtha venosa* (Ramme, 1929)

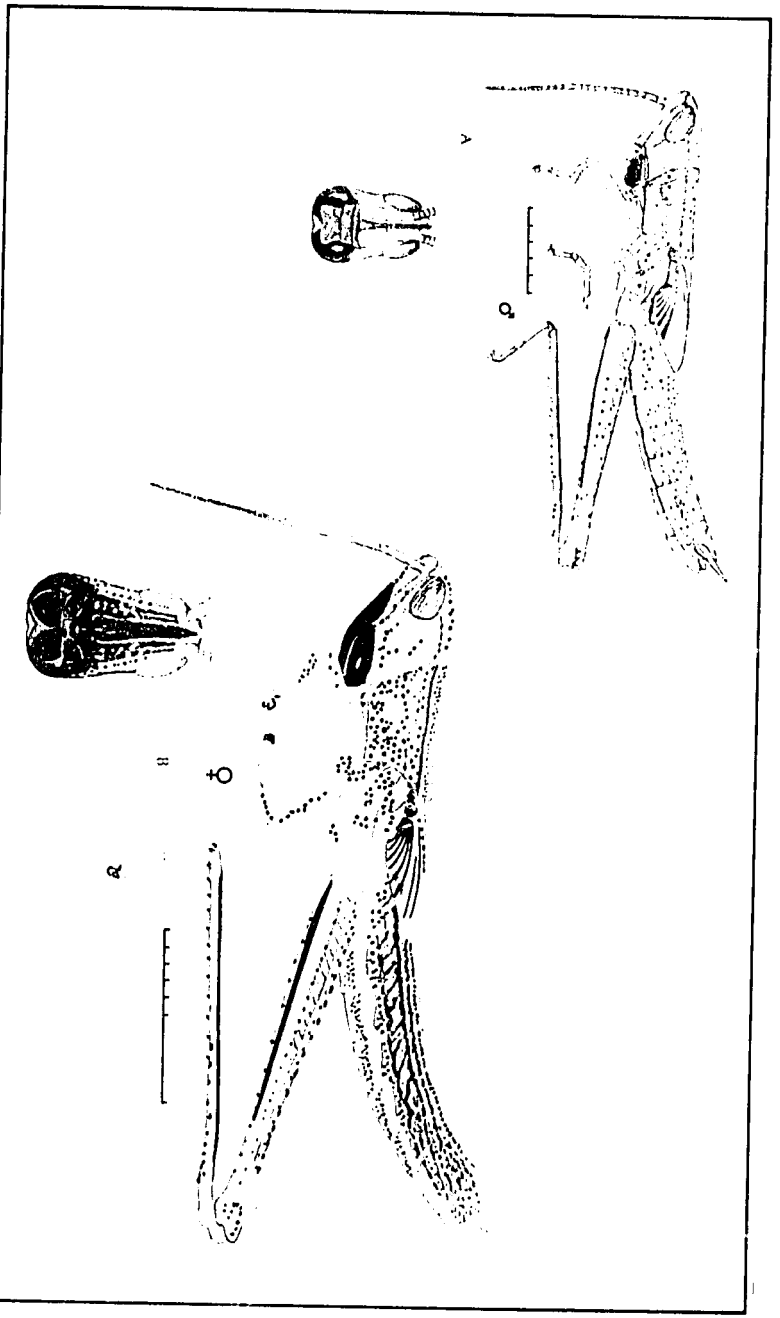




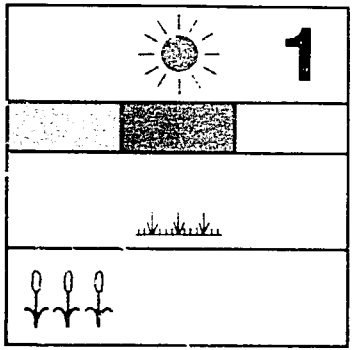


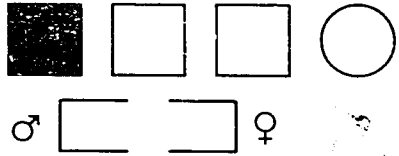
C

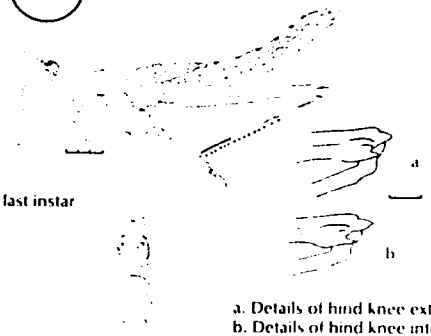
The nymphs of this species are closely associated with moist grasslands on clay soils subject to flooding that they frequently share with the preceding species and with *Hieroglyphus daganensis* (no. 3). Like *H. daganensis*, they manifest some gregarious tendencies and hopper concentrations often consist of a mixture of the two species. The colour differs from that of adults by the absence of the lateral band. In solitarious forms the general coloration is fawn to light brown on the sides, somewhat paler dorsally, with abundant dark speckling (A). The gregarious coloration is distinctive (B and C) and develops in the later instars.



46. Amphicremna tschoffeni I. Bolivar, 1908







A. Nymph of last instar

a. Details of hind knee external side
b. Details of hind knee internal side

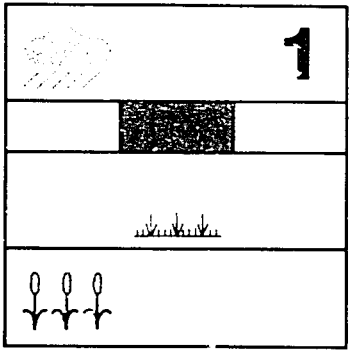
In their yellowish-brown coloration the nymphs of this species resemble the adults, as they do in their elongate shape and the elongate lobes of the hind knees. Further characters include the darkened areas at the base and apex of the inter-face of hind tibiae which bear 14-17 external spines.

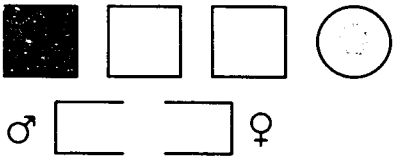
B. Nymph of penultimate instar

b. Details of hind knee internal side

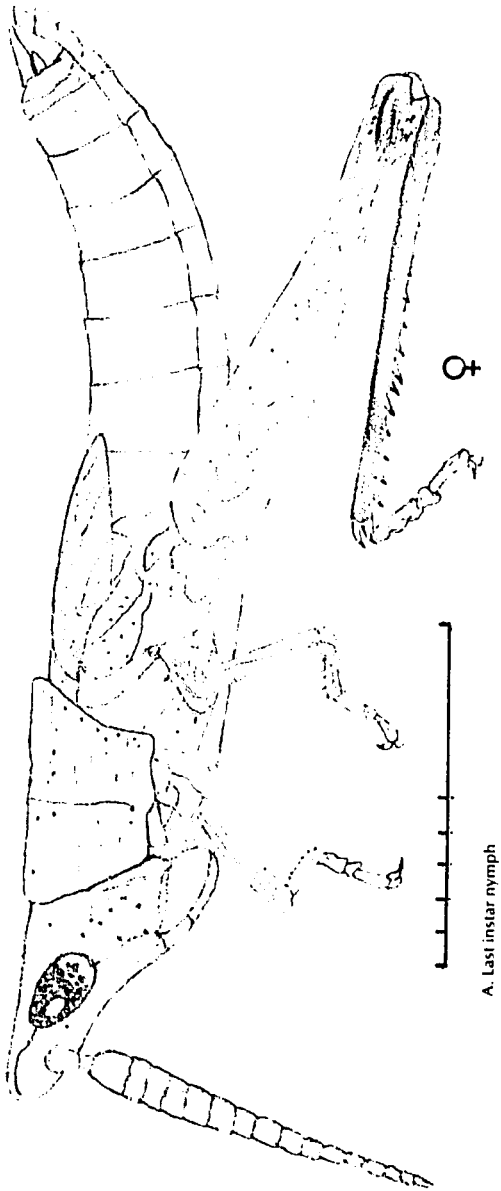
c. Details of hind knee external and internal side, adult

47. Sherifuria haningtoni Uvarov, 1926

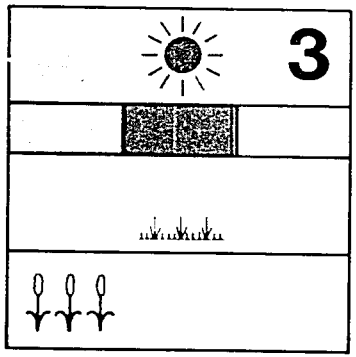


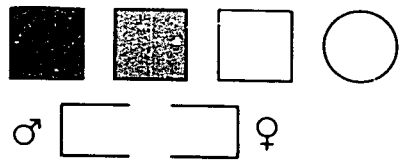


The nymphs and adults of this species are very similar in their general build and coloration. They are frequently found among the dense undergrowth of savanna trees.


♂
A. Last instar nymph

48. Coryphosima stenoptera (Schaum, 1853)



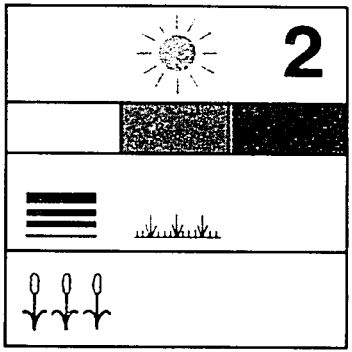


As in preceding species the nymphs are recognised by their resemblance to adults. Brown colour forms are more frequent than the green.

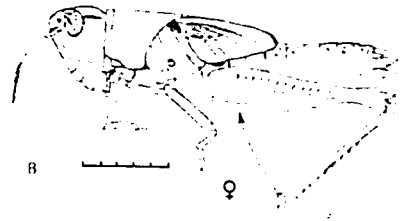
A. Last instar nymph

49. Aiolopus simulatrix (Walker, 1870)

«le criquet Fouisseur» Sudan plague locust



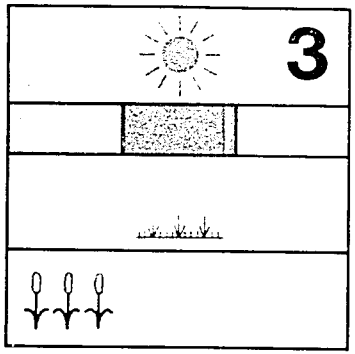
♂ 5 ♀

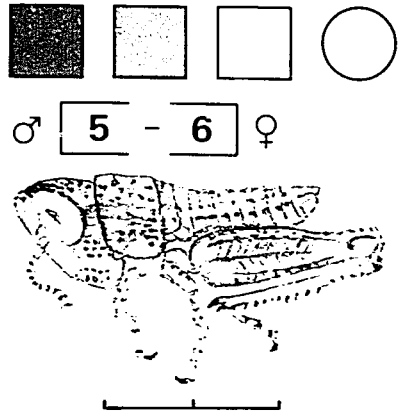


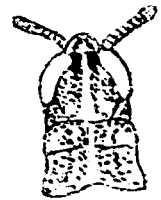
The Sudan plague locust is regarded as the most injurious grasshopper species to cereal crops in the Sudan, but rather less so in the Chad and Senegal basins, where it also at times causes serious damage. The nymphs, like the adults, have distinctive relatively short hind tibiae. *A. simulatrix* exhibits some gregariousness and its nymphs develop a dark pigmentation at high densities (A). The solitarious nymphs are brown (B), green, or a mixture of the two colours. The species is associated predominantly with grasslands on clay soils subject to flooding and to cracking when dry.

A
♀

50. Aiolopus thalassinus (Fabricius, 1781)

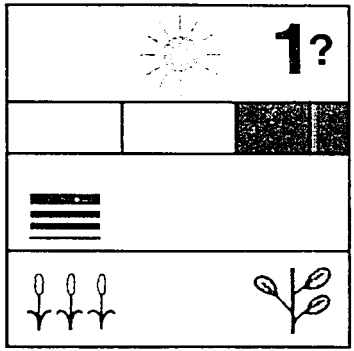


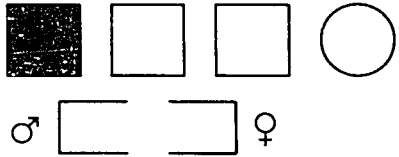




This species can be separated from its congener (no. 49) by its more slender hind femora and longer tibiae. The coloration of the nymphs is very variable: it is brown speckled with darker brown in the hatchlings (A), later it turns entirely green, or green laterally and brown, or violaceous dorsally, with or without a white median longitudinal stripe (C). It occurs in a wide range of grassland communities, but most frequently in short grass stands such as *Cynodon dactylon* along the banks of watercourses.

51-52. Pseudosphingonotus savignyi (Saussure, 1884) and *P. paradoxus* (Bel Bienko, 1948)



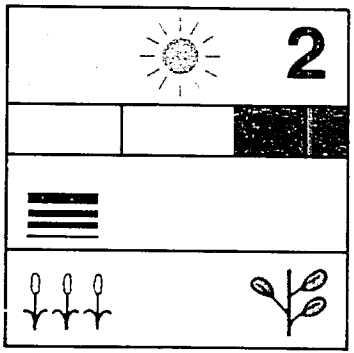


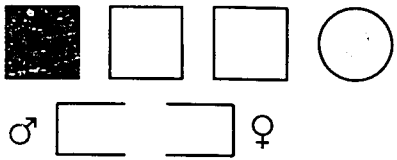
The adults of these two species are recognised by the differences in their wing venation and cannot be separated as nymphs. Otherwise they are recognised by their geophily and their variable coloration which harmonises closely with that of the substrate (A and B). Not to be confused with *Eurysternacris brevipes* (no. 54), a more robust species or with *P. canariensis* (Saussure, 1884), a smaller species, both of which occur south to 12°N latitude, while *P. savignyi* is not found south of the 15°N parallel.

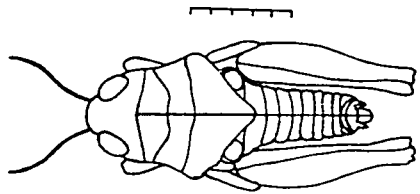
♂
8

♂

53. *Pycnodictya diluta* Ramme, 1929





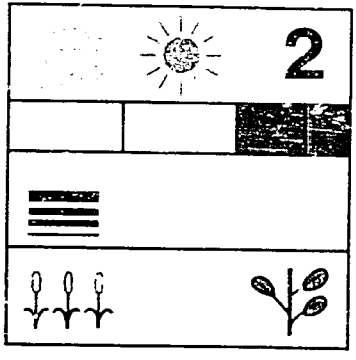


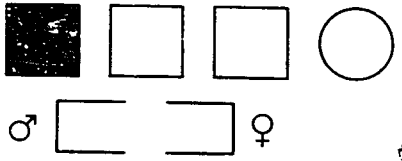
B. Third instar nymph

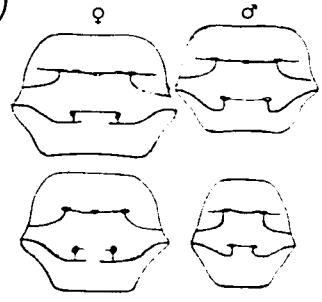
The nymphs of this species are recognised by their robust build, inflated head and arched pronotum; also by their close association with bare lateritic surfaces. The coloration always matches that of the soil. Not to be confused with *Scintharista notabilis* (Walker, 1870) a species of similar habits, but in which the pronotum is distinctly less arched.

A. Third instar nymph

54. *Eurysternacris brevipes* Chopard, 1947

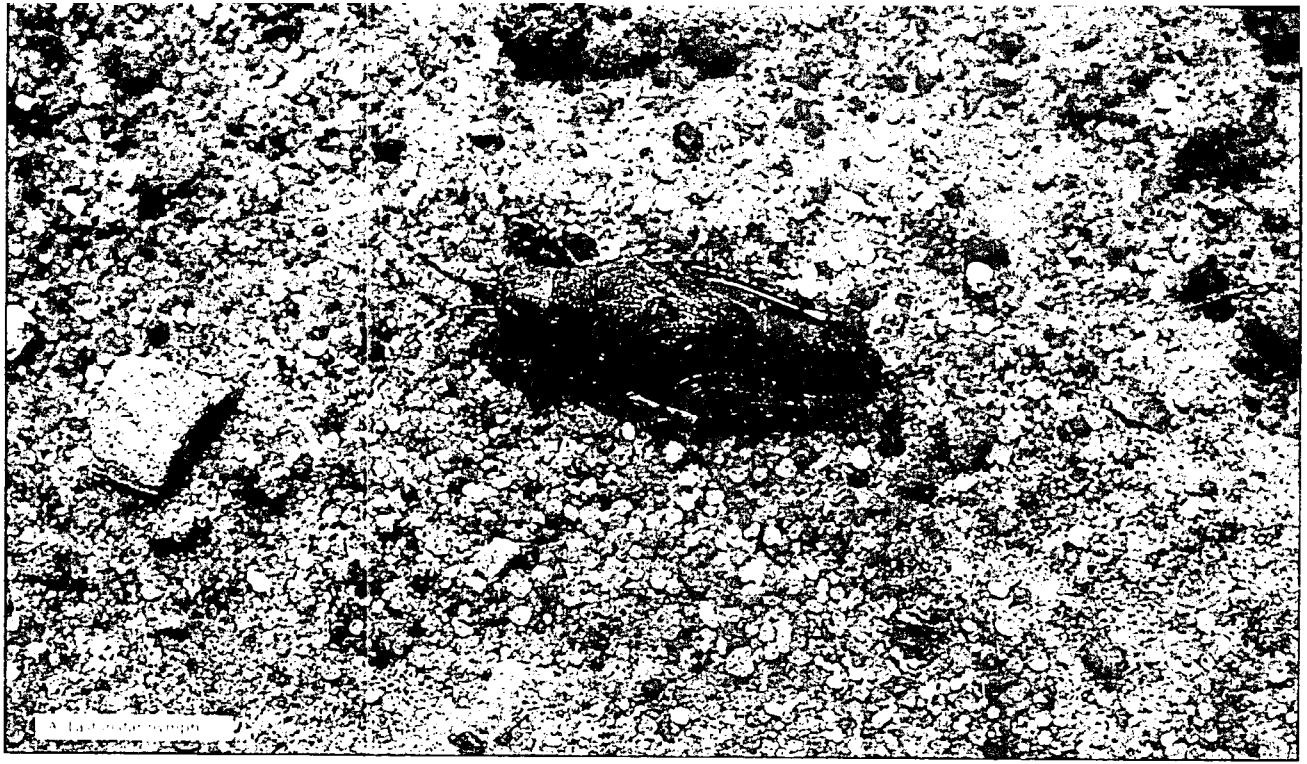




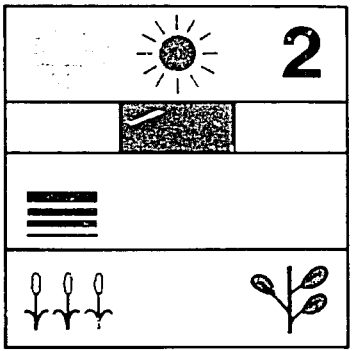


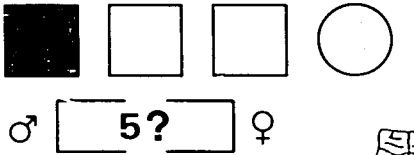
B. The sternal plate in *Eurysternacris* (above) and *Pseudosphingonotus canariensis* (below)

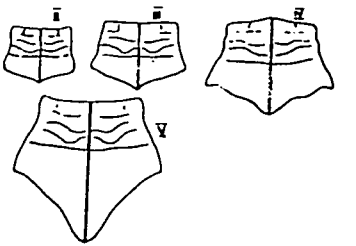
Similar to, but distinctly more robust and broader than *Pseudosphingonotus savigny i* (no. 51), especially in the female.



55. Heteropternis thoracica (Walker, 1870)

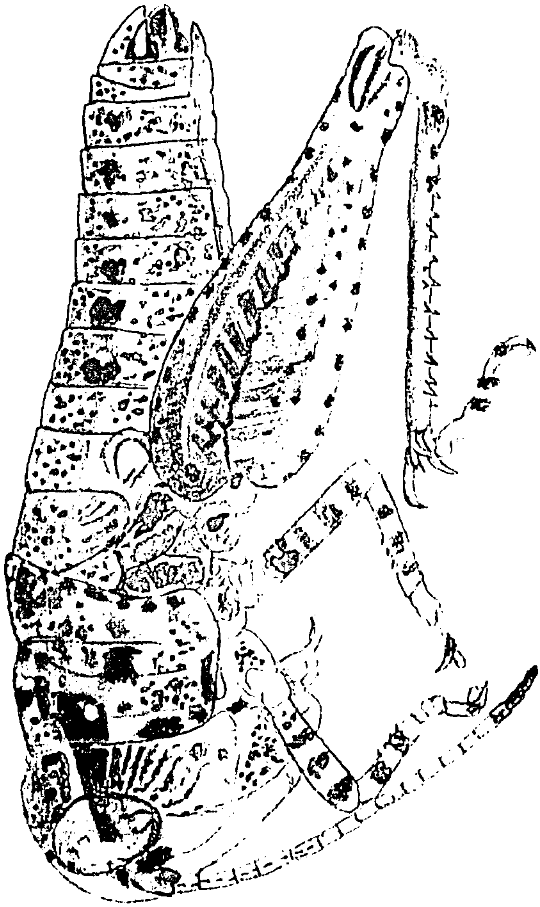




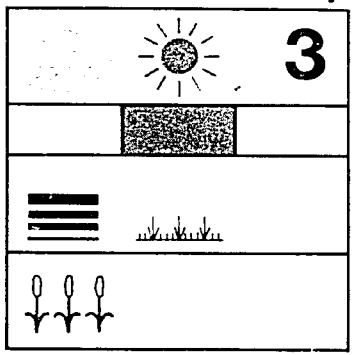


B. Dorsal view of pronotum in second to fifth instar nymphs

The nymphs of this species are easy to recognise by: robust build (maximum width greater than maximum height); long antennae; elongate metazona of the pronotum, especially in late instars (B); large hind femora, and elongate inner hind spurs. The general coloration harmonises with the soil surface, but the transverse dark bands on the front and middle legs are characteristic.

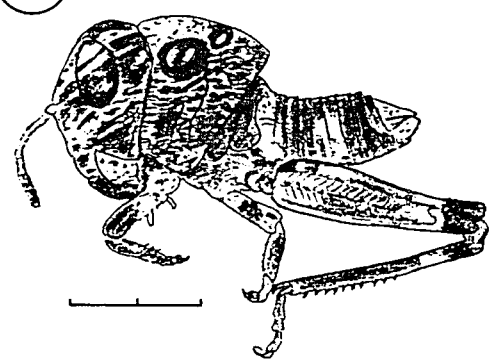


56-57. *Gastrimargus africanus* (Saussure, 1888) and *G. determinatus procerus* (Gerstaecker, 1889)



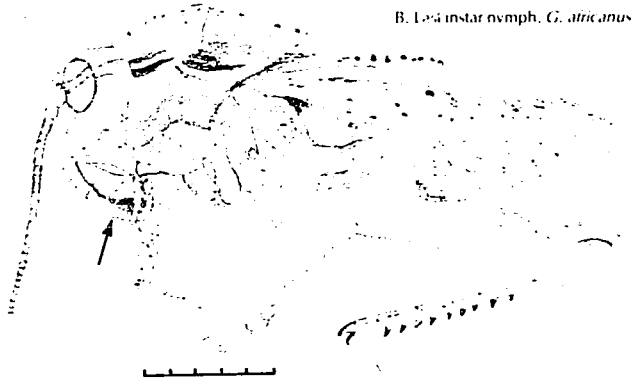
♂ 5 - 6 ♀

A. First instar nymph, *G. africanus*

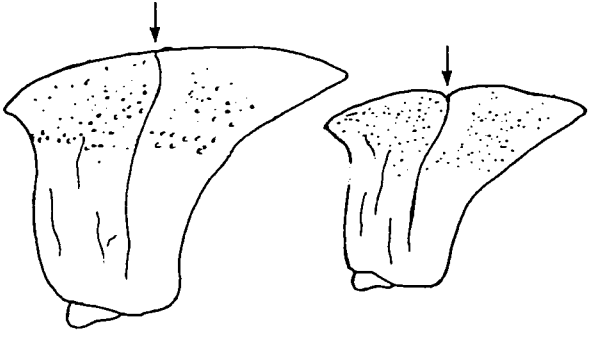


The nymphs are strongly compressed laterally with the median pronotal carina strongly raised as a crest. The first two instars are very distinctive: they are predominantly blackish-brown and bear three shiny tubercles, one behind the eye and two others in a straight line on the pronotum (A). Subsequently these tubercles disappear and the nymphs turn brown, or partly green, often with a pale pattern behind the eye and on the pronotum (B). The nymphs of *G. africanus* are similar to those of *G. d. procerus* but in the latter the first and second instar are a paler brown and the tubercles are more shiny while in later instars the pronotal crest is cut by the main sulcus in *africanus*, but not in *procerus*. Both differ from *Locusta* and *Oedaleus* by the more crested pronotum.

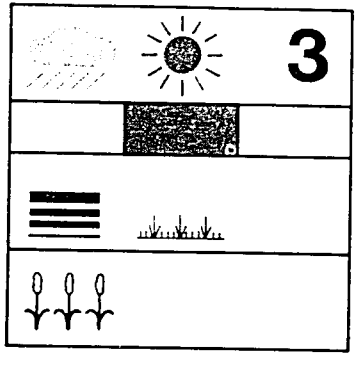
B. Last instar nymph, *G. africanus*

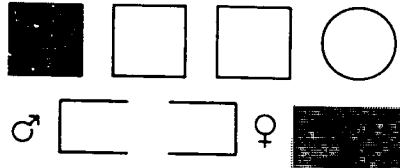


C. Pronotum sulcus in (a) *G. africanus*, and (b) *G. d. proceras*



58. Humbe tenuicornis (Schaum, 1853)



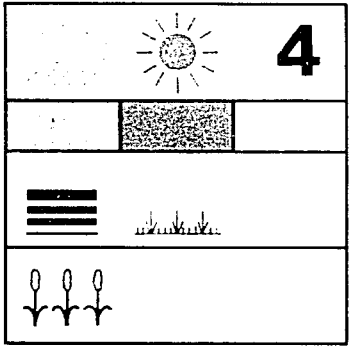


B. Last instar nymph

The nymphs are relatively smaller and even more compressed laterally than those of *Gastrimargus*, and their pronotal crest is even more raised. They also have very thin antennae and are usually a uniform brown without distinctive patterns.

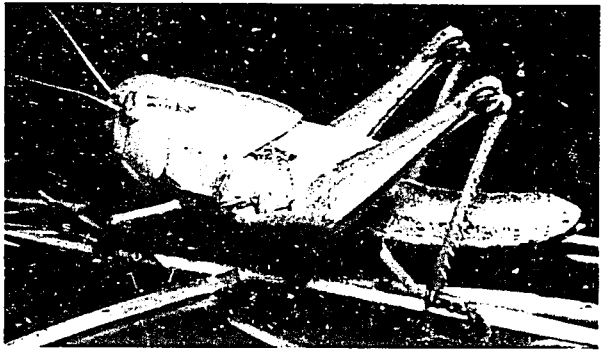
A. Fifth instar nymph

59a. Locusta migratoria migratorioides (Reiche and Fairmaire, 1850) «le criquet migrateur Africain» African migratory locust



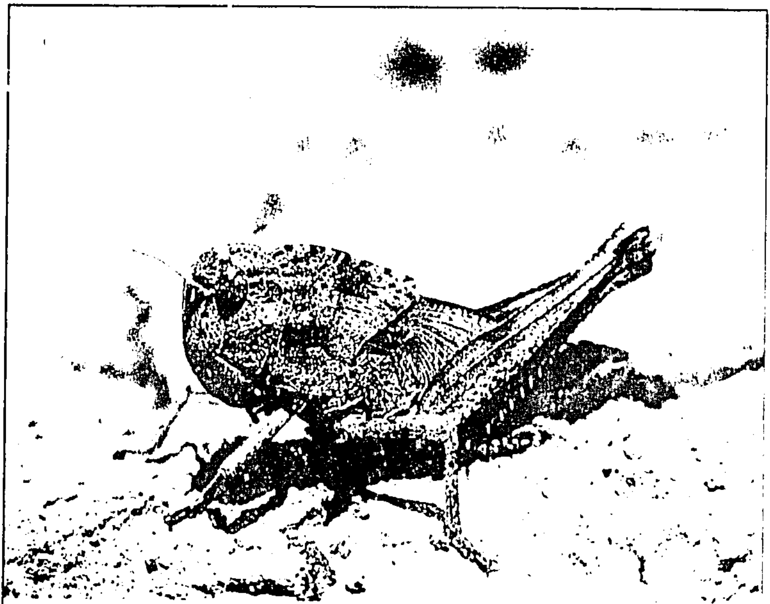
3 l. phase solitaire
solitarious phase

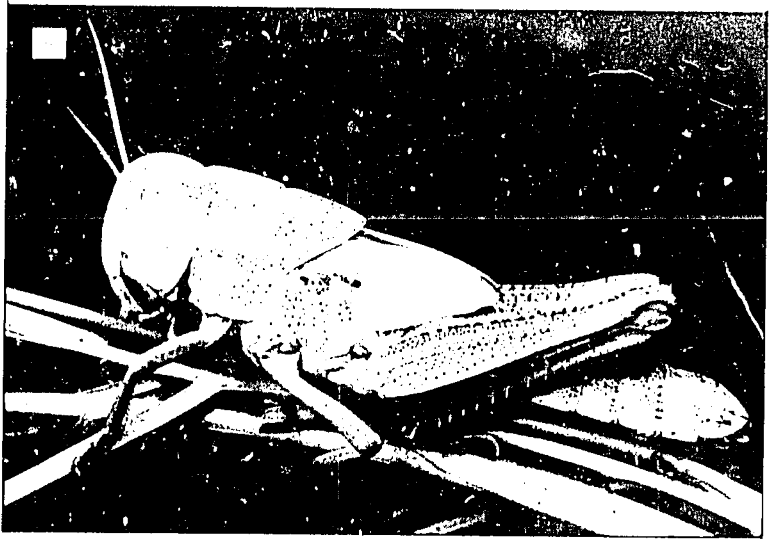
♂ 5 5+1 ♀



A

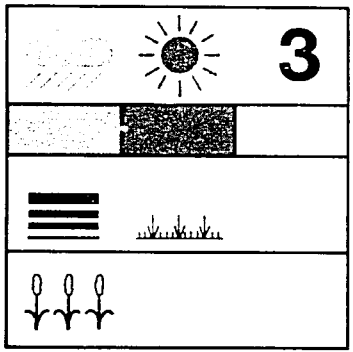
Like other locusts the migratory locust changes its phase on crowding. Solitary nymphs are cryptically coloured in shades of green, brown, grey, or even black (on burnt ground) (A-C). Not to be confused with *Gastrimargus*.

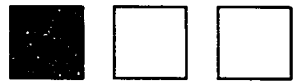




59b. Locusta migratoria migratorioides (Reiche and Fairmaire, 1850) «le criquet migrateur Africain» African migratory locust

1





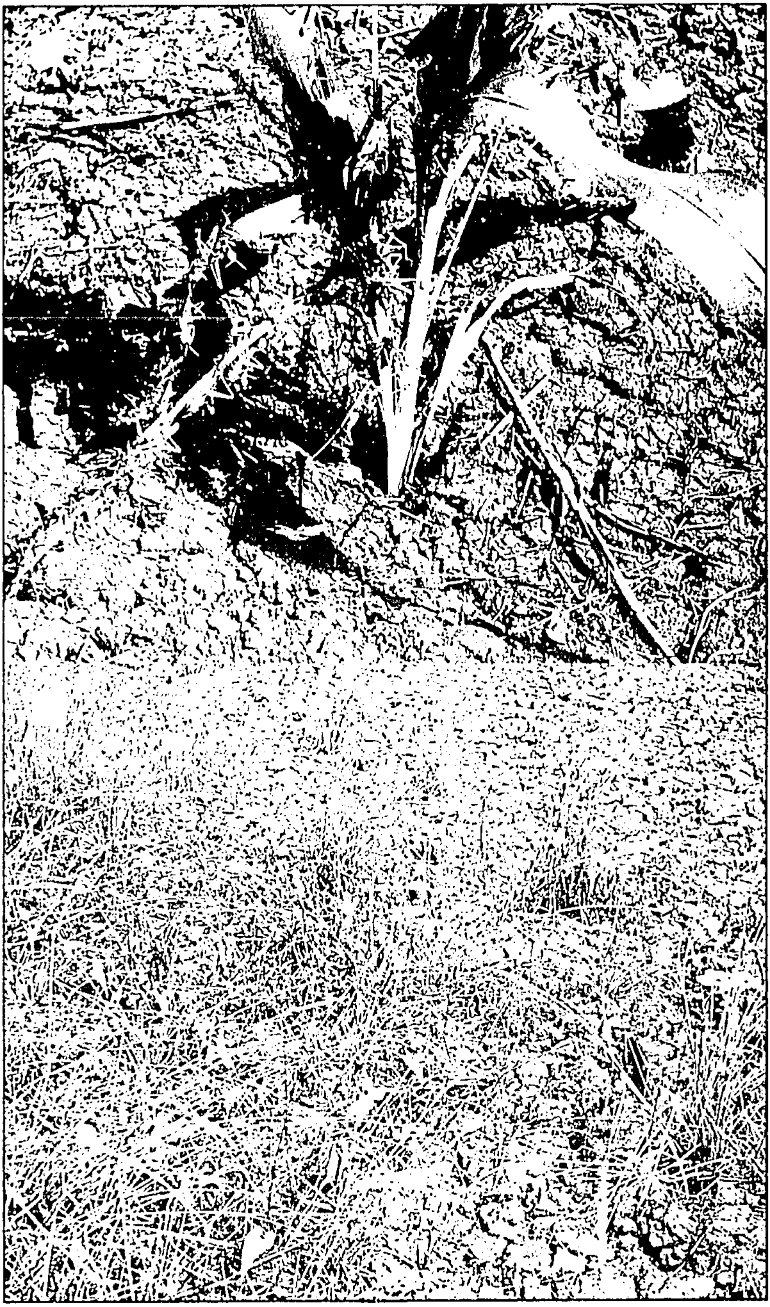
2. phase grégaire
gregarious phase

♂ 5 5 ♀

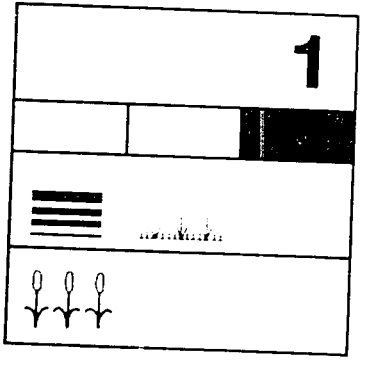
B

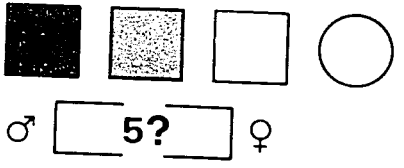
A

The gregarious nymphs generally occur in bands and when marching may invade crops and cause damage (C and D). Their pronotal crests are less raised than in the solitarious phase and their coloration is black and rust-brown (A and B). The migratory locust generally inhabits moist and wet grasslands subject to seasonal flooding.



60. *Oedaleus johnstoni* Uvarov, 1941

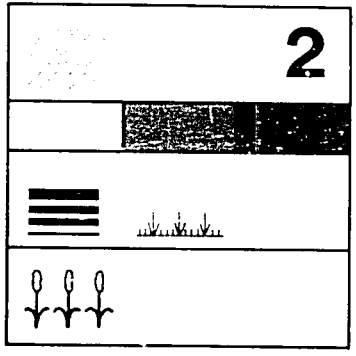


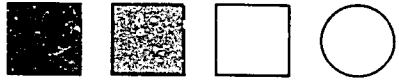


As in other *Oedaleus* species the nymphs occur in shades of green or brown. This species is found north of the 16th parallel in Saharan pastures, which they may, at times of mass reproduction, damage more or less severely. This occurs particularly frequently in the valleys of Adrar des Iforas in Mali. Because of its geographic distribution it is seldom found together with *O. senegalensis* (never with *O. nigeriensis*) but differs from both in its more robust build and larger, more arched pronotum.

A. Last instar nymph

61. Oedaleus nigeriensis Uvarov, 1926





C. Last instar nymph, brown form

D. Lateral pronotal lobes in *O. nigeriensis* above and *O. senegalensis* below – right to left: third, fourth and fifth instar nymphs

3

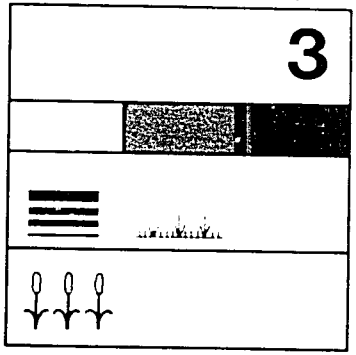
It is difficult to separate *O. nigeriensis* and *O. senegalensis* in the first two instars. Later they may be differentiated by the more elongate pronotal lobe in *O. nigeriensis*. A further distinctive character is the oblique white stripe across the eye.

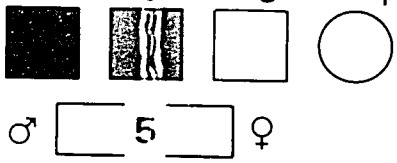
A. Lateral view last instar nymph, green form

B. Dorsal view, brown form

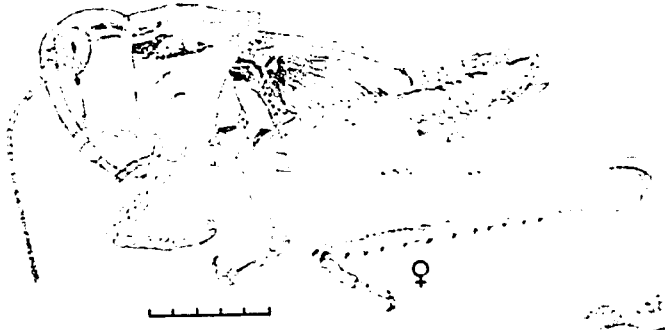
62. *Oedaleus senegalensis* (Krauss, 1877)

«le criquet Sénégalais» Senegalese grasshopper

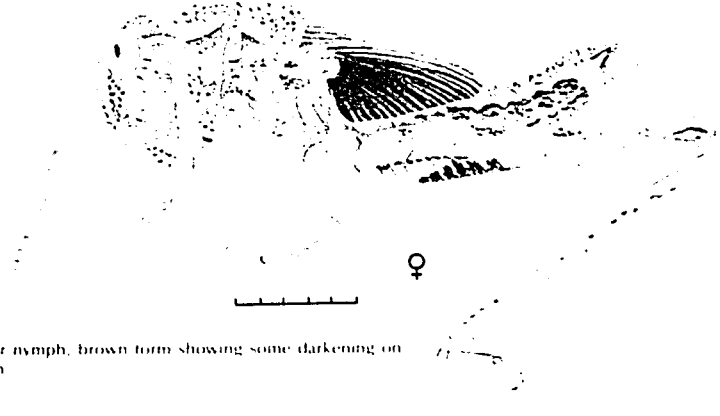




This is by far the most injurious species of Sahelian grasshopper. It shows some gregariousness, such that, when crowded, the nymphs may form marching bands; their colour changes progressively with a dark pattern appearing on the wing pads and the outer face of hind femora in both the green and especially the brown forms. Not to be confused with the preceding species.

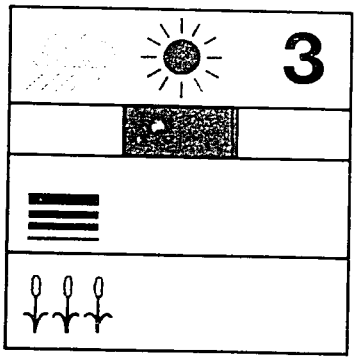


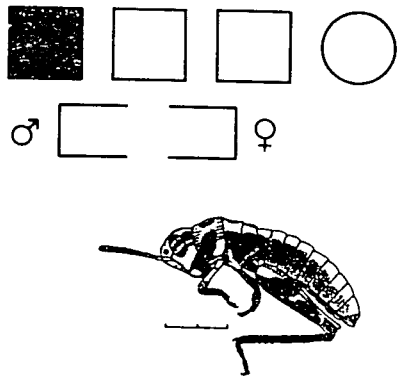
A. Last instar nymph, green form



B. Last instar nymph, brown form showing some darkening on gregarisation

63. *Morphacris fasciata* (Thunberg, 1815)





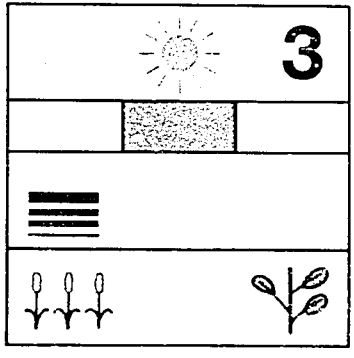
B. First instar lateral view

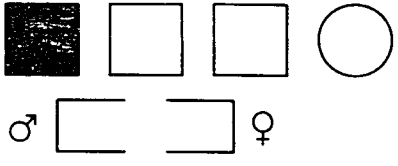
A. First instar dorsal view

The nymphs are easy to recognise by the dark band across the lower part of the pronotal lobe, which extends onto the head (A, B, C). The longitudinal furrows are as distinctive in the nymphs as they are in adults. This species shares the habitat of *Aiolopus thalassinus* (no. 50) and *Acrotylus patruelis* (no. 68).

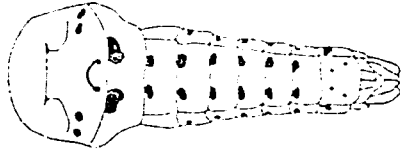
C. Third instar nymph

64. *Trilophidia repleta* (Walker, 1870)

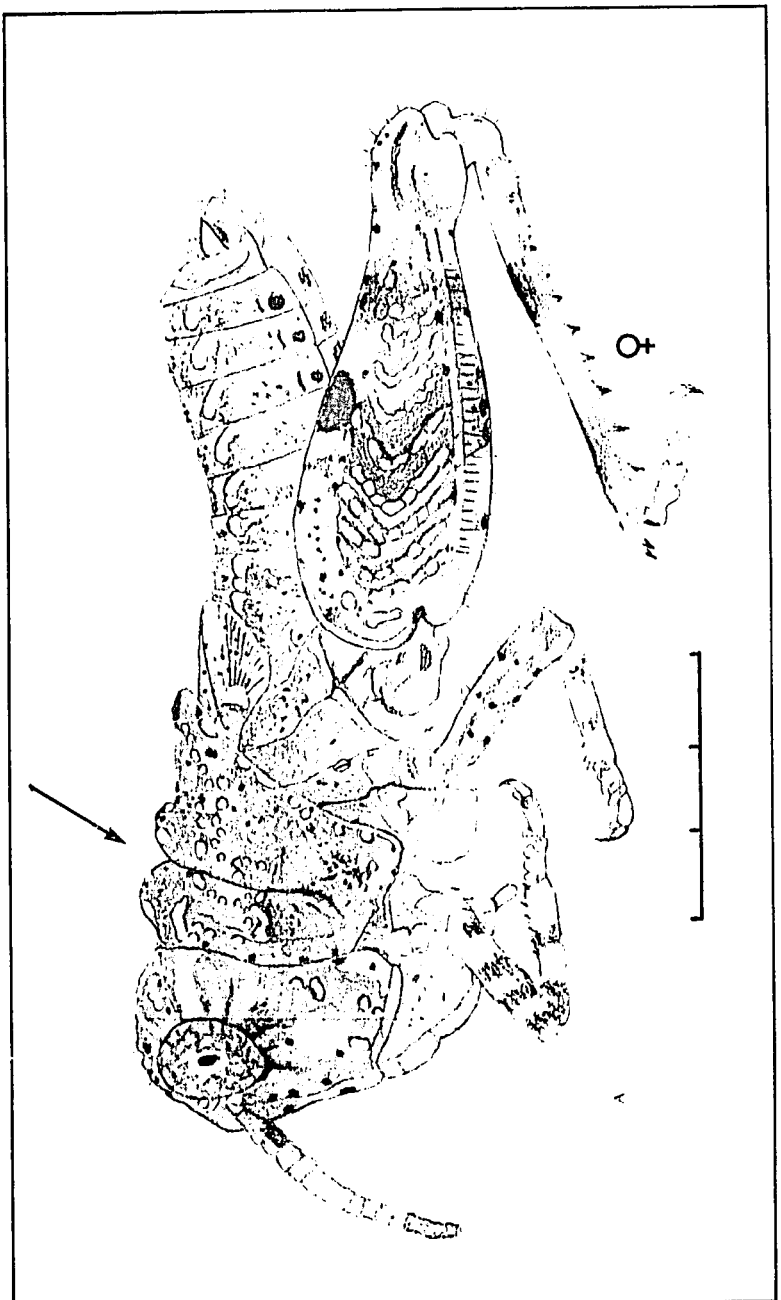




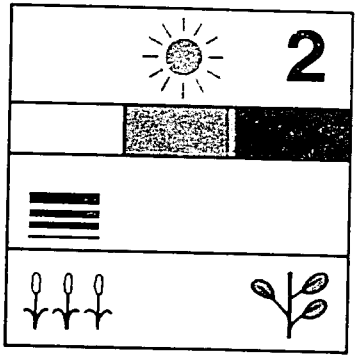
B

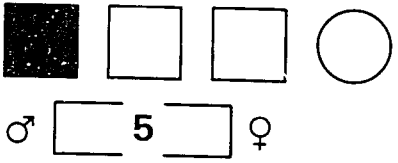


This species is easily recognised by the shape of its pronotum, which is deeply incised by transverse sulci so that two teeth are seen in profile, a character readily visible in the nymphs (A). It is also easily distinguished from its congener, *T. conturbata* (Walker, 1870), by the row of black spots on the underside of the abdomen (B).



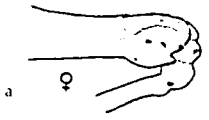
65. *Acrotylus blondeli* Saussure, 1884





B. Dorsal view of pronotum in the fifth instar

C. Inner side of hind knee in *A. blondeli* (a) and *A. longipes* (b)

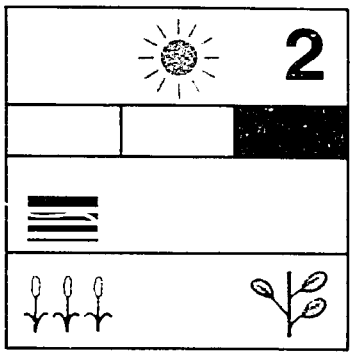


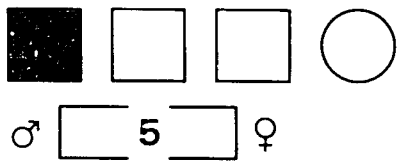
The nymphs belonging to some *Acrotylus* species are readily recognised by the shape of their pronotum which, as in adults, is very short and saddle-shaped. In addition the nymphs bear a dark vertical stripe on the sides of the third abdominal segment, and sometimes a second, on the fourth. *A. blondeli* has a single stripe, and a dark inner side to the hind knee and apex of tibia. Not to be confused with *A. longipes* (no. 66).

A. Third instar nymph

66. Acrotylus longipes (Charpentier, 1843)

3



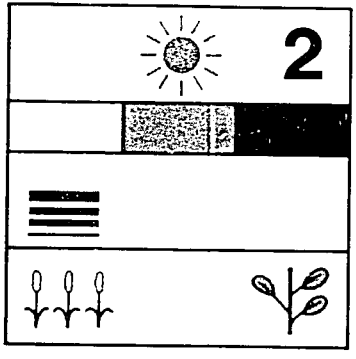


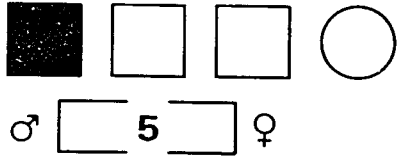
B. Dorsum of pronotum

The nymphs of *A. longipes* are characterised by two vertical stripes and long slender legs, also by the distinctive pattern of the pronotum (B), a pale inner side of the hind knee and by their sandy dry habitat in the northern Sahelian and the Saharan zones. Not to be confused with *A. blondeli* (no. 65).

A. Fifth instar nymph

67. Acrotylus daveyi Mason, 1959

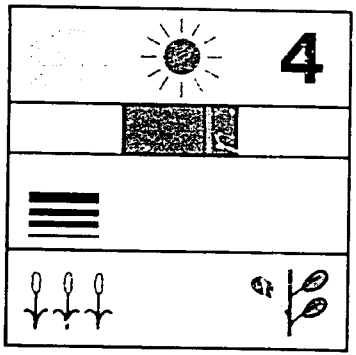


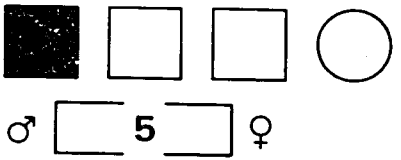


The nymphs are more robust and have shorter legs that the other *Acrotylus* species. They bear two stripes and the pronotal pattern is characteristic. The species has a typically Sahelian distribution and frequently occurs in fields of millet and cowpea.

A. Nymph of penultimate instar

68. Acrotylus patruelis (Herrich-Schaeffer, 1838)

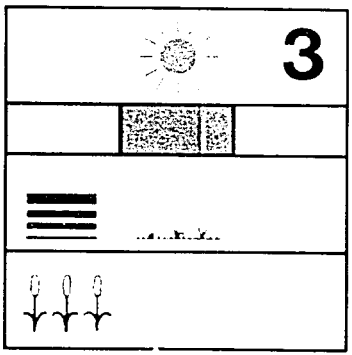


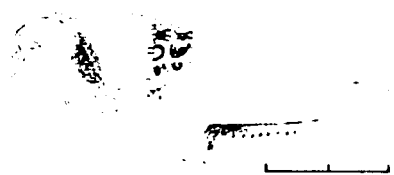


As in the other species, the structure and the pattern of the pronotum are characteristic; there are two broad vertical stripes. This species is found predominantly on clay substrates with sparse vegetation cover, the habitat is shared with *Morphacris fasciata* (no. 63) and *Aiolopus thalassinus* (no. 50).

A. Last instar nymph

69. *Calephorus compressicornis* (Latreille, 1804)



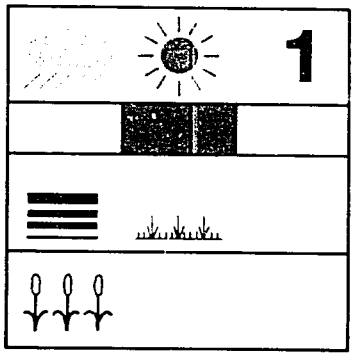


A. First instar nymph

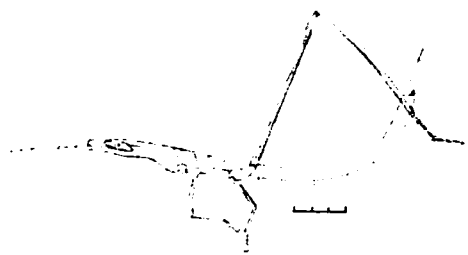
The young nymphs of this species are remarkable for their coloration (A); older nymphs resemble the adults and, like them, have green (B) and brown forms. The preferred habitat is patches of *Cynodon dactylon* (star grass), along the edges of watercourses.

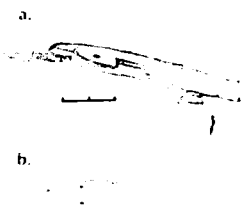
B. Fifth instar nymph

70. Acridarachnea ophthalmica I. Bolivar, 1908

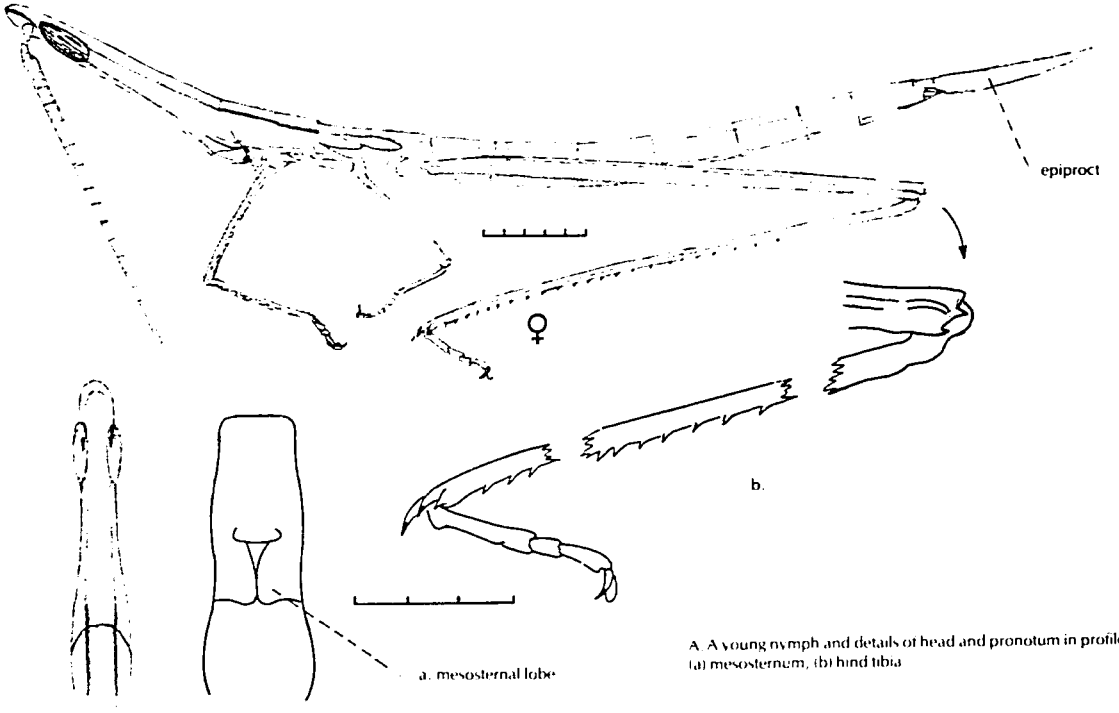


♂ 5 7+ ♀



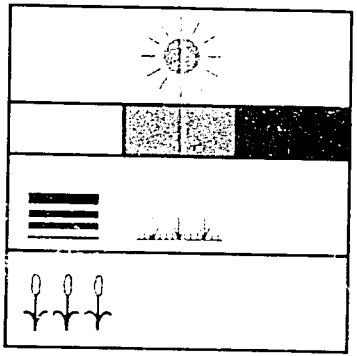


The nymphs resemble the adults and can be recognised by their striking elongate build and the closed mesosternal interspace (b). As in *Acrida* species, the supraanal plate (epiproct) is elongate in nymphs and short in adults.



A. A young nymph and details of head and pronotum in profile: (a) mesosternum, (b) hind tibia

71-73. Truxalis johnstoni Dirsh, 1950, *T. procera* Klug, 1830 and *T. longicornis* (Krauss, 1902)



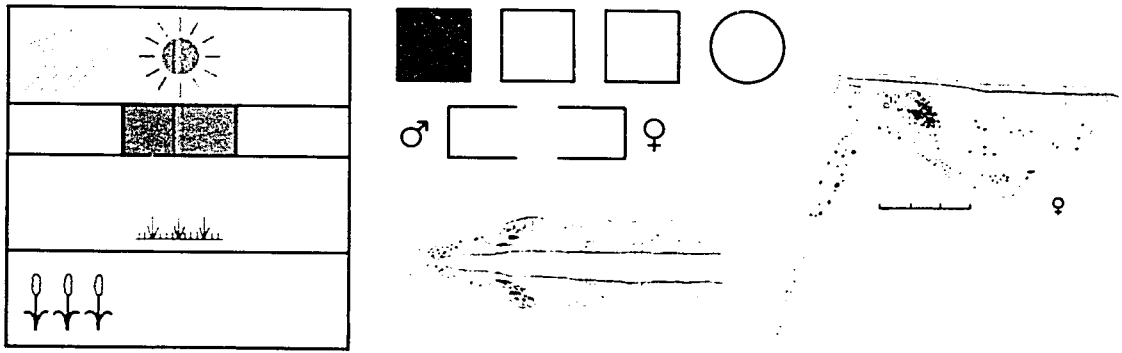
♂ 5 7+ ♀

A

The nymphs of *Truxalis* can be separated from those of *Acridarachnea* by their open mesosternal interspace and from those of *Acrida* by their longer epiproct; but the separation of *T. johnstoni* from *T. procera* can only be attempted in later instars, once the shape of the pronotum becomes sufficiently distinctive - with wavy lateral carinae in *T. procera*. *T. longicornis*, however is identified by its very long antennae and the fact that in West Africa it has so far been only recorded from the Air mountains in Niger, where it occurs on rocky hill slopes.

B
♀

74-75. Brachycrotaphus tryxalicerus (Fischer, 1853) and *B. steindachneri* Krauss, 1877

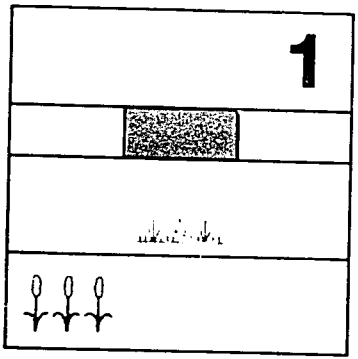


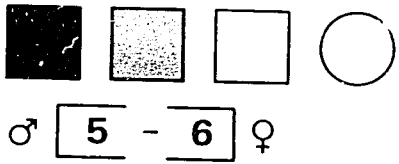
A. *B. tryxalicerus*, fifth instar nymph

The nymphs of *Brachycrotaphus* closely resemble the adults in their elongate build, long flattened antennae, elongate pointed head and elongate abdomen extending beyond the hind knees; the epiproct does not extend beyond the tip of the abdomen (B). There is at present no certain way of distinguishing between the species; it is possible that the nymphs *B. tryxalicerus* are paler and bear a pale dorsal stripe (A), but this needs verification.

B. *B. steindachneri*, last instar nymph

76. *Kraussella amabile* (Krauss, 1877)



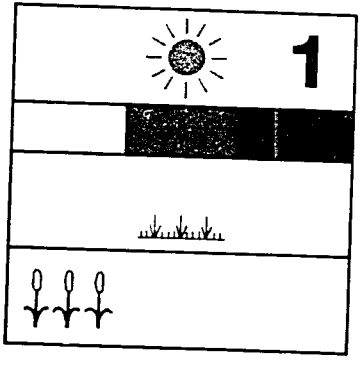


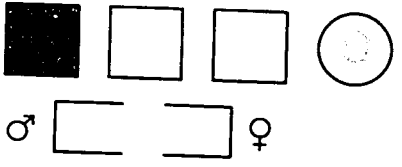
A. Comparison between nymph and adult

The nymphs of this species, particularly in later instars, are readily recognised by their characteristic coloration, notably different from that of the adults.

B. Last instar nymph

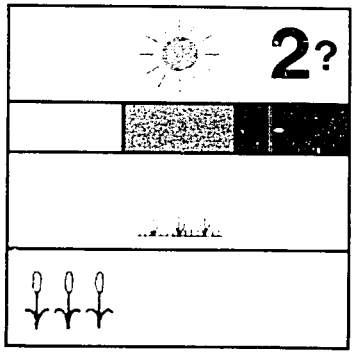
77. Dnopherula werneriana (Karny, 1907)

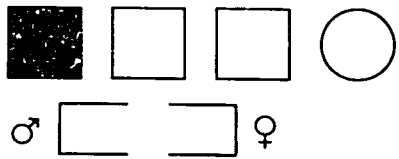




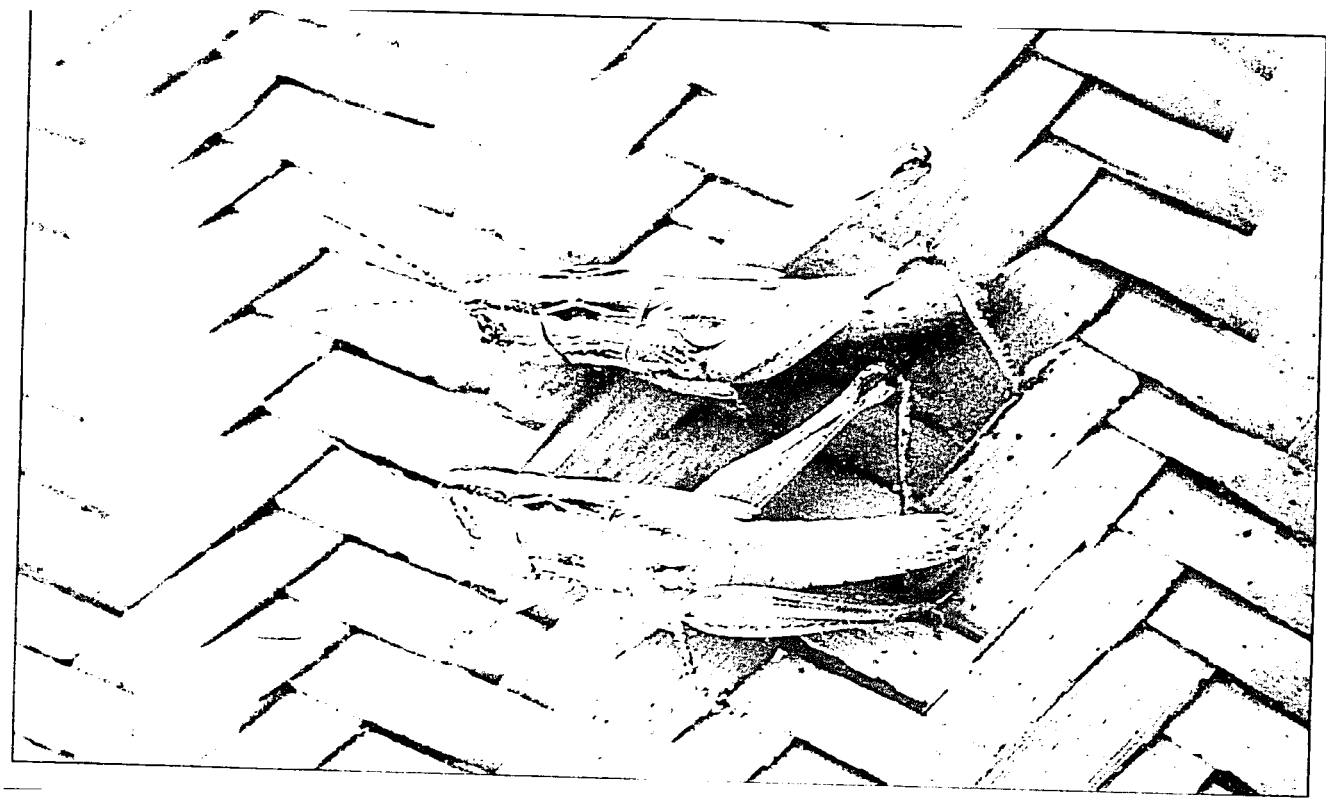
The nymphs resemble the adults but the pronotal pattern is more distinct and the white dorsal stripe is wider.

78. Rhaphotittha targui (Chopard, 1941)





As in the preceding species the nymphs resemble the adults but have a more distinct pronotal pattern. As in adults there are many colour forms; the general coloration is various shades of straw colour, brownish or greyish and the pronotal pattern is more or less distinct.



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G.A. Colquhoun: 59aA, 59aB, 59bA; R. Farrow: 59aC; C. Manuel: 38; G.A. Mitchell: 7A; J. Roffey: 36; P. Turner: 59bB.