Sindh Univ. Res. Jour. (Sci. Ser.) Vol.47 (2): 267-274 (2015)

SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)

Studies on the Immature stages of *Aiolopus thalassinus thalassinus* (Fabricius) (Oedipodinae: Acrididae: Orthoptera)

F. SOOMRO[++], R. SULTANA, M. S. WAGAN , A.R. ABBASI*, B. K.SOLONGI**

Department of Zoology, University of Sindh, Jamshoro

Received 19th January 2015 and Revised 18th April 2015

Abstract: *Aiolopus* are graminivorous and considered important pest of various crops i.e. maize , millet, sorghum, wheat, berseem, alfalfa, vegetables and grasses. *A. thalassinus thalassinus* among the dominant member of this genus and have polyvoltine breeding cycle throughout the year. Present study focus on nymphal stages of this notorious pest from various districts of Sindh. It was observed that there are six instars instead of five nymphal instars which were reported by earlier workers i.e. Chesler (1938) and Baloch (1978). Beside this total number of instars, sex ratio and different color phases were also studied. Detail morphological description of various instars provide the easily identification for separation of different stages of *Aiolopus*.

Keywords: *Aiolopus* , Graminivorous, Nymphal instar, Morphological description, Identification

1. INTRODUCTION

The representative of genus *Aiolopus* are mainly diverse and widely distributed group of band winged grasshoppers throughout the world including Pakistan. The genus was erected by Fieber in (1853). It consists of 13 species from Asia, Africa and Europe (Min and Min 2008). However as for as status of *Aiolopus* in Sindh is concerned they are pest of varieties of crops and prevalent throughout Sindh. Due to its taxonomic status this genus always remains source of anxiety for scientist from last few decades. Many species of this genus are misidentified by earlier workers and put into different and incorrect genera but after the thoroughly revision of Hollis (1968) its exact taxonomic status has been cleared. *A. thalassinus thalassinus* is chiefly graminivorus and one of most noticeable pest highly distributed with great frequency all round the year in Sindh. Ahmed (1978) reported *A. thalassinus thalassinus* having dominant status in Sindh, it mainly exceed from all other species retained its dominance on all host plants especially on maize, millet, grasses and vegetables.

Nymphal stages are feeding on short grasses and seedling of crops because they do not have functional wing therfore they are fore more vigorous than adult. Interestingly no detail work on the nymphal stages of this species have been done except the preliminary work of Baloch (1978) but he was unable to identify correct sequence of instars in this species. Therefore, present attempt has been made to establish the accurate number of immature stages of *A. thalassinus thalassinus* extensively from various districts of Sindh. The result of such study will be instrumental for pest controlling authorities in near future.

2. MATERIAL AND METHODS

2.1 Investigation area.

Various stages of *Aiolopus thalassinus thalassinus* were collected from agricultural fields i.e. maize, millet, sorghum, wheat, berseem, alfalfa, vegetables and grasses around the periphery of field and as well as from water channels with the help of traditional insect hand net (8.89 cms in diameter and 50.8 cms in length) and same by hand picking. Collection was made in the months of December 2013 to November 2014.

2.2 Killing and preservation of samples.

For the killing and preservation of specimens method described by Vickery & Kevan (1983) and Riffat & Wagan (2012) was adopted.

2.3 Sorting out of different hopper stages.

The stock culture collected from the various field was transferred into laboratory the collected material was sorted out into different nymphal stages by using magnifying glass.

2.4 Identification and measurement of hopper.

Identification of hopper was carried out under the stereoscopic dissecting binocular microscope. The body parts of the hoppers were measured with vernier caliper except first and second in stars. The first and second instars / hopper were measured by ocular squire graph at 2x and segments of antennae were counted under microscope. All the measurements are given in millimeter (mm).

[+]Corresponding Author Email: riffatumer@hotmail.com

*Department of Fresh Water Biology, University of Sindh, Jamshoro

* *Department of Entomology, Sindh Agriculture Uiversity Tandojam

3. RESULTS

3.1 Key to the nymphal instars of *A. thalassinus thalassinus*

1. Tegmina and wing pads, when presented directed downwards ---------- **2**

_. Tegmina and wing pad, turned upwards ------**5**

2. Tegmina and wing pad not developed, antennal segments (11.66±0.12mm) with (1.04±0.01mm) in length. (Table1. a)

----------**First Instar**

_. Tegmina and wing pad appear, ♂ antennal segments (16.66±0.12 mm) with (1.66±0.01mm) in length. (Table 1. b)---------- **3**

3. Tegmina and wing pad extended directed down wards with thicker margins, ♂ antennal segments (13.66±0.12 mm) with (1.12±0.01mm) in length. (Table 1. b)

----------**Second Instar**

_. ♂ Antennal segments (18.93±0.36 mm) with (2.52±0.04 mm). (Table 1. b) ----**4**

4. Tegmina and wing pads, triangular, thicker, veins appear, slightly bend backwards.

(Plate-I. c) ----------**Third Instar**

_. Wing pads triangular leaf like, pointed, cover tegmina extended up to first abdominal segment or slightly crossing margin of first abdominal segment . (Plate-I. d)

----------**Fourth Instar**

5. Wing pads up to fourth abdominal segment in female and up to fifth abdominal segment in male. (Plate-I. e) ---------- **Fifth Instar**

_. Wing pads up to fifth abdominal segment in female and crossing fifth abdominal segment in male. (Plate-I. f) ---------- **Sixth instar**

3.2 Morphological disruption of Instars

First Instar (Plate-I. Table 1. a)

Antenna filliform with 11-12 segments, segments wide and smaller. Body color brown with minute gray dots on head and thorax while olive green nymphs without gray or dark brown marking (two form in color pattern exist). Mouth parts even color not darker than body color. Omatidia of compound eyes start filling centrally with brown color. Towards lateral side brown band extended behind the eyes up to pronotum. Frontal rige narrow toward base and wide toward fron with raised edges and central depression, fastigium of vertex flat, cone shape, lateral carinae of vertex distinct, fastigal foveolae not distinct from above, flat trapezoidal. Pronotum flat not raised towards median carinae, median carinae distinct, edges curved, traces of two transverse sulci visible but not incut median carinae, posterior sulcus separate prozona from metazona former considerably longer than later, posterior margin of pronotum slightly invaginated inside at median carinae dividing into two lateral lobes. Towards lateral side meso and metanota flat without appearance of wing pads, femur evenly brown in color without regular spots or bands present on inside or outside .

Second Instar (**Plate-I. Table 1. b,c)**

Antenna with 13-14 segments in male 15-17 in female. General appearance like that of first instar with some more prominent characters. Towards lateral side narrow cream color band followed by wide dark brown band extending from eyes, Pronotum and light traces on abdomen. Fastigal foveolae distinct from above, pronotum raised toward median carinae, metazoan much raised than prozona, invagination of posterior margin of Pronotum slightly reduced, pronotum cover half of mesonotum, laterally meso and metanota with slightly extended rounded wing pads with thicker margins directing down wards (In green form wing pads pale in color). median carinulae of femur become sharp, grey spot appear on basal joint of tibia, Supra anal plate triangular, clear bifurcation of ovipositors visible but upper and lower valve are not separated , sub genital plate become conical in male .

Third Instar (Plate-I Table 1 b,c)

Antenna with 16-17 in male and 18-19 in female. Eyes slightly raised and prominent centrally filled more with grey followed by brown color towards margin. Grey spots become clear regularly distributed on head and pronotum. Fastigal foveolae more elongated with depression, trapezoidal. Lateral cream and brown color bands extending behind eyes up to abdomen become more distinct. Pronotum raised at median carina, invagination in posterior margin about to disappear, posterior margin almost flat, prozona twice longer than metazona, pronotum crossed by three transverse sulci, not incut median carinae, pronotum almost cover mesonotum dorsally, laterally wing pads become triangular and slightly bend backward, vein appears on wings pads, lateral bands more distinct, tympanum about to appear in traces form not mature. Femur without transverse band, basal joint of tibia with gray spot and inner side of distal end with grey band in green and brown form. Upper and lower valve of ovipositors separated, pointed, sub genital plate cone shape and hairy, Cerci thin, wider at base and more pointed in male instar.

Fourth Instar (Plate-I Table 1.b,c)

Antenna with 18-20 segments in male and 20-21 in female. Eyes more filled with grey color. Frontal ridge become wide towards apex no constriction towards median occellus, edges of frontal ridge not raised and becomes flat. Grey spots become more prominent and

scattered throughout body but absent in green form, fastigal foveolae distinct and visible from above, fastigium of vertex moderately wide concave centrally with distinct lateral carinae, Pronotum with median carina distinct but not raised, three transverse sulci crossing pronotum only posterior sulcus incut median carina, posterior margin clear round in shape, leaf like triangular pointed wing pads cover Tegmina up to first tergum or slightly crossing, wing pads with light grey coloration in brown from, absent in green form, tympanum differentiated but not reach maturity, grey coloration on distal area of tibia more clear towards inside.

Fifth Instar (Plate-I Table 1.a b,c)

Antenna with 21-22 segments in male and 22-23 in female, Frontal ridge flat wide without punchers, eye with grey spot towards vertex, Grey spots becomes distinct throughout body, lateral bands distinct up abdomen. Pronotum flat, posterior margin slightly angular, prozona about twice longer than metazona, wing pads up to fourth segment or slightly crossing in female and up to fifth segment but not touching edges in male instars, width narrow, veins thin not prominent, brown form with distinct grey spots throught body while green form with minute grey spots on head and Pronotum, wing pads with light grey or without coloration, femur mature, grey bands towards inner side absent, inner spur are considerably longer than outer spur with black tips. Upper and lower valve of ovipositor are separated but thinner weak and pointed no mature or differentiated. In male sub genital plate are conical but not tilted upwards in this stage .

Sixth Instar (Plate-I Table 1.a. b,c)

Antenna with 23-24 segments in male and 24-25 in female, segments elongated and narrow in width, no transverse bands are present on antenna. Head and lower mouth parts even brown color no dark coloration noticed, grey spots are distinct throughout and regularly arranged, omatidia of compound eyes completely filled with brown color, grey oval spot towards vertex. Lateral cream and brown color bands become more prominent and in particular manner as present in adult specimens, frontal ridge wide, flat with punchers. Pronotum with distinct median carina and obtusely angular posterior margin, with grey regular spots, wing pads much wider and with clear veination, wing pads with clear grey color in brown form, green form without color, wings pads up to fifth segment in female and crossing fifth segments in male, segments in this stage much wider, tympanum matured, femur matured with sharp median carina, two transverse incomplete grey bands present towards inner side, tibia with basal and distal grey coloration with 10-11 black tip spines, arolium with wide blunt apex, male sub genital plate clear conical curved upwards, ovipositor valves differentiated matured, thicker upper valve faced upwards, cerci differentiated.

Table 1 (a): Morphometric mean and standard error of First Instar of *Aiolopus thalassinus thalassinus*

Parameters	Ist Instar (n=15)	
	Mean ±SE (mm)	Range
No. of antennal Segments	11.66±0.12	11- 12
Length of antenna	1.04±0.01	0.97-1.10
Distance between eyes	0.22±0.01	0.13-0.30
Length of Head	0.95±0.02	0.80-1.08
Length of Pronotum	0.85±0.01	0.73-0.95
Length of Femur	2.71±0.01	2.62-2.80
Length of Tibia	2.36±0.01	2.20-2.45
Width of Femur	0.26±0.01	0.17-0.35

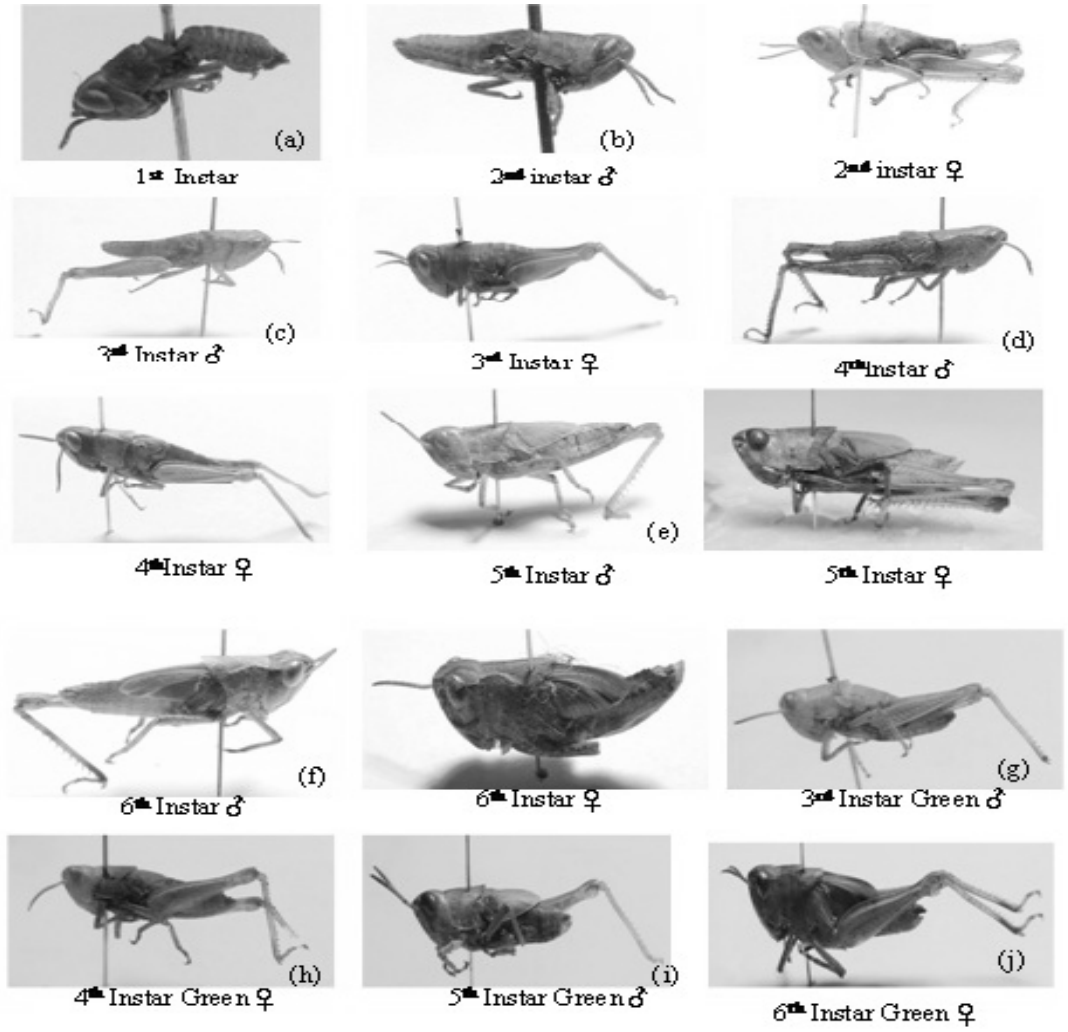

Plate-I. (a-j) Showing the different developmental stages of *A. thalassinus thalassinus*

Table 2: Distribution of various instars of *A. thalssinus thalassinus* from different districts of Sindh during 2013-2014.

Districts	Developmental Stages						Total	Collected Percentage %
	Ist	**2nd**	**3rd**	**4th**	**5th**	**6th**		
Karachi	00	00	00	05	03	08	16	2.29 %
Jamshoro	13	17	16	23	21	29	119	17.07%
Matiari	02	16	13	14	21	18	84	12.05%
Badin	09	06	07	09	17	19	67	9.61%
Sanghar	15	13	11	19	14	13	85	12.19%
Tharparkar	00	05	00	03	03	04	15	2.15%
Dadu	12	15	12	15	13	15	82	11.76%
Larkana	00	03	00	04	05	09	21	3.01%
Khairpur	07	05	19	11	16	17	75	10.76%
Sukkur	11	09	18	13	27	25	103	14.77%
Shikarpur	05	00	07	02	09	07	30	4.30%

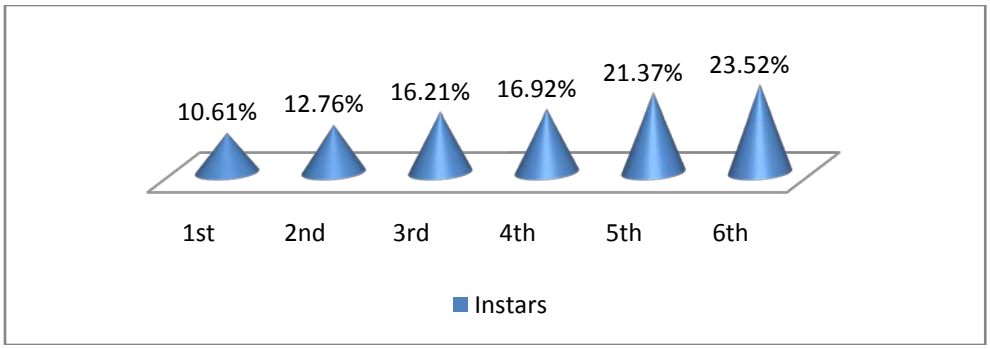

Fig. 1: Showing collected percentage of different instars of *A. thalassinus thalassinus* during year 2013-2014.

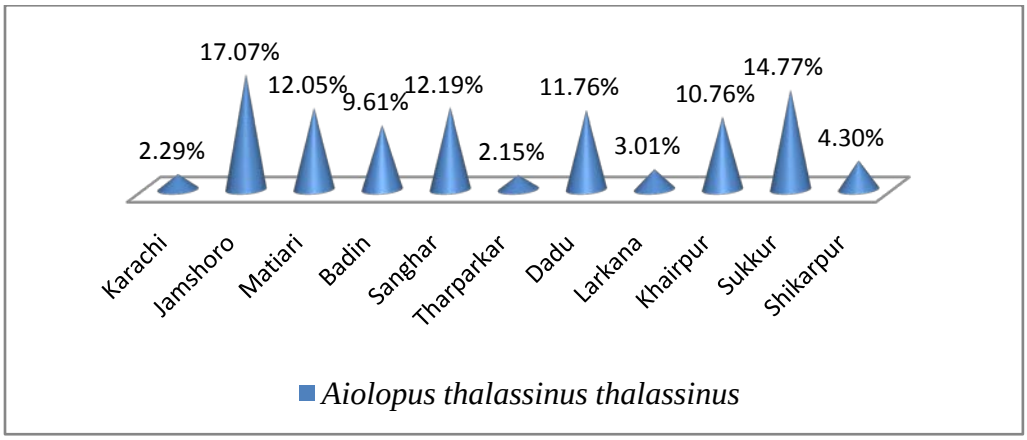

Fig. 2: Showing the district wise collection of various instars of *A. thalassinus thalassinus* during the year 2013-14.

Table 3. Survey for collection of various instars of *A. thalassinus thalassinus* in different months of year 2013-14.

Months	Ist Instar	2nd Instar	3rd Instar	4th Instar	5th Instar	6th Instar
Trip-I						
December	+	++	++	+	++	+
January	-	+	+	+	+	+
February	-	-	-	+	+	-
Trip-II						
March	++	+++	++	++	+	-
April	+	+++	+++	+++	+++	+++
May	+++	++	++	+++	++	+++
Trip-III						
June	+	++	+++	++	+++	++
July	+++	+++	+++	+++	++	+++
August	++	++	++	+++	+++	+++
Trip-IV						
September	++	++	++	++	+++	+++
October	+	+	++	++	++	+++
November	-	-	-	+	+	++

Note:
+ + + = More dominant
+ + = Moderate dominant
+ = Less dominant
- = Absent

4. DISCUSSION

Still now there is no authentic information on the biology of *Aiolopus* species is available. The present study has been carried out for the first time regarding the immature stages from this region. Earlier, Chesler (1938) studied the life history and described the immature stages of *A. thalassinus thalassinus* from the Transval. Hafez *et al*., (1962) discussing the general ecology and biology of this species from Egypt, they stated that the ability of both hoppers and adults to mature effectively in varieties of food crops and on *Cynadon dactylon* and but found both cotton and Lentil refused or detrimental to growth. (Note, 1939) discussing the color form and chromosomal complex and consider this species as grassland type with two basic forms green and light brown latter is more common than former. Earlier few authors i.e. Zimin (1938), Khalifa (1956), Chapman and Robertson (1958) and Descamps and wintrebert (1967) studied the some specific items of biology. This species breed throughout the year and polyvolatine in nature and causing considerable damage to both seasonal crops in Sindh. Review of literature showed that Acrididae having 4 to 9 instar but 5 to 6 were found frequent (Ramsey,1964). Earlier, Chesler (1938) and Baloch (1978) recorded five nymphal instars species during the present study we have reported six nymphal instars this disparity in the numbers of instar due to the geographical conditions of region or might be feeding on the different plants having great energetic nutritional value. Beside, the study of immature stages of *A. thalassinus thalassinus* we also confirmed the status of this species which is misidentified by Baloch (1978) from Pakistan. This is sub-species instead of species.

REFERANCES:

Ahmed, S.T., and M. Tajamal, (2014) Morphometric studies of the post embryonic developmental stages of Rice grasshipper, *Oxy japonica* (orthoptera: Acrididae), N.Y Sci. J. 7(4), 107-111.

Ahmed, S.T. (2014) Temperature dependent hopper development period of *Acrida exaltata* Walker (Orthoptera: Acrididae) in Kashmir, India, N.Y Sci.J, 7(4), 36-39.

Baloch, A.A. (1978), Some Studies on the nymphs of *Aiolopus thalassinus*, Turk.Bit.Kor.Derg, 2, 115-123.

Chapman, R.F., and I.A.D. Robertson, (1958), The egg-pods of some tropical African grasshoppers, J.Ent.Soc.Sth.Afr, 21, 85-112.

Chesler, J. (1938), Observation on the biology of some south African Acrididae, Trans.R.Ent.Soc.Lond, 87, 313-351.

Descamps, M. and D. Wintrebert, (1967), Pyrgomorphidae et Acrididae de Madgascar. Observations biologiquea at diagnosis (Orth. Acridoidea), Eos. Madr, 42, 41-263.

Hafez, M., and M.M. Ibrahim, (1962), On the ecology and biology of grasshopper *Aiolopus thalassinus* F. in Egypt (Orthoptera:Acrididae), Bull.Soc. Ent. Egypte, 46, 189-214**.**

Hafez, M., and M.M. Ibrahim, (1962) On biology of immature form of grasshopper *Aiolopus thalassinus* F. in Egypt (Orthoptera:Acrididae), Bull.Soc. Ent. Egypte, 46, 271-82.

Hafez, M., and M.M. Ibrahim,(1963), Field and laboratory studies on the behavior *Aiolopus thalassinus* F. towards humidity (Orthoptera: Acrididae), Bull.Soc. Ent. Egypte, 47, 75-96.

Hafez, M. and M.M. Ibrahim, (1963) a. On the temperature reaction of . Aiolopus thalassinus F. (Orthoptera: Acrididae), Bull.Soc. ent. Egypte, 47, 105-16.

Khalifa, A. (1956), the egg-pods of some Egyptian grasshoppers and the preference of female for soils of different moisture contents, Bull. Soc. Ent. Egypte, 40, 175-186.

Min, Z.Z., and S.H. Min, (2008) A taxonomic study of the genus *Aiolopus* Fieber (Orthoptera, Oedipodinae) from China, with description of new species, Acta Zootaxanomica Sinica, 33(4), 660-663.

Note, D. J. (1939), A comparative study of seven species of Transvaal Acrididae, with special reference to the chromosome complex, J.Ent.Soc..Sth.Af, 2, 196-260.

Ramsay, G. W. (1964) Moult numbers in Orthoptera (Insecta), N.Z.J.Sci, 7, 644-666.

Riffat, S., and M.S. Wagan, (2007) Life history and economic importance of *Hieroglyphus nigrorepletus* Bolivar (Hemiacridinae: Acrididae: Orthoptera) from Pakistan, J. Entomology, 4(5), 397-386.

Riffat, S., and M.S. Wagan, (2010) Comparative study on the immature stages of three *Hieroglyphus* species (Hemiacridinae:Acrididae: Orthoptera), Pak. J. Zool, 42 (6), 809-816.

Riffat, S., and M.S. Wagan, (2011) Test of few insecticides against the various developmental stages of *Hieroglyphus* species (Hemiacridinae: Acrididae: Orthoptera), Pak.J.Zool, 43(5), 941-946.

Riffat, S., and M.S. Wagan, (2012), Review of genus *Hieroglyphus* Krauss 1877 (Hemiacridinae: Acrididae: Orthoptera) with description of one new species from Pakistan, Pak.J.Zool, 44(1), 43-51.

Riffat, S., B. A. Bughio. A. Waheed. and K. Haji, (2012), Studies on the immature stages of *Oxy velox* (Fabricius) A Rice grasshopper from district Jamshoro Sindh, Pakistan, FUUAST J.Biol, 2(1), 57-62.

Roonwal, M.L. (1940), Preliminary note on some directional changes among locust and other Acrididae, and the importance of third instar, Indian J.Ent, 2, 137-144.

Skonmand, M.H.L., and G. Balanca, (1999), *Bryophyma debilis* (Karsch, 1896) Nymphal Instars (Orthoptera, Acrididae, Cyrtacanthacridinae), J.Orthoptera Res, 8, 110-118.

Vickery, V.R., and D.K.Mc E. Kevan, (1983), A monograph of the Orthopteroid insects of Canada and adjacent regions, Lyman. Ent. Mus.& Res. Lab. Memior , 13(I, II)2, 681-1462.

Zimin, L.S. (1938), Les Pontes des acridiens. Morphologie, classification et ecologie, Opred. Faune USSR 23, 84.

Table 1 (b): Morpho-metric mean in (mm) and standard error of different Instars of ♂ *A. thalassinus thalassinus*

Parameters	2nd Instar (n=15)		3rd Instar (n=15)		4th Instar (n=15)		5th Instar (n=15)		6th Instar (n=15)	
	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range
No. of antennal Segments	13.66±0.12	13-14	16.66±0.12	16-17	18.93±0.36	18-20	21.33±0.12	21-22	23.66±0.12	23-24
Length of antenna	1.12±0.01	1.05-1.22	1.66±0.01	1.57-1.75	2.52±0.04	2.24-2.80	3.59±0.02	3.50-3.85	3.52±0.08	2.40-3.85
Distance between eyes	0.38±0.01	0.33-0.45	0.39±5.36	0.35-0.42	0.53±0.01	0.45-0.60	0.62±0.01	0.56-0.70	0.66±0.01	0.57-0.72
Length of Head	1.22±0.01	1.18-1.40	1.53±0.03	1.26-1.65	1.71±0.04	1.43-2	2.07±0.02	1.95-2.20	2.21±0.02	2.10-2.40
Length of Pronotum	1.28±0.02	1.15-1.40	1.55±0.02	1.35-1.68	2.27±0.06	1.92-2.75	2.93±0.04	2.62-3.15	3.39±0.06	2.97-3.67
Length of Tegmina	----------	----------	----------	----------	1.31±0.01	1.22-1.40	4.66±0.03	4.37-4.90	5.69±0.12	4.72-6.21
Length of Wing	----------	----------	----------	----------	0.92±0.03	0.79-1.20	4.24±0.03	4-4.45	5.05±0.07	4.55-5.45
Length of Femur	3.46±0.06	3.21-3.82	4.37±0.03	4.10-4.53	5.89±0.05	5.60-6.30	7.43±0.06	7-7.70	8.06±0.08	7.52-8.40
Length of Tibia	3.03±0.09	2.60-3.53	3.81±0.04	3.60-4.12	5.16±0.05	4.72-5.42	6.43±0.07	5.89-6.85	6.93-0.08	6.42-7.49
Width of Femur	0.75±0.04	0.35-0.91	0.85±0.02	0.65-0.99	1.47±0.02	1.40-1.68	1.78±0.01	1.65-1.89	2.02±0.03	1.75-2.20
Width of Tegmina	----------	----------	----------	----------	0.51±0.01	0.45-0.59	0.87±0.02	0.75-0.99	1.24±0.02	1.08-1.40
Width of Wing	----------	----------	----------	----------	1.02±0.01	0.95-1.12	1.91±0.04	1.74-2.15	2.23±0.03	2.06-2.47
Total Body Length	6.19±0.01	0.33-0.45	8.09±0.08	7.52-8.90	9.54±0.19	8.4010.63	11.79±0.06	11.50-12.25	12.07±0.07	11.55-12.50

Table 1 (c): Morpho-metric mean in(mm) and standard error of different Instars of ♀ *A. thalassinus thalassinus*

Parameters	2nd Instar (n=15)		3rd Instar (n=15)		4th Instar (n=15)		5th Instar (n=15)		6th Instar (n=15)	
	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range
No. of antennal Segments	16.26±0.22	15-17	18.53±0.03	18-19	20.40±0.13	20-21	22.73±0.11	22-23	24.46±0.13	24-25
Length of antenna	1.32±0.01	1.15-1.40	2.26±0.03	2.03-2.45	2.64±0.07	2.28-3.15	3.89±0.06	3.11-4.20	4.10±0.04	3.75-4.38
Distance between eyes	0.40±0.01	0.33-0.46	0.50±0.01	0.35-0.56	0.59±0.01	0.52-0.70	0.78±0.01	0.70-0.90	0.83±0.02	0.75-1
Length of Head	1.35±0.02	1.22-1.47	1.73±0.02	1.47-1.84	1.91±0.07	1.16-2.34	2.58±0.05	2-2.80	3.10±0.03	2.80-3.26
Length of Pronotum	1.40±0.01	1.35-1.47	1.81±0.03	1.65-2.10	2.47±0.10	1.78-3.15	3.91±0.04	3.67-4.20	4.16±0.02	4.02-4.29
Length of Tegmina	----------	----------	----------	----------	2.20±0.04	1.85-2.45	5.53±0.08	4.40-5.75	5.97±0.04	5.60-6.18
Length of Wing	----------	----------	----------	----------	1.85±0.03	1.57-2.10	5.16±0.08	4-5.45	5.49±0.03	5.31-5.72
Length of Femur	3.90±0.04	3.67±4.20	5.24±0.09	4.50-5.75	6.36±0.19	5.25-7.12	9.23±0.13	8.50-10.15	9.99±0.08	9.38-10.35
Length of Tibia	3.49±0.40	3.30-4	4.38±0.07	3.75-4.88	5.50±0.19	4.37-6.70	8.25±0.13	7-9.10	8.71±0.09	8.08-9.20
Width of Femur	0.92±0.02	0.75-1.10	1.12±0.02	1-1.20	1.70±0.07	1.25-2.10	2.28±0.03	2-2.35	2.45±0.01	2.35-2.53
Width of Tegmina	----------	----------	----------	----------	0.58±0.02	0.48-0.73	1.21±0.02	1.05-1.40	1.41±0.01	1.38-1.50
Width of Wing	----------	----------	----------	----------	1.17±0.03	0.94-1.43	2.46±0.04	2.20-2.72	2.78±0.01	2.74-2.86
Total Body Length	7.43±0.091.	6.90-8	8.72±0.10	8.20-9.30	10.39±0.26	8.75-11.80	15.20±0.10	14.67-16	15.93±0.08	15.67-16.45