



Morphological study with special reference to Phallic complex of two important grasshoppers from Pakistan

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Received 12th July 2014 and Revised 6th August 2014

Abstract: A total of 750 specimens of *Locusta migratoria* Linnaeus and *Gastrimargus africanus sulphureus*, Bei-Bienko were collected from different agricultural lands, vegetables and pastures during the year 2012-2013. Significant variation has been found in the morphological characteristic as well as in genitalia components of these two studied species. Beside this, it was noted that they were seen huge numbers during March to end of October. Their distribution at province level was also discussed.

Keywords: Morphology, Phallic complex, important, grasshoppers, Pakistan

1. INTRODUCTION

Acridoidea is one of the most important after super-families of the order orthoptera; this order comprised of insects with Paurometabolous including grasshoppers, crickets and locusts. Previously several authors were taken out work in systematics in most insect orders, (Eberhard 1985, Otte 1984, Ajaili, Usmani and Furet. 1989. Moeed, 1966; Hollis, 1968, Jago 1967, 1977; Ahmed 1980; Ritchie 1981, 1982, Wagan 1990, Tokhai 1996, Baloch, 2000; Dirsh, 1975, Bie-Bienko, Mischenko, 1951 and Perwin *et al.*, 1983). However, still now nothing was published in detail regarding the *Locusta migratoria* L. and *Gastrimargus africanus sulphureus*, Bei-Bienko from this region that why present attempt has been made.

Since earlier days to present time *Locusta migratoria* L. is among the most destructive of all insect pests. They are particularly harmful in hot and dry regions when a sudden increase in their numbers; combined with food shortage this situation force them to migrated in huge swarms devouring virtually every green plant in their path. Such a way they are main pests in countries bordering deserts for example, Africa; where swarms of locusts have resulted in famine like condition as many times. Instead of this *G. africanus sulphureus*, Bei-Bienko; feeds upon the vegetation, herbs shrubs and top part of the plants (Cotes 1893; Uvarov 1942 Agarwala (1952) and Tandon 1975. As well as present findings will be helpful to bring the knowledge about these two orthopteran species that were considered as important from ecological and agricultural point of view.

2. MATERIAL AND METHODS

The specimens were collected from various provinces of Pakistan and study site include: grassland,

vegetation, agricultural fields, along the roadsides and herbs shrubs. All the collected specimens have been preserved by adopting the methods of Vickery and Kevan (1983). However, for the study of male and female genitalia method given by Kevan *et al.* a,b; (1969) and Randell (1963) respectively was adopted. The diagrams were drawn with the help of "Ocular square Reticule" placed in right eye piece of the stereoscopic dissecting binocular microscope. All the measurements are given in the millimeter. The scheme of measurement followed is that of Hollis (1975). The terminology with regard to phallic complex and female genitalia is adopted from (Otte, 1995) and by Chopard, 1969) respectively.

Repository

All the collected material has been deposited in the Museum of Entomology, Department of Zoology, University of Sindh Jamshoro, Pakistan.

3. RESULTS AND DISCUSSION

For the present study 750 specimens were available which were sorted out into two species.

Key to the studied species:

1. Size large, wings without dark band epiphallus large, ancorae elongated with tips sharply pointed and curved.....***Locusta*** Linnaeus.

Size medium large, wings with more or less dark bands; epiphallus moderate.....2

2. Pronotum without x-shaped marking, epiphallus with small ancorae and small bilobate***Gastrimargus***. Saussure.

Locusta migratoria Linnaeus

Diagnostic characters

Of large in size. Antennae filiform, about 24 segments, longer than the head and pronotum together. Head

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globular, shorter than pronotum. Fastigium of vertex wide, rounded, with flat lateral and median carinulae, extending roundly over frons, frontal ridge wide, flat, slightly narrow at median ocellar region. Pronotum tectiform somewhat narrow in prozona, median carina well marked sharp, forming an crest. Ventral surface of thorax with dense hairs Tegmina and wings well developed acutely rounded at apex. Hind femur broad at base, narrowing gradually towards knee, dorsal carina serrated. Hind tibia slender with 10-2 black tipped spines on either sides. Claws larger. Arolium small and rounded

Body Coloration: Generally dark brown to paler brown in color. Head and pronotum with yellow median and lateral oblique bands, extending from posterior margin of eyes and run parallel, but gradually inverging to acute apex of pronotum. Tegmina semitransparent, paler brown with irregular light or dark brown spots. Wings hyaline, light paler at base. Hind femur paler brown, with dark band on outer side, inner surface with two dark bands. Hind tibia light reddish.

Phallic complex

Apical valve of penis larger than the valve of cingulum; valve of penis thin, diverging at pre – apical part, with scissor like apices at apex. Valve of cingulum shorter than that of valve of penis, ending near to arch of cingulum, tapered at apex with scissor like appendices. Basal bridge fold, thick and wide. Apodemes moderate, pointed at apex, directed anteriorly. Zygoma smaller. Rami well developed, cylindrical and longitudinally extending into the sheath dorsally lobe like. Gonopore processes shorter, and thin with truncated apices. Ejaculatory duct large and produced anteriorly. The epiphallus bridge shaped, bridge thick, fairly wide and slightly convex. Anterior projections laterally upwarded with oval rounded subacute apices, wider anteriorly; posterior projections smoothly wide, deep, with marginal incurved furrows, boundries of lateral plates slightly round about. Ancorae larger, thick, wide, heavily curved at apex with pointed rounded apices, angularly oval rounded at base. Lophi large, flattened, having broad apical lobes; diverging slightly from the lateral plates and ending into small rounded process. Beside the lateral plates, oval rounded sclerites.

Female: Cerci small, conical hairy with slightly rounded apices. Ovipositor short, with curved valves, lower valve at base with lateral tooth like projection.

Spermatheca: The spermatheca with pre-apical diverticulum shorter and rounded. Apical diverticulum sac like, elongated and oval rounded at base.

Study sites:

Sindh: Larkana. 17.ix.83 2 Male, 1 Female (Wagan and Solangi). Moro: 26.x.83 1Male, 2 Female (Wagan).

Dadu: Manjhand, 5.ix.85 2 Male, (Wagan). Sehwan, 5.ix.85 3 Male, 2 Female (Wagan and leg) Jamshoro: Unarpur, 6.vii.2001 3 Male, 1 Female (Barkat). Jamshoro: Budhapur, 6.vii.2001 2 Male, 2 Female (Barkat). Jamshoro: proper 8.vii.2001 2 Male, 1 Female (Barkat). Laki, 11.vii.2001 2 Male, 1 Female (Barkat). Sehwan: proper 13.vii.2001 1 Male, 2 Female (Barkat). Dadu: Makhdoom Bilawal, 17.vii.2001 2 Male, 2 Female (Barkat). Dadu: Piyarogoth, 26.vii.2001 2 Male, (Barkat). Khairpur Nathan Shah, village: Khalique dino Bughio 28.vii.2001 3 Male, 2 Female (Barkat). **Punjab:** Okara: 1 Female, 1 Male, Okara, 4.iv.96 (Wagan). Kasur: 1 Female, Changa Manga, 24.vi.96 (Wagan). Lahore: 1 Male, Lahore, 5.iv.96 (Baloch and (Wagan). Lahore: but nr air port 4.vii.2004 2 Male, 2 Female (Wagan, Barkat). Lahore: but nr Shalimar bagh 5.vii.2004 1 Male, 1 Female (Wagan, and Barkat). **Balochistan:** Loralai: Shabozai 15.x.93 1 Male, 1 Female (Sadaullah Tokhai). Qillasaifullah: Nisai 21.viii.94 1 Male, 2 Female (Sadaullah Tokhai). Loralai: shabozai 15.x.2001 2 Male, 1 Female (Wagan and Barkat). Musakhail: Cham 14.xi.93 1 Female (Sadaullah Tokhai) K.P.K: Abbotabad: proper 12.vii.95 2 Male, 1 Female (Wagan and leg). Gilgit 23.viii.97 1 Male, 1 Female (Wagan and leg). Mansehra, ansehra 11.vii.95 2 Male, 2 Female (Wagan). Swat, 18.vii.95 2 Male, 1 Female (Wagan and leg). Swat: proper 12.vii.2004 2 Male, 1 Female (Wagan , Barkat).

Table I. Measurements in millimeters (mm), Showing the different body parameter of *Locusta migratoria* Linnaeus

Body Parameters	Male (n = 21)		Female (n = 16)	
	(Mean ± Sd)	(Range)	(Mean ± Sd)	(Range)
Length of Body	33.57±3.41	33-35	48.68±14.96	46-60
Length of Antennae	9.52 ±3.03	9-11	11.06±4.13	10-14
Length of Pronotum	7.90±4.27	7-10	11.16±0.95	11-12
Length of Tegmina	47.57±34.27	35-60	52.37±23.82	48-64
Maximum width of Tegmina	6.66±3.24	6-8	8.56±3.14	8-10
Length of hind Femur	21.09±8.28	19-25	26.06±3.94	25-28
Maximum width of hind Femur	4.71±3.19	4-6	6.16±1.28	6-7
Length of hind tibia	18.76±9.67	16-22	23.12±6.45	21-26

Remarks: This species is very closely related to *L. danica* Uvarov in having general body appearance but can easily be separated from the same in having hind femur rather long and slender and by the other

characters as noted in the keys and description. This species have been collected from the agricultural and non agricultural fields. It commonly occurs in different areas of the Pakistan .Ahmed (1980), Eades and Otte (2008), Wagan (1990) Wagan & Solangi (1990) reported this species from different parts of Sindh while Yousuf (1996) reported this species from the various districts of Balochistan and Punjab.where as Baloch (2000) recorded from the Punjab.

***Gastrimargus africanus sulphureus* Bei.Bienko**

Diagnostic characters. Of medium size. Antennae filiform, about 25 segmented, longer than the head and pronotum together. Head sub-globular; shorter than pronotum. Fastigium of vertex concave with slightly indicated median carinula. Fastigial foveolae indistinct. Pronotum tectiform constricted in prozona , with median carina moderately arcuate, sharp, weakly crossed by posterior sulcus. Lateral carinae absent; posterior and anterior margin acute angular. Tegmina and wings fully developed. Hind femur slender, dorsal carina dentate, dorsal genicular lobes rounded. Hind tibia slender, thick, with 10 inner and 12 outer black tipped spines. Arolium of medium size and triangular .

Phallic complex: Apical valve of penis thickening, wider and slightly longer than the valve of cingulum; convex at apex with rounded apices. Valve of cingulum upwarded, thick, having sub acute apices at apex, and deep at base. Arch of cingulum with wavy furrow. Basal bridges fold emarginated. Zygoma well developed and toothed. Apodemes moderate, smoothly produced anteriorly with club shaped tip, rounded at apex. Rami large lobe like, cylindrical, with wavy process at margins dorsally. Gonopore long, and with obtuse apices. Ejaculatory duct smaller and directed anteriorly. The epiphallus bridge shaped, bridge fairly wide, thick, with both anterior and posterior margins almost straight. Anterior projections rounded, posterior projections broad with incurved sub marginal furrow. Ancorae large, upwarded, slightly with pointed apices at apex, ending into shorter rounded processes. Lophi groundnut like in shape, placed sub marginally on the lateral plates, usually directed anteriorly; having oval rounded terminal processes, end in small incurved obtuse rounded processes with acute apices. Beside the lateral plates oval rounded sclerites.

Body Coloration: Generally brownish in color. Head and pronotum paler brown. Tegmina semitransparent, with two alternate light and brown bands, apex with small brown speckles. Wings shiny sulphur yellow at base, dark band complete and well developed apex darkened. Hind femur ventrally with bluish tinge and with two light bands. Hind tibia pinkish red with apical light band. **Female:** Cerci short and conical,

with rounded tips. Ovipositor small, valves with curved apices, pads of ventral valves smooth.

Spermatheca: The spermatheca pre-apical diverticulum short, conical and straight, with rounded apices. Apical diverticulum sac like and rounded at base.

Study sites: **Sindh:** Hyderabad, but near Tando Muhammad Khan, 16.viii.97 2 Male, 3 Female (Barkat). **Punjab:** Rawalpindi: 29.vi.97 6 Male, 8 Female (Wagan & leg). Chakwal, but nr chakwal 8.vii.2004 5 Male, 3 Female (.Wagan, Barkat). Kallarkahar, nr lake 13.vii.2004 7 Male, 5 Female (Wagan & Barkat). **Balochistan:** Loralai: Shabozai 15.x.93 1 Male, 1 Female (Sadaullah Tokhai). Barkhan: Aishiani, 11.vii.94 2 Male 2 Female. Shaeedpost, 9.vi.94 2 Male, 1 Female (Sadaullah Tokhai). **K.P:** Abbotabad: nr abttabad 12.vii.95 3 Male, 2 Female (M.S.Wagan & leg). Dassu, 21.viii.97 2 Male, 4 Female (M.S.Wagan & leg). Gilgit 23.viii.97 3 Male, 2 Female (M.S.Wagan & leg). Mansehra, nr Mansehra 11.vii.95 6 Male, 5 Female (Wagan & leg). Swat, but nr hills 22.vii.2004 7 Male, 5 Female (M.S.Wagan, Barkat). Swat: proper 23.vii.2004 4 Male, 3 Female (Wagan, Barkat).

Table .2: Measurements in millimeters (mm), Showing the different body parameter of *Gastrimargus africanus sulphureus*

Body Parameters	Male (n=15)		Female (n=11)	
	(Mean $\pm$ Sd)	(Range)	(Mean $\pm$ Sd)	(Range)
Length of Body	25.13 $\pm$ 4.23	24-27	37.81 $\pm$ 5.10	36-40
Length of Antennae	11.93 $\pm$ 3.33	10-13	11.45 $\pm$ 2.94	10-13
Length of Pronotum	6.66 $\pm$ 2.29	6-8	9.63 $\pm$ 2.11	9-11
Length of Tegmina	25.2 $\pm$ 3.52	24-27	34.9 $\pm$ 6.50	31-37
Maximum width of Tegmina	4.53 $\pm$ 1.92	4-5	6.27 $\pm$ 3.17	5-7
Length of hind Femur	17.6 $\pm$ 3.34	16-19	22.9 $\pm$ 3.59	21-24
Maximum width of hind Femur	4.53 $\pm$ 1.92	4-5	6.54 $\pm$ 1.64	6-7
Length of hind tibia	15.33 $\pm$ 2.68	14-16	10.65 $\pm$ 3.26	19-22

Remarks: This species is very closely related to *G.africanus africanus* on the basis of general appearance but can easily be separated by pale yellow coloration of hind wing and not bright yellow and by the other characters as noted in keys and description. This species has been collected from the tall trees of pine having the vegetation of grasses and herbs from the various parts of the Punjab & K. P. K Ahmed (1980) Yousuf (1996) and Baloch (2000) recorded this species from the Punjab and K. P. K.

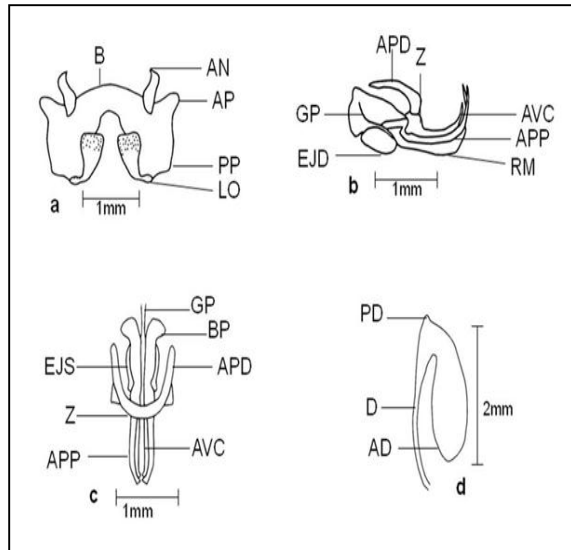


Fig.1. *Locusta migratoria* , genitalia. a) Epiphallus. b) Endophallus and Cingulum lateral view. c) Same dorsal view. d) Spermatheca.

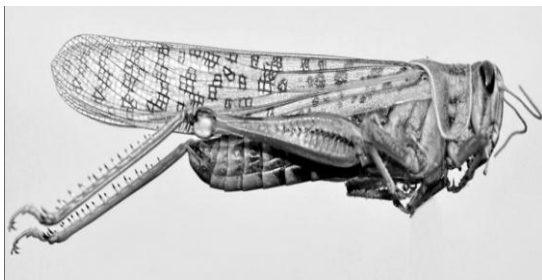


Fig. 2 *Locusta migratoria* Linnaeus Male

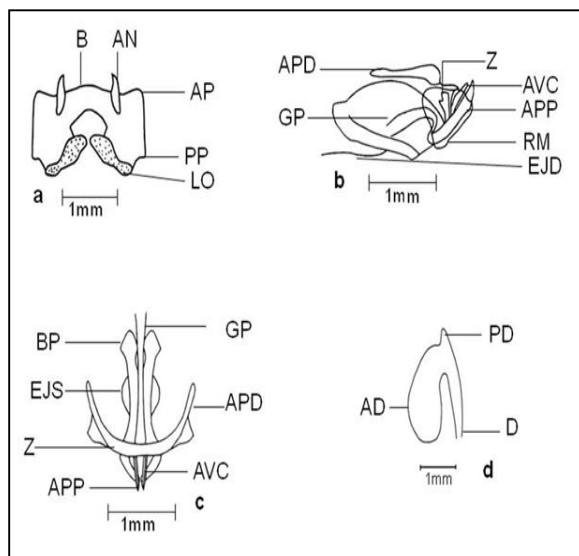


Fig. 2 *Gastrimargus africanus sulphureus* , genitalia. a) Epiphallus. b) Endophallus and Cingulum lateral view. c) Same dorsal view. d) Spermatheca.



Fig. 4 *Gastrimargus africanus sulphureus* Bei-Bienko Male.

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