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A TAXONOMIC REVISION OF THE GENUS *Dociostaurus* (ACRIDIDAE, GOMPHOCERINAE)

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ABSTRACT

The genus Dociostaurus Thunberg (Orthopera, Acrididae, Gomphocerinae) is revised, nineteen species and nineteen subspecies now being included.

This genus consists of three subgenera: Dociostaurus, Stauronotulus and Notostaurus. The genus Kazakia Bei-Bienko is synonymised with Dociostaurus and the genus Notostaurus reduced to a subgenus of Dociostaurus.

Three species and three subspecies are newly described, also specific and subspecific synonymy are quoted.

Characters previously used for systematics and diagnosis in the genus were based only on external characters (epiphalli were presented for a few species). The following diagnosis and analyses were made in the present work:

1. A complete diagnostic description for every species using external characters.

2. A full study and description of the male genitalia with complete illustrations and drawings.

3. Statistical analysis of stridulatory peg intervals and file peg numbers. This was augmented in a few species by a study of oscillograms of the stridulation.

4. Study of the chromosomes of eight species and two subspecies.

The genus Dociostaurus Thunberg which was regarded as a purely palaearctic genus, is now known to occur in the Ethiopian region. D. maroccanus and D. brevicollis occur in the Somali Republic.

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INTRODUCTION

History of genus:

The genus Dociostaurus was first described in June 1953 by Fieber and in the same year, but in November, by Fischer under the name Stauronotus; Fischer's name, though for a time generally accepted, must give way to Dociostaurus Fieber, according to the law of priority. W.F. Kirby in his Synonymic Catalogue (1910) included 12 species in the genus Dociostaurus. Later, in 1911, I. Bolivar described D. kervillei from Aleppo (Syria) and in 1917 D. dantini from Morocco; Kirby and Waterhouse (1914) included in this genus five species described by Walker under Stenobothrus. Prof. Stschelkanovzev described D. tartarus in 1909, a species which is omitted in Kirby's catalogue. Lastly, Werner (1913) published one more species from Egypt under the name of D. gracilis.

B.P. Uvarov (1921) revised this genus to include 10 species:

1) He synonymised Stauronotus hauensteini Bol. and Stauronotus kervillei Bol. with Dociostaurus crassiusculus Pantel.

2) He considered D. brevicollis and D. tartarus to be two subspecies of D. crucigerus.

3) He synonymised D. gracilis with D. genei.

4) He described two new species: D. plotnikovi and D. kurdus.

Later, in 1923, Uvarov described D. cephalotes, followed by D. albicornis turcmenus in 1926 and D. hauensteini elbursianus in 1932. Bei-Bienko introduced the genus Kazakia in 1933 with one included species K. tarbinskyi (synonymised under Dociostaurus in this paper). At the same time he described the genus Notostaurus, later reduced by Tarbinsky in 1940 to subgeneric rank. The latter author described the subgenus Stauronotus

in 1940 also. The subspecies D. kraussi aurantipes was published in 1933, the species Notostaurus popovi Miram being added to the world of science in 1935. The 1940's and 1950's were full of additions to the genus - D. curvicercus Uvarov, 1942; D. diamesus Bei-Bienko, 1948; D. cappadocicus given species status in 1951 by Ramme; D. iranicus, D. elbursianus elbursianus, D. elbursianus caspicus and D. svenhedini by Ramme in 1951; D. kraussi claripes, D. k. orantus, N. albicornis rubripes, N. albicornis robustus and N. popovi comtulus by Mistshenko in 1951. Finally D. minutus La Greca, 1962 and D. h. farsistanicus Descamps, 1964 were added in the sixties.

Methods and techniques.

1) Measurements:

(i) General measurements. Being limited by time, body measurements are not given by range and mean (statistically). Here the number of individuals measured in this work is based on 4 or 5 specimens from the extremes in the size range of each species. Having large numbers of specimens it was possible to gauge the size variation and to give measurements which are much more useful than those given in previous publications. The measurements are given in millimetres for male and female and were made with a dial calliper (with accuracy of 0.05 mm) though measuring of small specimens was done under the microscope i.e. each part was drawn by means of a camera lucida and then measured. The parameters chosen are intended to give the reader a general picture of the insect's size and the proportion of parts. The parameters chosen were:

a) Total length; distance from frons to apices of folded hind femora (in horizontal position) (except for D. maroccanus in which the folded tegmina extend far beyond apices of folded

hind femora and in which body length was measured to apices of folded tegmina).

b) Tegminal length - distance from intersection of costal border of tegmen with posterior edge of pronotum to apex of tegmen, wings and tegmina being folded.

c) Femur length - distance from proximal end of posterior femur to tip of outer apical lobe at joint withtibia. The term "knee of posterior femur" refers to expanded distal portion.

(ii) Measurements of file peg intervals. Counting pegs and measuring the distances between them required a microscope with light passing through the objective lenses to illuminate the pegs from above. In this case there was no need to make a special preparation. The hind femur was fixed on a flat or concave microscope slide (covered with a film of glycerol). Counting and measuring the intervals started from proximal end of the file. Very slow movement of the slide was achieved using the micrometer stage. Readings of measurements of intervals were recorded as units on a scale inserted into the objective lens. Each unit under the magnification used represented 0.0034 mm.

(iii) Measurements of apical penis valves were made under the microscope with a camera lucida attachment. The complex was put in a solid watch-glass in 75% alcohol, movement or vibration of the complex being prevented by fixing it between small pieces of broken coverslip. The length of the apical penis valves (mm) was taken from the drawing from the proximal ventro-anterior base of the apical penis valves (meeting point with the flexure) to the tip of the valves.

(iv) Measurements of chromosomes. This was done by the means of a dial calliper using photographs of each autosome pair. These measurements

were used for finding the percentage of the length of each autosome in comparison with the total length of the set; thus the magnification of photographs is not important in this case.

2) Preparations:

(i) Stridulatory file - see under measurements and also scanning electron microscopy.

(ii) Preparation of chromosomes.

a) Blood smear technique. This method has been used by Michael Tyrkus (Department of Biology, Wayne State University, Detroit, Michigan, 1971) on cricket haematocytes (a chromosome culture method).

0.1 cc of Grace's Insect Medium containing 0.04 mg of Colchicine/ cc of media was injected directly into the haemocoel through the abdomen. Injected animals (D. maroccanus and N. albicornis) were then kept at room temperature (72°F) for 22 hrs.

At the end of this period the animals were bled by severing a leg at the coxa. The wound area was touched onto a clean, wet microscope slide and the haemocoel contents spread. The contents were allowed to mix with the water on the slide for up to a minute then the preparation was heat fixed over a spirit burner.

The slides are then stained with 1% aceto orcein and permanent mounts made. This experiment unfortunately did not produce results as satisfactory as those obtained for crickets. Many resting nuclei were seen on the preparations, but it was not possible to see any chromosomes.

b) Testis squash technique. The squash method tends to spread the

chromosomes further apart than they are in the living cell. This facilitates the observation of individual chromosomes (K.R. Lewis and B. John, 1964).

The testis of D. maroccanus (alive) was taken by dissection and fixed in 1:3 acetic-alcohol and stored in a refrigerator.

For squashing, two or three follicles of each testis were placed in a small drop of stain (acetic orcein) on a slide. The material was squashed by tapping it firmly with the flat end of a brass rod (about 3 mm in diameter) for about 10 seconds. When the material had been broken up so that there was a fairly uniform suspension of small cell-groups in the drop, a coverslip was put into position. The preparation was then heated gently over a low flame of a spirit lamp. The slides were then placed between a folded sheet of filter paper and firm vertical pressure applied with a finger tip over the area of the coverslip to absorb excess stain and prevent air bubbles.

Pressure helps to flatten the cells as well, spreading the chromosomes; it also helps to stick the cells to the glass.

These temporary preparations were kept in a refrigerator for a few days after ringing the coverslips with rubber solution and then used for examination and chromosome photography.

Permanent preparations were made using a liquid nitrogen technique.

All slides were examined carefully and after photography the best slides were selected for permanent preparations. First the coverslips were removed from the temporary slides. The rubber solution sealing the coverslip was pulled off with fine forceps. The slide was plunged into a flask containing liquid nitrogen. When boiling

had ceased the slide was taken out. The coverslip (still on the slide) was blown upon until a white film of ice covered the surface of the coverslip (this was done as quickly as possible so that the slide was not allowed to warm up, only the coverslip being thawed). At this stage the coverslip was gently removed using a sharp scalpel or razor blade.

Both slide and coverslip with their attached tissues were then transferred to absolute alcohol (in a ridged smearing dish in vertical position) for about 2 minutes dehydration. Finally the coverslip was mounted (material side down) over a drop of euparal on a clean slide. The same procedure was applied to the slide (material side up). The mounts were then hardened by putting them in an oven. The advantages of euparal are:

a) it does not contract upon hardening;

b) it does not become acidic and cause the stain to fade.

About 60 permanent preparations of different species were made by this technique.

(iii) Genitalia. About 700 specimens (mostly D. genei and jagoi) of the genus Dociostaurus were dissected and studied including types and paratypes both from the British Museum (Natural History) and other European museums.

Since the specimens used were mostly dried, they were first put in a relaxing box for 24 hours or more. For quick dissection (not type specimens) it was possible to trickle a few drops of boiling water onto the end of the abdomen.

When the tissues were sufficiently soft, the supra-anal plate was raised with a needle, the pallium cut laterally and the phallic complex

uncovered; the whole complex was then gently pulled out and the rest of the pallium cut. The external covering (supra-anal plate, paraprocts, subgenital plate) remained undamaged and could be returned to their normal position, so that the external view of the insect appeared unchanged by the operation. The complex was then immersed in 10% caustic-potash solution for 2-16 hours (or 20% KOH solution for 1-2 hrs); this was found preferable to boiling in caustic-potash, which was too drastic. Further treatment consisted of removing the muscular tissues and tracheae, and washing in distilled water. The whole complex was then ready to draw with a camera lucida. The ectophallic membrane and epiphallus were then removed and the remainder of the complex drawn. In addition, the whole cingulum or only its apodemes and zygoma, were removed and the endophallus drawn, sometimes with parts of the cingulum.

The next stage was to remove the sacs and to draw the sclerotised parts of the endophallus (ejaculatory sac and ej. duct were removed in this work).

All phallic complexes dissected and examined in this work were dehydrated through successively stronger alcohols (50%, 75% and 85% alcohol) and preserved in small and narrow glass tubes (Durham tubes, 23 x 0.5 mm) containing a mixture of $\frac{1}{3}$ glycerin and $\frac{2}{3}$ of 75% alcohol, pinned through the stopper under each specimen.

(iv) Recording of song. The primary object of this study was to seek a non-morphological criterion which might supplement the morphological criteria presently employed in differentiating between the species. I decided to investigate the acoustic aspect of stridulating and the relationship between the song pattern (oscillogram) and the situation of pegs on hind femur (inner aspect) of Dociostaurus.

Song recordings were carried out both in the sound proof room (British

Museum, Natural History) and in the field (field observations in Iran). I also received a tape from Mrs S. Blondheim which contained good recordings of the song of several species in Israel.

a) Laboratory recording. Insects (D. maroccanus ♂, ♀) employed in this experiment were from Moghan (north-west of Iran) which were kindly sent to me alive by Ing. Damanabi (Plant Pests & Diseases Research Department, E. Azarbaidjan).

In the laboratory, observations were made with animals confined in a glass vivarium of 80 x 45 cm size. The interior of the vivarium was arranged so as to resemble the habitat of Dociostaurus An incandescent and an ordinary 60 watt lamp were placed in one end and soil temperature on the top of vivarium surface was given by a thermometer laying on the soil surface in the bottom of the cage.

The temperature inside the cage ranged from 32-40°C, the outside temperature being 28°C in the sound proof room.

Song recordings were made with a Uher 4000 report L tape recorder and a Uher Dynamic Microphone Model M5/4. Except for certain signals involving flight which could not be reproduced indoors, there seems to be a fairly close correspondance between behaviour occurring in the field and that occurring in the laboratory (Daniel Otte, 1970), but for Dociostaurus it is very difficult to create conditions like those occurring in nature.

3) Calculations:

Stridulatory mechanism and graphing peg intervals. Stridulatory mechanism consists of two component parts: a file consisting of a series of articulated pegs on inner side of the posterior femur and a scraper

which is a hard ridge (first radial vein of the tegmen), friction between the two resulting in vibration of the integument (Uvarov, 1966).

In Dociostaurus, like the other genera of the subfamily Gomphocerinae, the stridulatory file consists of a series of peglike hairs, the row of pegs being situated along the lower inner side of the posterior femur. The files are not always straight and in most species the pegs are arranged in a wavey line. The shape of stridulatory pegs in genus Dociostaurus was schematically shown first by Jannone (1939b). The number of pegs was used for diagnosis in some European grasshoppers by Jacobs (1953).

The file character was used in taxonomy by M.G. Emsley, D.A. Nickle and W.W. Moss (1967) at the Academy of Natural Sciences, Philadelphia, in diagnosis of male Katydids in the subfamily Phaneropterinae. In these insects the measurements of distances between teeth (situated on the central surface of the left tegmen) were made for four species of the genus Ceraia Brunner. In the present work analysis of the stridulatory organ in Dociostaurus was first used for differentiating two very similar species (D. genei and D. jagoi). They had both been regarded as D. genei Ocskay since 1932. Although studying the male genitalia quite convinced me that there were two valid species present more analysis was required to confirm this diagnosis. This study of the number of pegs and interval distribution gave an excellent character for species differentiation (see the pattern of pegs Figs. 22 and 28 and graphs Figs. 21 and 27) for genei and jagoi. Whilst measuring the intervals and counting the pegs of D. dantini, my attention was attracted to the point that the peg number of some specimens (identified as dantini) was less and the intervals more irregular. By examining the material under the microscope (external characters and phallic complex), it became quite clear that they differed from dantini collected from High Atlas (Morocco). These

specimens were found from Middle Atlas and were thus identified as a new species (D. avicennai). Further analysis involved statistical calculation and the results being demonstrated on the graph (Fig. 90) for D. dantini but for D. avicennai because of shortage of specimens only simple measurements and counting were carried out. Peg interval data was put onto punch tape (number of pegs and the relevant intervals) and fed into a terminal at the Centre for Overseas Pest Research (COPR). A simple graph drawing programme was written by Dr N.D. Jago. The result is demonstrated by solid black triangles or circular symbols indicating the situation of pegs on the file. Axis y is divided to 100 units with an increment of 1.66667 and the number of dots on x axis is equal to the number of peg intervals recorded on the file.

In order to estimate the extent of file interval variation within a species and to demonstrate the relevance of the file as a taxonomic character, measurements of distances between teeth were made for all species of the genus Dociostaurus, 10 members of each species were examined. The recorded data were punched on the tapes and processed using a further computer programme. To make comparison possible between the 10 insects in each sample false zero values were added to the data of animals with less than the maximum number of pegs. The zero values were added equally to both ends of the file or, in some species like D. genei and D. jagoi they were all added to one end because in the latter case these graphs were asymmetrical and by adding zeros to the distal end of the data it was possible to align similar sections of the file.

The programme gave the mean and standard deviation for each peg interval while printing the number of pegs involved in each standard deviation calculation. These results were then plotted, as modified Dice-Leraas diagrams (Simpson, Roe and Lewontin, 1960). The greatest variation in the stridulatory plots occurs at the two extreme ends of the

file (5-15 pegs in each side with long distances between them) which may not be important for producing song. The shape of the pegs is nearly conical, set vertically to the base line of the file. There are usually some hair-like, non-modified pegs visible at the two ends of the file (sometimes between the pegs). They are ignored in my calculations and it is unlikely that they affect the specific correlation between tooth pattern and song.

It can be seen from electron scanning photographs (Figs. 186, 187) that the pegs have a conical shape with a rounded apex (in some species with an attenuated tip), but basically they have a cylindrical shape, are then slightly narrowed and inserted into the ridge with a ring-like articulation. Presumably they are somewhat moveable. The number of pegs in the female is almost equal to that of the male in some species (e.g. D. maroccanus) with less density and smaller size of pegs.

Stridulatory organ as a phase character. Studying the morphology of stridulatory pegs also led me to an interesting point about the phase polymorphism in D. maroccanus. This was found accidentally when an analysis was being made of the big variation in some members.

Phase character in the Moroccan Locust was mentioned by Uvarov 1928a: 231 following Baranov's (1925c) measurements of members from two forms of the Yugoslavian D. maroccanus. Baranov called the smaller specimens D. maroccanus degeneratus (in fact examples of the extreme solitarious phase of this species). Also phase solitaria and gregaria were defined by Tarbinsky in 1932, Pasquier in 1934, Jannone in 1938, Bodenheimer in 1944 and Safarov in 1964. All definitions were based on colour variation, behaviour and morphometrical measurements such as head, pronotum, tegmen, posterior femur and various ratios between these parameters.

I had collected personally, both from gregarious populations (during

the invasion period of 1968) and solitarious scattered populations (recession period, 1958) in the Mehran Steppe (Western Iran) and from this material selected 50 members of each phase. The genitalia of the two groups (solitaria and gregaria) were entirely similar and constant in shape and structure, but examination of the peg intervals showed a new character correlated with phase variation in D. maroccanus. The differences between the stridulatory mechanisms of the two phases are as follows:

a) The number of pegs in ph. solitaria was 85 whereas in gregaria it reached 120.

b) Distances between pegs (excluding two extreme ends of the file) are more regular in gregarious phase, but in the solitarious phase there is a relatively high fluctuation of peg intervals along the file (see diagram Figs. 180 and 181 and graph, Figs. 178 and 179). Consequently mean and standard deviation of peg intervals form a smooth, even shape in phase gregaria, but irregular fluctuating file pattern in the solitarious phase. Note that the number of stridulatory pegs in the genus Dociostaurus is not related to the body size or to the length of hind femur, e.g. D. anatolicus ♂ is much larger than that of D. albicornis and with conspicuously longer posterior femur (about twice as long as that of D. albicornis), but the maximum peg number in anatolicus is only about 60 while that in albicornis reaches 95.

4) Collection of field material:

It became clear that field observation and collecting of live specimens of genus Dociostaurus was necessary. This work was carried out during $3\frac{1}{2}$ months in Iran (April-July) and during a 15 day visit to Israel in 1973. The species collected from Iran were D. maroccanus, D. anatolicus, D. albicornis, D. hauensteini, D. jagoi, D. larensis, D. tartarus and D. crassiusculus nigrogeniculatus.

Testes.

The testes lie in the first third of the abdomen and were removed by vivisection of adults in the field. The lateral ridge between the tergites and sternites of the abdomen was cut and the testes removed with fine forceps. Snap top vials with 1 part of glacial acetic acid and 3 parts absolute alcohol (analar) (freshly mixed) were used to house and fix the testis material. Each vial was labelled and a similar label pinned under the relevant specimen. All vials containing testis samples were kept in a flask of ice. The specimens were then killed in a cyanide jar and labelled as to locality, date of collection, altitude of habitat, ecological condition of the terrain and the name of collector. They were then laid in a box between layers of cellulose wool. Night collecting with a light trap was not successful, perhaps because of the strong winds prevailing at the time.

Song recording.

The same apparatus which had been used for laboratory recording (Uher 4000) was employed for field recording, but this work again was not very satisfactory, because of (i) the noise of strong wind; (ii) interference with the songs of other species living in the habitat; (iii) lack of rainfall which led to late maturation of populations. In many places few insects were collected and in most localities the populations were so thin and scattered that recording songs was impossible.

The material collected from Israel: D. curvicercus, D. genei littoralis, D. jagoi, D. cephalotes and D. anatolicus. I could not find D. maroccanus and D. hauensteini, where oviposition is normally over in early July. In some localities like Bab-el-Hawa (Golan Heights) the species D. cephalotes, D. curvicercus, D.jagoi jagoi and D. anatolicus are sympatric, whereas in coastal areas like Ziqim or Nahel Sorek only D. genei littoralis was found.

5) Photography:

(i) Chromosomes. Photography was achieved using the slides of chromosome preparations under a microscope equipped with a camera and a magnification of up to 1000 x. The objective lens used for this purpose was 100 (normal or phase contrast). Sometimes a x 40 objective was used to get several sets of chromosomes. The film used in this work was KB 17 35mm 17 Din (40 ASA) manufactured by Fotokemika, Yugoslavia. The exposure was assessed by a separate exposure meter on which the film speed was adjustable. About 1000 photographs were obtained from different cells, i.e. several pictures of each slide containing several (well developed) sets of chromosomes. The enlarged prints of each set of chromosomes were 3.75 times as large as negatives, thus giving a total magnification of about x 3750 (for chromosomes and interpretation see page 19).

(ii) Scanning electronmicroscopy of stridulatory pegs. Advantages: provides useful magnification of up to 30,000 x (depending on the material) but also, and very importantly, a depth of focus of at least 300 x better than the best available with a light microscope at comparable magnifications. Resolution of 150-200 A^{o} is obtainable under optimum conditions.

Preparation. No special staining was necessary.

a) Specimens should ideally be very clean, but this was not possible with the museum preserved material available which could only be cleaned (rather unsatisfactorily) with a fine brush and a jet of compressed air. The imperfection of this method is evident from some of the photographs.

b) After cleaning, the posterior femora were mounted on standard Cambridge Stereoscan stubs with Durofix (some slight additional cleaning was possible at this stage under a stereomicroscope). The Durofix was allowed to dry for a few days in order to prevent

any out-gassing in the reduced pressure whilst coating.

c) The specimens were then coated in a Polar 55000 SEM gold coating unit. The specimens were placed in the chambers and air evacuated down to 0.06-0.08 torr. Argon, at a pressure of 5 lb/in^2, was allowed to enter the chamber and sputter coating allowed to proceed, at a current of 40 ma and a voltage of 1.2 Kv for 2 minutes. This resulted in a very uniform coating of gold about 475 A^o thick.

Examination: apparatus used - Cambridge Instrument Company Stereoscan SEM Mark IIA.

Suitable results were obtained with an electron accelerating voltage of 10 Kv and a final aperture of size 1. The low Kv enabled charging effects to be minimised without too much loss of definition as the magnifications used were relatively low.

Aperture 1 (diameter, 200 um) provided the best depth of focus but did not lower the resolution below a tolerable limit. Photographs were taken using 35 mm Ilford, Pan F film.

The scanning electromicroscopy was done at the Imperial College of Science and Technology (Zoology Department) under the guidance of Mr H. Goto.

6) Drawings:

The drawings in this paper are mainly those showing the shape of head and pronotum from above, phallic complex (lateral and dorsal), epiphallus from dorsal view, supra-anal plate and cerci as seen from above, meso and metasternal interspaces, sometimes female ovipositor organ, hind femur and tegmina. The scale of magnification is shown under each figure (1 mm). Care was taken to draw all material in the

same position. To help the identification of species and subspecies a relatively large selection of drawings is provided in this revision. Pattern and colouration (especially on head and pronotum) and also the structure and degree of sclerotisation of phallic complex and epiphallus were noted. Because of the great taxonomic value of illustrations of genitalia in this revision, much care has been devoted to the preparation of figures, the shading and style of presentation showing the nature and real structure of organs accurately. All drawings are oriented with the anterior end towards the top of the page in the case of dorsal views. In the profile drawings the posterior end is on the right. Shading was carried out under a stero microscope using different magnifications to produce different density of dotting (thin for light and thick for dark colour).

Chromosomes and interpretation.

All spermatocytes of testis preparations under this study were in active meiosis and most photographs produced were from the diakinesis stage. Some are in early diplotene, full-diplotene and metaphase I, metaphase II, anaphase I and anaphase II stages (Figs. 184, 185). To interpret them, counts were made of chiasmata and measurements made of autosomes. Comparison was made to interpret intraspecific variation. In addition to demonstrating the whole set in one picture photos of every bivalent of each set were cut and stuck in order of size in horizontal lines. For this purpose diakinesis and diplotene stages were used. Diakinesis is the best stage since when the chromosomes are foreshortened, relatively short and thick, they show the characteristic loops, rings or cross shaped form but are still easily countable.

The course of meiosis is seen in Figs. 184, 185 (an amalgam of different species) and consists of preleptotene, late leptotene, late zygotene, late pachytene, early diplotene, diplotene, diakinesis, metaphase I,

metaphase II, anaphase I and anaphase II. The interpretation of chromosomes (as used in taxonomy in the present work) is tabulated for each species from which the testis material was available and is arranged as follows:

(i) Locality from which the live specimens were collected.

(ii) Autosome pair number (1-11). Autosomes regarded as the chromosomes other than the X chromosome.

(iii) Chiasmata. In some pairs these are found to occur well away from the chromosome ends (interstitial (i)), but in some of them chiasmata occur at the end of the chromosome arms during late diplotene and diakinesis (terminal (t)). In Dociostaurus the position of the chiasma from pair 1-8 is either terminal or interstitial (ti) but usually terminal (t) from pairs 9-11.

Number of chiasma usually varies between 1 to 3 from pair 1-9 but always one from pair 9-11.

(iv) Terminal heterochromatic segments. In most species of animals all the chromosomes have heterochromatic regions around the centromeres, which may be small or constitute large blocks or segments. In many instances, however, there are also distal heterochromatic segments (M.J.D. White, 1972).

In the genus Dociostaurus these segments (called terminal heterochromatic segments) are present in all species. They are sometimes conspicuously large and compact, e.g. in D. anatolicus, strongly visible in stages early diplotene, diplotene and diakinesis medium size (D. tartarus) or small (D. maroccanus).

(v) The comparison was made between each equivalent of chromosome pairs

within the several cells of the same species. They were classified as being symmetrical (s) or asymmetrical (a) the latter being the rarest state.

(vi) Percentage chromosome length. This was carried out by the measurement of each member of a pair (average of two arms in ring or cross or coil shaped) and finding the % of each pair as a proportion of total length of all chromosomes. The simple mean was calculated from several equivalent chromosome pairs from different cells within a given species.

(vii) Analysis of chromosome dimensions. The dimensions of the chromosomes were not directly related to body size in the species of the genus. The bivalents were very small and constricted in D. maroccanus, a species which has a relatively large body size, while in D. hauensteini hauensteini the bivalents were very large, almost the largest chromosomes in the genus. The body size of the latter taxon is very small, about $\frac{1}{3}$ of that of D. maroccanus (measurements taken at similar miotic stages, i.e. in diplotene or diakinesis). Also studied were the relative chromosome lengths, in some species e.g. D. larensis, D. tartarus and D. curvicercus (Israel, i. from Jerusalem and ii. from Betgoverin). This relationship is particularly strong between D. larensis and D.tartarus which in the grounds do not seem to be similar (graph, 188).

Likewise between D. albicornis albicornis and D. albicornis turcmenus (graph 190) the plots of chromosome length distributions were approximately parallel and close to each other. In the same graph significant differences can be seen between D. genei littoralis and D. jagoi jagoi (both collected from Israel.

It is quite noticeable (in graph 189) that there is little relationship in the relative chromosome lengths of D. maroccanus, D. anatolicus and

and hauensteini hauensteini. Figure 189 shows that D. maroccanus has the most regular and smooth distribution chromosome length (%) in comparison to the other species.

Unfortunately because of time limitation a statistical calculation was not possible in the present work.

Literature used for interpretation: see bibliography.

Abbreviations and terminology: The nomenclature of the phallic complex used in this paper is mostly that followed by V.M. Dirsh, 1965, but a few changes and new abbreviations were made to prevent confusion.

The changes are:

Apr = Anterior lateral projections of epiphallus which are connected to the ancorae and weakly sclerotised on their middle parts (Ap, of Dirsh, 1965).

Ppr = a pair of proximal anterior expansions of the lophi with a weak sclerotisation on their margins and usually rough surface on their lateral outer angles (Pp, of Dirsh, 1965).

New abbreviations were made as follows:

J = junction, median posterior dorsal flange of the basal penis valves at point of contact with flexure of which the profile (sloping or vertical) is characteristic in some Dociostaurus species.

P = projection, separate lobes on posterior margin of the last abdominal tergite of which the shape and size are characteristic in many Dociostaurus species.

Pa = posterior appendages of apical penis valves; present in some species only.

Z/m = the ratio was used as one of the characters for separation of D. genei and D. jagoi.

Z = projection of the horizontal length of the eye (as seen from above) onto the mid line of the body.

m = the distance the frons extends in front of a line joining frontal edge of the compound eye (as seen from above).

The following terminology is that followed by Dirsh, 1965 with a description and function for each one. Phallic complex:

A = ancorae - a pair of vertical or oblique projections standing on the anterior margin of epiphallus (on the lateral parts of the bridge) with sclerotisation heavier on their margins.

B = bridge, a sclerotised structure connecting two lateral parts of epiphallus and bearing the pair of ancorae on its lateral sides. This part tends to be very thin when the insect is very young and immature.

Ac = arch of cingulum. Sclerotised and tabular in shape, posteriorly connected to the basal part of cingular valves and anteriorly attached to the zygoma. It is usually solid and rarely bilobate, but in immature specimens of Dociostaurus it is very thin, less sclerotised and divided into two parts of which the upper posterior part is attached to the zygoma.

Ap = apical penis valves, a pair of valves situated on posterior part of complex, thick and more sclerotised at the base and narrowed towards the apex and hollow inside (like a syringe). Usually connected with a very thin membrane round the middle to the arch of cingulum. Its length, shape and position (oblique or vertical) is highly significant for differentiation of Dociostaurus species and also offers a good generic character.

Apd = apodemes, a parallel pair of horseshoe shaped structures with different length of arms and different degree of sclerotisation in different species.

Bp = anterior expansions of penis valves consisting of two excurved plates attached to muscles on proximal edges. They are very thin and hardly excurved when the insect is young and immature.

Cv = cingular valve. A pair of valves situated between apical valves of penis and arch of cingulum, usually slightly longer and less sclerotised than apical valves of penis and closely attached to the latter. Both sides of the pair approximately parallel to each other, except in subgenus Stauronotulus in which they tend to curl inwards to overlap at the base (near arch of cingulum).

Ejd = ejaculatory duct non-sclerotised tube-shaped structure, connected to the ejaculatory sac and easily removable from the latter.

Ejs = ejaculatory sac or endophallic sac; an expansion of ejaculatory duct.

Eph = epiphallus, situated between two arms of apodemes (or dorsal part of phallic complex). Very useful for differentiating Dociostaurus species.

Fx = flexure, a very narrow and strongly sclerotised and flexible part of complex connected ventrally to the valves of penis and to upper margin of basal penis valves.

Gpr = gonopore process. A pair of highly sclerotised processes on the basal valves which are attenuated ventrally towards the spermatophore sac, joining this sac on its proximal apex and also attached to the anterior part of the sac along posterior $\frac{3}{4}$ of its margin. The shape and length of this process is a good species character in Dociostaurus species.

L = lophi, a pair of sclerotised processes with a rough surface near the middle of the epiphallus, anteriorly joined to the posterior of the bridge and posteriorly connected to a pair of lobe shaped processes (Ppr = posterior projections). The latter can be regarded as an extension of the lophi. The size and degree of sclerotisation and also the degree of projection are used as useful taxonomic characters in the present work.

Lp = two lateral plates of epiphallus, variable in size and weakly sclerotised.

Rm = rami of cingulum, lateral parts of cingulum which connect to the zygoma and cover ventro-posterior surface of the penis valves forming a collar shaped structure.

Sps = spermatophore sac. The larger part of endophallic sac with a transparent membrane which is usually thickened around the margin of the sac. Spermatophore sac is divided into two parts of which the posterior is located between the arch of cingulum and flexure and the anterior part between the flexure and gonopore process.

Zyg = zygoma of cingulum; transverse basal part of cingulum to which arch of cingulum and cingular valves are joined and extending laterally to form rami of cingulum.

Abbreviations for the terminology applied to the end of abdomen:
Sa = supra-anal plate (epiproct), the last tergite of abdomen (no. 11), which covers anus from above. The structure of this part and the lobes (P) situated in its anterior part are characteristic for each species in this genus.

Sg = subgenital plate, ninth (♂) and eighth (♀) abdominal sternite, covering phallic complex in male and genital opening in female. Only a useful diagnostic character in D. maroccanus.

C = cercus, a pair of processes situated at the sides of the supra-anal plate. The size and position of ♂ cerci are used as a diagnostic character for some species, e.g. D. curvicercus in males only.

Pr = paraprocts and a pair of lobes at the sides of the last ♀ abdominal tergite and anus.

Vo = valves of ovipositor, consisting of two visible pairs of valves (ventral and dorsal) of which the structure is sometimes diagnostically useful in determining the species.

For antennae: ♂ & ♀

Sc = scape, first basal antennal segment attached to head (at antennal sockets).

Pd = pedicel, second antennal segment.

The size and colouration of the above mentioned segments are sometimes characteristic.

Wing-venation. The terms for the wing venation and wing areas used as taxonomic characters in this work follow the terminology of Dr D.R. Ragge, 1955. Each area (except the precostal area) is named after the vein which forms its anterior boundary. The areas are always subdivided into cells. The precostal area (Pc), which only occurs in the forewing, is often produced anteriorly to form a precostal lobe (Fig. 20A). Drawings were made for tegmina of D. genei genei and D. jagoi occidentalis which are oriented as if they were in the folded position on the insect.

Oscillogram traces, song records and mating behaviour

Sonograms were produced by replaying the tapes through a Tektronix 502A oscilloscope at $3\frac{3}{4}$ inches/second.

After suitable amplification the records were filmed on Ilford NS6 recording paper using a Shackman oscilloscope camera. Film was moved at a speed of 1 inch/sec for all the records.

Oscillograms of courtship song proper and calling song of ♂ Dociostaurus were prepared (Fig. 40). The first 4 rows show the courtship songs of D. curvicercus at an early stage in courtship. The song patterns show some differences in rows 1 and 2, and 3 and 4, because different stages of courtship are in progress. According to W. Loher and M.K. Chandrashekaran, 1972 (Division of Entomology, University of California, Berkeley), it is possible to interpret each courtship song (covering two rows in plate 40) as follows. Two phases in the courtship involve sound production.

1) ticking phase consists of a few simple chirps (phase 2 of Loher et al., 1972).

2) courtship song proper including 14-15 composite chirps (phase 3).

Phase 1 regarded as the introductory phase involves mainly visual stimuli (Lower & Chadrashekaran, 1972) which are not described in this paper because shortage of time prevented full study. There is a relatively long gap between each simple chirp (in the ticking phase at the beginning of the row) and shorter intervals between each composite chirp (in courtship phase) which are regarded as 'syllables'.

Row B (5 and 6) represented the courtship song for D. jagoi jagoi, row C that for D. genei littoralis and row D that for D. cepahlotes. For D. maroccanus and D. anatolicus only calling songs are represented (rows E and F respectively). Row G shows the calling song of D. hauensteini.

The temperature at which the songs were recorded is not given in this paper. The temperature does affect pulse and chirp rate, but not the

form of each pulse.

General results of studies on stridulatory file morphology and peg structure

Behaviour patterns normally performed by receptive females seemed to be passive ones in this species (D. maroccanus). It may be that unlike males, females are sexually responsive for short periods only (see work on other species by D. Otte, 1970). Principal patterns of Dociostaurus behaviour involving communication, pair formation and courtship, aggression and repulsion are closely associated with signalling. Signals can be named according to the patterns of movements of the display, e.g. stridulating, leg tipping, antennal pointing, etc.

In Dociostaurus maroccanus males stridulate, usually by rubbing a stridulatory file on the hind femora against the R1 vein of the forewings (CS). According to my observations in the laboratory and long observations in the field in Iran, D. maroccanus is a graminivorous species (Uvarov called them Graminicole) and Daniel Otte named them G vegetation dwellers. Males of this species possess songs which are believed to attract the females, and which are performed by solitary males. My observations show that females stop when males stridulate and that male stridulation is most frequent in the presence of other males. Thus in this species song may be of greater importance in male/male repulsion than in attraction of females. Females of Dociostaurus answer the calls of males usually with silent femoral movements (in the laboratory) and stridulate occasionally, but very softly. I have not been able to determine whether this stridulation is for answering or attracting males or whether it is a repulsion signal.

The male mounts the female when he is sufficiently close. But if the female has got eggs and she is ready to lay, she is sexually unreceptive and performs movements to inhibit mounting by males (e.g.

kicking male furiously - perhaps an energetic form of femur-raising and oppression mentioned by Otte). In D. maroccanus the male begins to stridulate very fast during mounting and makes a loud noise (I have recorded this song). This stridulation is quite distinct from calling, which is usually short and fast, and the male will continue to signal until the genitalia are attached.

Aggression: males of D. maroccanus were observed to call in response to the calls of other males. As a result, bursts of calling by groups of males can be heard. Bursts of aggressive calling were heard when about 7 males of D. maroccanus were confined in a vivarium or in a jam jar.

Presentation

1. Diagnosis: Male and female diagnoses of species of Dociostaurus are described in this paper using the characters listed below:

i) Internal characters: phallic complex (mostly as seen in side view) especially apical penis valves, epiphallus (dorsal view); or chromosome characteristics (in some species).

ii) External characters, consisting of:

a) General colouration; b) Fastigium verticis and temporal foveolae; c) Frontal ridge; d) head (vertex and occiput); e) compound eyes; f) Antennae; g) Pronotum; h) Meso- and metasternal interspace (in some species); i) Tegmina; j) Posterior femora; k) Hind tibiae; l) supra-anal plate; m) number and spacing of stridulatory pegs; n) oscillogram of song (in a few species).

2. Distribution: Genus Dociostaurus covers a vast region extending through north-western China, central and western Asia, southern Europe, northern and north-eastern Africa (Somali), and the Canary Islands.

Geographical distribution is indicated under each species and subspecies and description of detail such as localities, altitude and sometimes habitat details can be seen under "material examined".

3. Keys to the species and subspecies are based mainly on male characters such as genitalia, the most outstanding features of external and stridulatory organ characters.

4. Synonymy. All synonymy (including type, paratype data of synonymised taxa) has been presented in the following manner. Previous name of insect; author; date of determination, reference; sex, locality of collection and date; collector's name and depositing of type. An indication is given of the author responsible for the synonymy.

5. Material examined. Material for study had the following origins:

1. Collection of material (including accession collections) at the British Museum (Natural History), London.
2. Specimens collected by myself from Iran and Israel.
3. Material (including types and paratypes) studied in USSR (Leningrad, Zoological Institute, Academy of Sciences) and also the material which was lent to me by the Academy.
4. Museum d'Histoire Naturelle, Paris.
5. Instituto Espanol de Entomologia, Madrid.
6. Zoologisches Museum of the Humbolt-Universität, Berlin.
7. The Hebrew University (Department of Entomology), Jerusalem.
8. Museum of Natural History, Beograd.
9. Museo Civico di Storia Naturale, Genova.
10. Plant Pest & Diseases Research Institute, Tehran.
11. Plant Pest & Diseases Research Department, Tabriz (E. Azarbaijan) (live material).

6. The species groups: species in the genus can be grouped according to

differences in their male genitalia:

i) Subgenus Stauronotulus. Those with valves of penis blunt, cingular valve widened in the base and strongly curling and overlapping each other, epiphallus with a very thick, strong bridge and bi-lobate strongly elevated lophi, e.g. D. maroccanus, hauensteini and crassiusculus.

ii) Subgenus Dociostaurus. Those in which the penis valves are more erect, sometimes slightly incurved near the apex; length of cingular valves (the part standing above the arch of cingulum) relatively long and both cingular and apical penis valves more or less attached to each other, e.g. D. genei, jagoi, curvicercus, minutus, brevicollis, tarbinskyi and tartarus.

iii) Subgenus Notostaurus. The apex of penis valves in this group sharp, somewhat directed outward. Usually with a narrow gap between cingular and apical penis valves (more noticeable above arch of cingulum). Cingular valves shorter (measured from arch of cingulum upward). An angular process weakly projecting on ventro-posterior edge of apical penis valves. Epiphallic bridge not very thick and lophi not strongly prominant. D. cepahlotes, anatolicus, albicornis, popovi, diamesus, plotnikovi, dantini, avicennai and larensis.

Note: In D. minutus, the structure of penis valves (especially that of cingular valves) resembles that of D. hauensteini. The separate lobes of the last abdominal tergite are similar to those of D. crassiusculus. Thus this species could, perhaps, be grouped with the first species group, but since there is only one specimen of each sex of this species in the B.M.N.H. I am unable to make a final decision on this at present.

Genus Dociostaurus Fieber, 1853

Type species by subsequent designation Gryllus maroccanus (Thunberg, 1815) (Kirby, 1910). Mem. Acad. Sci. St. Petersburg, 5: 244. Genus designation Lotos, 3: 118.

SYNONYMY.

Stauronotus Fischer, 1853. Orth. Eur., 297, 351. Type species Gryllus cruciatus Charpentier, 1825.

Kazakia Bei-Bienko, 1933b. Bol. Soc. Esp. Hist. Nat., 33: 332, 338. Type species Kazakiatarbinskyi 1933b. Syn.n.

Stauronotulus Tarbinsky, 1940: 28, 182. Type species D. hauensteini Bolivar, 1893.

DIAGNOSIS.

Introduction. The generic diagnosis must inevitably rest more heavily on males than females. All members of this rather unspecialised group possess a femoral stridulatory file of the gomphocerine type bearing from 22 (D. hauensteini) to 124 (D. tartarus) pegs. Because of their generalised external anatomy the genus can only be defined on a combination of characters which taken together separate them from their nearest relatives, which may lie in such genera as Dnopherula.

Like all grasshoppers they develop certain characteristics when they display brachypterous facies:

(i) the metazona of the pronotum becomes shorter than the prozona,

(ii) the apical half of the tegmen is reduced at the expense of the basal half.

Characters arising as a result of brachypterism cannot, therefore, be used to define the peculiarities of this genus and indeed may obscure

some of the valid generic characters.

The following characters taken in combination can be considered to offer a preliminary diagnosis of the genus:

1. Antennae filiform, unspecialised and never clubbed. Usually longer than head and pronotum taken together but occasionally same length. Flattened but not widened from segment 3 onwards.

2. Frontal ridge pitted, flat, sulcate or convex; usually longitudinally sulcate above level of ocellus. Upper extremity of ridge half width of ridge at level of ocellus; width at ocellus greater than that of first antennal segment. If sulcate, lateral margins not carinulate, margins being rounded. Frons oblique or vertical.

3. Fastigium verticis concave, horizontal or sloping forwards at about 30° from the horizontal. No median dorsal carinula anterior to transverse arcuate groove of fastigium.

4. Temporal foreolae with sharply defined angulate corners, never ovoid. Usually clearly impressed triangular or rhomboid. Orientation dorso-anterior (not lateral or downwards as in some Dnopherula and Rhaphotittha species). Visible from above (as in Stenobothrus - Chorthippus complex).

5. Inter-ocular space dorsally less than or equal to width of each compound eye as seen from above (thus differing from Chorthippus - Stenobothrus complex in which foreolae are narrower and vertex wider dorsally than in Dociostaurus).

6. Vertex with weakly developed tricarinula in subgenus Notostaurus, weaker in D. tarbinskyi, but absent in other species. Vertex proportionately shorter than in Dnopherula.

7. Eyes large and with longest axis 1.25 to 3 times length of subocular groove.

8. Median dorsal pronotal carina entire thus separating the genus from abberrant gomphocerines like Pseudoutanacris Jago, Cordillacris Rehn, Pedioscirtetes Thomas, Bootetlix Bruner, Xeracris Caudell, Heliaula Caudell and Cibolacris Hebard.

9. Lateral pronotal carinae absent or present in prozona. Usually present in both prozona and metazona; markedly diverging forwards in prozona and caudad in metazona. Lateral carinae absent between transverse sulci 2 and 3 and weakly developed or absent between sulci 3 and 4. Lateral pronotal carinae thus differentiate this genus from others with elongate species, which lack lateral carinae or have parallel lateral carinae. Also unlike Amphitornus McNeill, Arcyptera Serville, Euchorthippus Taro, Rhaphotittha Karsch, Pnorisa Ital, Dnopherula Karsch, Opeia McNeill, Mongolotettix Rehn, Chrysochraon Fischer de Waldheim, Faurea Uvarov, Notopomala Jago and Kraussella I. Bolivar which have subparallel or weakly excurved lateral carinae rather than abruptly excurved ones (especially tending to be parallel in prozona). Width of narrowest part of prozona equal to or greater than half maximum width of metazona.

10. Lateral carinae usually with light bands of pigment along inner edges of lateral carinae forming a characteristic 'X' shaped marking.

11. Roughly semicular elevated (or flat) whitish area bounded in front lateral continuation of sulcus 3 and usually reaching back edge of side lobe.

12. Tegmina and wings fully developed or shortened. When fully developed tegmina have a costal vein which reaches front margin beyond its middle point. This feature is obscured in brachypterous derivatives, e.g. D. plotnikovi, D. minutus and D. dantini. The costal vein reaches the front tegminal margin beyond the middle in New World forms like Anlocara Scudder, which otherwise strongly resemble Dociostaurus.

Note that precostal and medial fields are usually slightly expanded.

13. Hind-wings colourless (rarely light red on the proximal base e.g. anatolicus and albicornus) without dark bands. Extra-anal area of hind-wing unmodified for stridulation as is that in some Stenobothrus - Chorthippus species.

14. Male genital structure:

(i) Epiphallus with strong undivided bridge (B). Posterior processes (Ppr) of lophi sclerotised but slender, not greatly inflated or produced dorso-posteriorly. Lophi large directed inwards or obliquely upwards, rounded and rugosely sclerotised.

(ii) Flexure entire and usually sharply curved. Angle between flexure and penis valves usually acute.

(iii)Penis valves moderately long to very long. Cingular valves widely separated or closely appressed. Subgenera Notostaurus and Stauronotulus with rather uniform genital structure, but rest of species specifically individualistic. Apical penis valves with ventro-posterior projection (unlike Dnopherula). Sheath-like ventral part of apical penis valves

smoothly curved below (see Fig. 75), not hatchet-shaped in profile (Figs. 78-79) as in Eremippus and Bodenheimerella.

15. Chromosomes - showing a marked tendency to having large apical heterochromatic segments and asymmetry in smaller autosome pairs. In subgenus Stauronotulus chromosomes are large; in subgenus Dociostaurus (especially D. maroccanus) very small. Apical heterochromatic segments developed most fully in Notostaurus.

In all cases the chromosome number was $2n + x = 23$ in males, which places Dociostaurus outside the Chorthippus complex where $2n + x = 17$.

KEY TO SPECIES OF THE GENUS Dociostaurus

1. Apices of folded tegmina reaching or surpassing tip of folded femora 2

- Apices of folded tegmina never reaching or just level with tips of folded hind femora 9

2. Metazona of pronotum at least $1\frac{1}{4}$ times longer than metazona, and antenna equal to or slightly longer than head and pronotum together. Longest axis of compound eye never more than twice as long as subocular groove. Temporal foveolae short (quadrangular or slightly longer than deep) 3

- Metazona of pronotum equal to or slightly shorter than prozona and antennae at least $1\frac{1}{4}$ times longer than head and pronotum together. Longest axis of compound eye at least $2\frac{1}{4}$ times longer than subocular groove. Temporal foveolae about twice longer than deep 6

3. Apices of folded tegmina extending well beyond tips of folded posterior femora 4

- Apices of folded tegmina just reaching or just surpassing tips of folded hind femora 5

4. General appearance more robust. Compound eyes small, longest axis of eye being about 1.6 times as long as subocular groove. Pronotal metazone strongly elongate (about 1.45 times longer than prozona). Frontal ridge flat. Fore femora thickened. Hind tibiae red in colour. Supra-anal plate large. Lobes on posterior margin of last tergite decumbent and not produced at all. Cerci strongly elongate, surpassing tip of supra-anal plate. Subgenital plate broad with apex bluntly truncate. Apical penis valves unique, very long and strongly incurved

with blunt apices. Cingular valves broadly curling and overlapping at base. Arch of cingulum very small and bilobed. Posterior projection and lophi very small and thick on epiphallus.

maroccanus (Thunberg)

- More slender. Compound eyes larger, longest axis of eye about twice length of subocular groove. Antenna with ivory white last segment. Frontal ridge sulcate. Fore femora not thickened. Hind tibiae blue. Lacking broad lobes on posterior margin of last tergite. Cerci very thick at bast and strongly incurved. Subgenital plate short and conical. Apical valves of penis shorter, not curved, with pointed apex and projecting process along ventro posterior edge. Epiphallus comparatively larger than in all other species. Lophi strongly enlarged and sclerotised.

curvicercus Uvarov

5. Darker in colour. Tips of folded tegmina just reaching knee of folded posterior femora. Fastigium verticis relatively large, about 1.15 times longer than wide. Temporal foveolae short and not regular trapezoidal. Frontal ridge somewhat sulcate above median ocellus. Eyes bulging. Antennae thicker, scape with a black spot on its upper inner side. Genicular lobes of hind femora entirely black. 3-4 black dots on lower outer carinula of hind femora. Valves of penis elongate with pointed apices. Supra-anal plate wider than long. Number of stridulatory pegs 22-32.

genei (Ocskay)

- Colour lighter. Tops of folded tegmina reaching to or slightly surpassing knee of posterior femora. Fastigium of vertex small, about as long as deep. Temporal foveolae larger and almost quadrangular. Antenna thinner. Lower genicular lobes (outer side) of hind femora

light in colour. Supra-anal plate narrower. Valves of penis short, blunt and broadly upcurved. Number of stridulatory pegs 50-76.

jagoi sp.n.

6. Lateral carina in prozonal disc of pronotum feebly developed anterior to transverse sulcus 3 and weakly divergent forward. Head strongly reclinate and 'X' shaped marking on pronotum usually absent. The third segment of hind tarsus about 3 times longer than median segment 7

- Lateral carina on prozonal disc absent and light bands forming 'X' shaped marking, if present, strongly divergent forward. Frons feebly sloping backward and third segment of hind tarsus not more than twice longer than median segment 8

7. Fastigium verticis elongate, depressed and not parallel sided posteriorly. Foveolae long and almost rectangular. Longest axis of compound eye about 2.8 times longer than subocular groove. Antennae light in colour. Median carina in prozonal disc developed. Hind tibiae pale yellowish green. Supra-anal plate long. Lobes on posterior margin of last tergite relatively large with rectangular interspace. Phallic complex very small. Apical penis valves short, oriented obliquely upward and slightly upcurved. Cingular valves slightly outcurved. Junction not distinctly flanged. Number of stridulatory pegs 80-103.

larensis sp.n.

- Fastigium verticis longer (1.8-2.1 times longer than wide), strongly concave, sloping downward, roughly parallel sided posteriorly but margins slightly incurved at level of frontal ridge. Temporal foveolae longer (about twice longer than deep) and narrowed towards frontal ridge. Longest axis of compound eye about 2.4 times as long as subocular groove. Antennae darker, usually with black spot on pedicel. Median carina on

prozonal disc obliterated. Lower outer carina in hind femora with 4-5 small black spots. Hind tibiae greyish blue. Supra-anal plate wider than long, lobes on posterior margin of last tergite smaller with very wide interspace. Phallic complex larger. Apical penis valves longer and more vertically oriented. Cingular valves incurved at proximal end. Junction strongly flanged. Number of stridulatory pegs 90-95.

tarbinskyi (Bei-Bienko)

8. Fastigium verticis wide, not always parallel sided posteriorly. Antennae dark brown, very long (1.5-1.75 times longer than length of head and pronotum together). Posterior femur more robust, shorter. Hind tibiae red. Frontal ridge slightly depressed near median ocellus. Supra-anal plate a little longer than wide. Lobes on posterior margin of last tergite deep, small with a deep median incision. Sub-genital plate with conical blunt apex. Number of stridulatory pegs 58-90. Apical penis valves thick (at base) with a projecting portion along half its length posteriorly (Fig. 62). Posterior projections of epiphallus elongate laterally.

brevicollis (Eversmann)

- Fastigium verticis about 1.5 times longer than wide with rounded angles and black linear patterns on sides. Antenna light in colour and 1.3-1.45 times longer than head and pronotum together. Posterior femur relatively slender and long. Hind tibia normally pale yellow greenish. Frontal ridge heavily impressed below median ocellus. Supra-anal plate wider. Lobes larger with obtusangular interspace. Sub-genital plate large and obtusely rounded. Number of stridulatory pegs 80-124. Apical penis valves slender, straight and almost vertical. Posterior projection of epiphallus not elongate.

tartarus (Stschelkanovzev)

9. Median dorsal carina on vertex and occiput obliterated to entirely absent 10

- Median dorsal carinula distinctly to indistinctly present on vertex and occiput 16

10. Lobes on posterior margin of last tergite decidedly enlarged and closely appressed on mid-line with broad and bluntly rounded apices half covering supra-anal plate. Frontal ridge flat and convex at level of antennal bases. Fastigium verticis slightly concave. Hind femur thick and powerful with a low number of stridulatory pegs (22-32). Hind tibiae usually red.

hauensteini (Bolivar)

- Lobes on posterior margin of last abdominal tergite not as large as in hauensteini with a noticeable interspace and not even extending to mid-point of supra-anal plate. Fastigium verticis concave. Hind femur longer proportionately and not thickened. Number of stridulatory pegs higher 11

11. Lobes on posterior margin of last tergite distinctly projecting and angular. Lateral pronotal carinae not visible in prozona..... 12

- Lobes on posterior margin of last tergite not projecting. Fastigium verticis deeply concave. Lateral carinae present both in prozona and metazona 15

12. Lobes of last abdominal tergite almost rectangular and wider than long with distinct interspace. Valves of penis short covered with membrane or sheath, having a projection on ventro posterior margin.. 13

- Lobes of last abdominal tergite not rectangular, valves of penis longer and not covered with membrane 14

13. The smallest species in genus Dociostaurus with strongly abbreviated tegmina (only extending to third abdominal tergite). Fastigium verticis about 1.43 times longer than wide, surface slanting forward and downward. Temporal foveolae large and as long as wide. Head strongly projecting above mid-line of pronotum. Longest axis of compound eyes about twice as long as subocular groove. Antennae slightly longer than head and pronotum together. Lateral carinae not present on prozonal disc. Light bands on inner side of metazonal lateral carina narrow. Hind tibiae dark dirty grey. Number of stridulatory pegs 61.

minutus La Greca

- Larger size. Apices of folded tegmina just reaching or just surpassing tips of folded hind femora. Fastigium verticis as long as wide and not sloping downward. Temporal foveolae longer than wide. Head not strongly projected above the level of pronotum. Longest axis of compound eyes about 1.5 times longer than subocular groove. Antennae 1.5 times longer than length of head and pronotum together. Lateral carina weakly present in prozonal disc. Light band on inner side of metazonal lateral carina widened toward sulci 4 and triangular. Shiny black patterns present on lateral pronotal lobes covering intersapce between transverse sulci 2 and 4. Hind tibiae red. Number of stridulatory pegs 30-40.

crassiusculus (Pantel)

14. Smaller in size and darker in colour. Fastigium verticis elongate (1.57 times longer than wide), usually sloping forward and downward and strongly concave. Temporal foveolae narrower posteriorly. Light 'X' shaped pronotal markings bordered on both sides by darker bands of brown or black. Metazonal disc light brown. Three dorsal spots on posterior femora often extending a short way onto external surface.

Upper genicular lobes dark and lower lobes light on both inner and outer sides. Hind tibiae dull dirty pink or pale creamy blue. Arch of cingulum small. Bridge of epiphallus thin and slightly curved.

diamesus Bei-Bienko

- Fastigium verticis regular pentagonal, as wide as long, slightly sloping forwards. Temporal foveolae wider posteriorly. Two light bands between transverse sulci 2 and front of pronotum faint. Metazonal disc dark brown. Lateral pronotal lobes with shiny black spot covering area between, and overlapping, sulci 2 and 3. Posterior femora slender, 3 black spots on their upper carina extending onto both inner and outer sides of femur but reaching lower edge of outer area. Knee dark brown or black. Hind tibiae dull grey. Arch of cingulum large. Bridge in epiphallus thick and straight.

plotnikovi Uvarov

15. Fastigium verticis pentagonal, about 1.5 times longer than wide. Temporal foveolae subrectangular and narrower. Compound eyes relatively longer. Longest axis of eye about 1.9 times longer than subocular groove. Pronotum feebly constricted from above. Lateral carina on prozona weakly divergent forwards to parallel. Hind margin of pronotum rounded. Posterior femora light yellow stramineus. Hind tibia light red or yellowish. Third segment of posterior tarsi long (about 2.3 times longer than median segment). Supra-anal plate ovoid. Cerci very thick. Phallic complex broad. Apical penis valves rather vertically directed with projecting process on ventro-posterior margin. Arch of cingulum sclerotised with anterior pointed angle toward junction point. Flexure very acute at junction. Junction forming elevated crest. Zygoma small with rounded posterior margin. Number of stridulatory pegs 61.

dantini (I. Bolivar)

– Fastigium verticis broad with rounded angles, slightly wider than long. Temporal foveolae ovoid and broad. Compound eyes shorter and broad, longest axis of eye about 1.65 times as long as subocular groove. Pronotum broad. Prozonal disc strongly constricted. Lateral prozonal carina strongly divergent forward. Pronotal posterior margin obtusely angular. Posterior femora light dull brown. Hind tibia pinkish. Third segment of hind tarsus shorter (about twice as long as median segment). Supra-anal plate wide, triangular. Cerci slender, slightly outcurved and projecting well beyond apex of supra-anal plate. Phallic complex narrower. Apical valves of penis oblique, their projection smaller. Arch of cingulum more massive. Flexure robust but not sharply curved. Junction sloping down smoothly to anterior part of flexure. Zygoma large with wide angular posterior part. Number of stridulatory pegs 45–50.

avicennai sp.n.

16. Tegmina short, not surpassing middle of supra-anal plate. Maximum length of hind wings not more than 0.8 times length of tegmina. Vertex convex between compound eyes. Vertex sloping down sharply to middle of fastigium..... 17

– Apices of folded tegmina surpassing tip of abdomen but only just reaching tips of folded femora. Hind wings almost same length as tegmina. Vertex gently sloping towards middle of fastigium..... 18

17. Smaller fastigium verticis narrow and longer than wide, its front angle acute. Fastigium verticis strongly concave. Frontal ridge sulcate. Temporal foveolae wide, almost rhomboid. Median dorsal carinula lies between 2 decumbent irregular elevations. Compound eyes larger, longest axis of eye 2.75 times longer than subocular groove. Median pronotal carina not strongly elevated. Prozonal lateral carina distinct

and curved with narrow light band. Head and pronotum strongly rugose. Tegmina leathery. Hind tibia dull blue. Supra-anal plate triangular almost as long as wide. Cerci swollen basally, their apices falling short of tip of supra-anal plate. Number of stridulatory pegs 38-45.

cephalotes Uvarov

- Much larger fastigium verticis slightly wider than long with rounded front angle. Frontal ridge flat. Temporal foveolae longer than wide. Median dorsal carina single. Compound eyes not as large as in D. cephalotes. Longest axis of eye 2.25 times longer than subocular groove. Median pronotal carina strongly elevated. Lateral carina in prozona not distinctly elevated, diverging uniformly forward, with wider light bands bordering them. Tegmina subtransparent, a few black dots present on lower outer hind femoral carinula. Hind tibia pale yellow with black band at proximal end. Supra-anal plate elongate, longer than wide. Cerci long and narrow, their apices level with or slightly surpassing tip of supra-anal plate. Number of stridulatory pegs 48.

popovi Miram

18. Fastigium verticis strongly concave in mid point, heart shaped. Temporal foveolae longer than deep and slightly pitted. Compound eyes elongate, largest axis of eye 2-3 times longer than subocular groove. Antennae whitish. Pronotum elongate. Median dorsal carina and adjacent disc strongly elevated. Lateral carina on prozonal disc anterior to transverse sulcus 2 well developed. Hind margin of pronotum rounded obtuse angled. Hind femur slender with blackish knee. Hind tibia black at proximal end. Apices of cerci falling short of supra-anal plate tip. Apical penis valves short and sharp, slightly curved with a small projection on ventro-posterior margin. Number of stridulatory pegs 42-62. Terminal heterochromatic segments of meiotic

autosome pair very large.

anatolicus (Krauss)

- Fastigium verticis concave, broad and pentagonal. Temporal foveolae narrow and longer than in D. anatolicus. Compound eyes large. Longest axis of eye about 2.5 times longer than length of subocular groove and more inflated than in D. anatolicus. Antennae light but darker than in D. anatolicus. Pronotum with broader disc, weakly constricted at middle. Median dorsal carina less elevated. Lateral carinae on prozonal disc not strongly developed. Hind margin of pronotum obtusangulate. Hind femur more robust. Dorsal genicular lobes of inner and outer sides dark, with lower inner and outer lobes light. Hind tibia light at base. Cerci thinner, longer and slightly incurved, with apices level with tip of supra-anal plate. Number of stridulatory pegs 60-90. Terminal heterochromatic segments of meiotic autosome pair small.

albicornis (Eversmann)

1. Dociostaurus genei (Ocskay, 1832)

Type: ? Gryllus genei Ocskay, 1832. Acta. Acad.Caesar.Leop.carol.,16(2): 961. Type lost. Neotype here designated: ITALY, Lido degli Estensi, Porto Garibaldi, Comacchio, 3.X.60 (L. Capra). Mus. Civ. Stor. Nat. Genova. Plesiotypes in B.M.N.H. from YUGOSLAVIA.

SYNONYMY. See under subspecies.

DIAGNOSIS. Male:

1. Phallic complex. Apical valves of penis (Ap) in lateral view (Figs. 13, 14) are elongate with pointed upcurved apices. Apical valves are those parts of aedeagus with greatest diagnostic value. Cingular valves (Cv) sharp and extending beyond apical valves of penis (Figs. 13, 14). Arch of cingulum (Ac) solid, not divided. Flexure (Fx) sharply curved. Basal valves of penis (Bp) wide and excurved as seen from above (Figs. 5, 6).

Epiphallus (Eph) comparatively large and wide. Lateral plates (Lp), which form sides of epiphallus, well developed, sloping obliquely outwards and forwards. Median lophi (L) sclerotised. Bridge (B) comparatively thick. Space between lateral lobes as wide as deep. Ancorae (A) almost parallel with longitudinal axis of insect (Figs. 9, 11).

2. General colouration dark blackish brown with less variation than in other closely related species, e.g. D. jagoi sp.n.

3. Fastigium verticis 1.15 times longer than wide (Figs. 1, 2), concave with four distinct and almost equal marginal carinulae. Temporal foveolae pitted, short forming a not completely regular trapezoid. Vertex narrower between compound eyes, less expanded posteriorly between eyes than in D. jagoi (see Figs. 3, 4).

4. Frontal ridge gently attenuated towards fastigium verticis. Surface punctuation distinct. Hardly depressed on median ocellus but sometimes sulcate above the latter. Margins of frontal ridge sharp from fastigium down to level of median ocellus.

5. Head projecting prominently above level of pronotum. Occiput with an obsolete median dorsal ridge marked only by a line of pigment.

6. Eyes large, wide and prominant as seen from above and with dorsal surfaces nearly level with top of vertex as seen from lateral aspect. Ratio z/m 3.1-4.53 and the longest axes of eye about twice as long as the length of subocular groove.

7. Antennae dark with dark brown pattern on ventral part of each segment. Pedicel (Pd) and scape (Sc) light in colour. Scape large usually with a black spot on upper inner side. Antennae relatively short and thickened towards apex, length being slightly longer than that of head and pronotum together (ratio 1.25).

8. Pronotum with wide disc especially in metazona. Prozona shorter than metazona. Maximum width of pronotum equal to length of median carina (Figs. 1, 2). Transverse sulci 2-4 well developed. Lateral carinae in anterior part of pronotum usually not elevated. Posterior part of pronotum with light lateral bands of colour which are distinctly forwardly convergent towards median carina. Lateral carinae of metazona elevated. Metazona with rounded posterior edge.

9. Folded tegmina with apices reaching tips of folded hind femora. Median and subcostal fields usually differing in their venation from that in nearest relatives of this species (Fig. 20A) (e.g. D. jagoi).

Thus typically medial field has few cross veins (cells usually longer than deep) and precostal field is not expanded and has oblique straight cross veins. In D. jagoi occidentalis medial field has many regular cross veins (cells deeper than long) and cross veins of expanded precostal field are sinusoidal.

10. Posterior femora usually with 3 black spots on ventro-lateral carina and outer upper side, which extend onto inner side of femur. Genicular lobes black in both dorsal and ventral parts on inner and outer sides. Three or 4 black dots usually present on lower carinula in outer side of femur.

11. Hind tibiae black at extreme proximal end. Rest of tibia blue with light band near the base.

12. Supra-anal plate wider than long. Posterior margin of last abdominal tergite divided into two clear median lobes (Figs. 17, 18) whose outer corners slope smoothly into lateral edges of tergite (not angularly outcurved as in D. jagoi sp.n. (Figs. 19, 20)). Cercus fairly robust, conical.

13. Number of stridulatory pegs in this species 22-49, mean 12.5-15 (Figs. 21-24).

Female:

1. General colouration dark brown.

2. Temporal foveolae wide and nearly parallel sided. Vertex wider than long, its width between eyes being nearly 1.5 times that of frontal ridge between bases of antennae. Front angle of fastigium verticis about 90°

whose depression parallel sided and weakly concave.

3. Frontal ridge with punctuated surface and sharply defined lateral margins, narrowed in upper part towards vertex.

4. Compound eyes wide and prominent as seen from above. Vertical dimension of eye 1.4-1.5 times longer than length of subocular groove.

5. Antennae dark, as long as length of head and pronotum together as seen from above. Scape and pedicel light in colour, usually with a black spot on medio-dorsal side.

6. Pronotum with wide disc. Lateral carinae not raised in prozona. Lateral light bands in metazona as for male. Posterior margin of pronotum rounded.

7. Folded tegmina with apices level with tips of folded posterior femora.

8. Posterior femora with 3 distinct black spots on ventro-lateral carinae of outer side. These spots usually extending dorsally onto inner and outer sides of posterior femur. Genicular lobes black in both dorsal and ventral parts, on inner and outer sides, though lower outer lobe may be lighter with black pattern.

9. Posterior tibiae brownish or dark blue with a light band near knee. Black at extreme proximal end.

DISTRIBUTION. This species is known from Spain (localities 50-2500 m above sea level), southern France (Mediterranean coast), southern Switzerland (at high altitude), northern Italy (including type locality),

southern Italy (at low elevations up to 70 m above sea level), Yugoslavia (Adriatic coast) and south-western Israel (Mediterranean coastal area). The discontinuities in its distribution are remarkable (Fig. 26).

MATERIAL EXAMINED. See under each subspecies.

DISCUSSION. There is some controversy over the exact type locality of D. genei. A personal communication from Dr F. Capra draws attention to the possible error in Fischer, 1853, who attributed a Swiss locality to the specimens sent by Gene to Ocskay. In Capra, 1946, it is noted that Gene worked and collected around Pavia (= Ticinum of Latin authors) so that "pago Ticinense" can be interpreted as "surroundings of Pavia" not "Canton Ticino". Later authors all quoted "Canton Ticino" of Fischer without examining actual specimens. Only Brunner, 1882 examined material and this can be traced back to that originating from Gene in Pavia.

Further confusion arises from the name of both town and river being Ticino. The river rises from the mountains in Canton Ticino, Switzerland at 1000-2000 m above sea level and descends in Italy to 100-200 m above sea level. Judging by other localities in Italy the latter altitude would seem to be ecologically more acceptable than the higher one thus lending support to the type locality being in Italy. Accordingly a neotype has been chosen from material sent to me from Italy by Dr Capra. This is topotypical material from the Pavia region. The fact of D. genei (quickly recognisable by the long genital valves of the males) being known from 1800-2500 m in the Sierra de Guadaramma and 2000 m from the Sierra de Cazorla in Spain can be explained by the drier Mediterranean character of these localities.

Various Dociostaurus material from southern Europe, northern Africa and the Middle East (Mediterranean area extending as far as Turkey and

Iran) has had the name Dociostaurus genei applied to it by many authors since 1832. Several species and subspecies are involved in this confusion, however. The species are very closely similar in external characters, all being small insects. I have dissected about 300 males from the material at my disposal and have examined their phallic complexes carefully. The most useful diagnostic parts of the phallic complex are the apical penis valves (Ap), basal penis valves (Bp) and also the epiphallus (Eph) (Figs. 5, 6, 9, 11, 13, 14). For this study specimens were included from Spain, France, Portugal, Sardinia, Corsica, Italy, Yugoslavia, Morocco, Algeria, Libya, Israel, Jordan, Syria, Cyprus, Turkey and Iran.

The material was eventually divided into two forms according to the character of the genitalia (Ap - short in D. jagoi sp.n.; elongate in D. genei), stridulatory pegs and additional external characters. Thus in D. genei sensu strictu:

1. Length of apical penis valves. Material characterised by those from Spain, France, Italy and Yugoslavia (for localities see under subspecies) has long, narrow, pointed valves with a length of 0.92-1.25 mm (Figs. 5, 13). Specimens from Israel, by contrast, have valves 0.74-0.79 mm long and posterior genicular lobes wholly black (this material has been given separate subspecies status as D. genei littoralis subsp.n.) (Figs. 6, 14).

2. The number of stridulatory pegs on the posterior femur and their spatial distribution. Analysis of these parameters allows easy differentiation of D. genei from D. jagoi sp.n. Pegs of some 300 specimens were measured, using only the file of the right hind femur (Figs. 21-24) for the sake of consistency. The number of file pegs in D. genei (long genitalia) was found to be 22-49, whereas in D. jagoi (short apical penis valves), a taxon incorrectly identified as D. genei by many previous

authors, the number of pegs often reached 76 (e.g. in material from Sardinia) (Figs. 27-30). Interestingly, there is a negative correlation between the length of the apical penis valves and the number of file pegs (see graph, Fig. 25) which is of use taxonomically.

KEY TO SUBSPECIES OF *D. genei*

Males.

Apical valves of penis (Ap) longer, thinner and sharper (length 0.92-1.25 mm) (Fig. 13). Arch of cingulum (Ac) relatively big. Basal valves of penis wider and strongly outcurved (compare lateral views, Figs. 5, 6). Gonopore processes (Gpr) wider and shorter. Antennae thicker. Temporal foveolae narrower with parallel marginal carinula. Frontal ridge slightly concave, hardly impressed near median ocellus and bearing black spots on portion above ocellus (Fig. 1). Fastigium vertics wider. Occiput rugose. Pronotal metazone with narrow light bands (Fig. 1), rest of metazone being dark in colour. Prozona with black dots. Coloured band on metazonal lateral carinae obsolete between transverse sulci 2 and 4 and anterior to transverse sulcus 2. Lower lobe of hind knee (outer aspect) darker. Hind tibiae dirty brownish or dark blue (Yugoslavia). Interspace between two lobes, on dorso-posterior margin of last abdominal tergite, rectangular (Fig. 17). Cerci shorter and thicker and slightly oblique inwards (Fig. 17). Number strigulatory pegs 22-35 (Figs. 21 and 22).

genei genei (Ocskay) stat.n.

General body form more elongate. Apical valves of penis shorter and thicker (length 0.74-0.79 mm) (Fig. 14). Arch of cingulum relatively more slender. Basal valves of penis longer and narrower (Fig. 6). Gonopore processes (Gpr) narrower and longer. Antennae narrower. Foveolae of vertex wider, but slightly narrower in front. Frontal ridge flat, slightly impressed only near median ocellus. Fastigium verticis longer, narrower and more concave. Occiput smooth. Pronotal metazona with wider light bands on each side of disc (Fig. 2), lateral light bands being visible anterior to transverse sulcus 2. Posterior femora with

three brown spots on outer area of which most proximal is almost obliterate while other two distal ones are very distinct and sharp. Lower lobe of hind knee (outer side) lighter. Hind tibiae bluish. Interspace between two lobes, on dorso-posterior margin of last abdominal tergite, triangular (Fig. 18). Cerci thin, relatively long and slightly incurved (Fig. 18). Number of stridulatory pegs 35-49 (Figs. 23, 24).

genei littoralis subsp.n.

1a. Dociostaurus genei genei (Ocskay, 1832) stat. nov.

Type : for details see under species.

SYNONYMY.

Gryllus crucigerus Rambur, 1838. In Rambur, 1838 (Mardi) Faune. ent. Andalousii, 2: 86-87. Type ♂ SPAIN, Malaga, ____, Brit. Mus. (Nat. Hist.) London. Type lost.

Synonymy by Uvarov, 1948d.

Acridium pygmaeum Bonelli (in litt.). In Orthoptera Europaea, Fischer, 1853: 352, fig. XVII, 11ax.

Type in Heyden collection.

Synonymy by Fischer, 1853 under subgenus Stauronotus as a variety of St. cruciatus Charpentier, 1825 (erroneous). First correct synonymy under D. genei by Dr Franz Xav Fieber, 1853, Lotos. 3: 118.

DIAGNOSIS. See key, p.

MEASUREMENTS.

	Male	Female
Length of posterior femora (mm)	7.7-9	9.7-11.3
Length of tegmina (mm)	9-11	10.8-11.6
Length of body (mm)	12.5-14.8	15-19

MATERIAL EXAMINED.

Spain: 2♂, 5♀ Sierra de Guadaramma, 1800-2500 m, 17.IX.62 (D.& R. Ragge); 2♂, 4♀ Sierra de Cazarla, nr. Nava de Paulo, 2000 m, 1.IX.63 (P.M. Newman and A. Bovin); 1♂, 1♀ Cadiz, nr. Sunlucar, Bonanza (7-12).IX.62 (P.M. Newman); 1♂, 1♀ nr. Segovia, 22.IX.62 (D. & R. Ragge); 2♂, Orense Puerto de Allariz, c. 850 m, 20.VIII.62 (J. Huxley).

France: 2♂, 9♀ Alpes Maritimes, dep. 800 ft, ____30 (B.P. Uvarov); 3♂, 7♀ Bouches-du-Rhone, Arles, nr. Mas Thiberte (1-17).VII.60 (_____); 1♂ Herault, 5 km. E of Montpellier, 2.VIII.58 (_____).

Italy: 4♂, 3♀ S. apullia prov., Maglie, 70 m, 29.IX.37 (F.E. Zeuner); 1♂, 3♀ S. Apullia prov., Vignecastrisi _____ (_____); 2♂ nr. Castro, 50 m, 27.IX.37 (_____); 1♂, 1♀ Taranto, ____18 (E. Hargreaves); 1♀ Piem, _____ (D. Chiliani); 2♀ Vezona, VII.29 (Confaloniari); 1♂, 1♀ Lido degli Estensi, Porto Garibaldi, Comacchio, 3.X.60 (L. Capra).

Yugoslavia: 2♂ Dalmatia, I. of Huar, Lesina, 18.VIII.60 (Matveev); 1♀ Mostav, Hercegowina (22-24).VIII.30 (O. Holik); 30♂, 25♀ Mostar, Hercegowina, 18.VII.70 (Z. Adamovic).

DISCUSSION. For distribution see map, Fig. 26. The species inhabits coastal plains, hill sides and mountain slopes up to 2500 m (in Spain). In such zones the vegetation includes pine forest, oak woodland, bush and heather, dry meadow (burnt and unburnt), saltmarsh and olive groves. All are in general dry ecozones.

1b. *Dociostaurus genei littoralis* subsp.n.

Type: ♂, Israel, Ziqim, Mediterranean sea coast, sand dune 22.VII.73 (A. Soltani), depository: British Museum (Natural History).

DIAGNOSIS. See key, p. 54.

MEASUREMENTS.

	Male	Female
Length of posterior femora (mm)	9.4-10.2	11.7-14.3
Length of tegmina (mm)	11.9-13	14.2-18.7
Length of body (mm)	15.5-17.5	18-23.8

MATERIAL EXAMINED. All material paratypes unless otherwise stated. Israel: 6♂, 5♀ Nahal Sorek, near sea coast, 29.X.70 (C. Blondheim); 10♂, 8♀ Ziqim, south-western coastal area, 22.VII.73 (A. Soltani).

DISCUSSION. I have had the good fortune to both collect material myself in the field in 1973 (with the help of Mrs C. Blondheim and Prof. A. Shulov) and also to borrow material from Mrs Blondheim in 1972. It is now clear that insects living in coastal dunes among scattered tall bushlike growths of wild vines conform to the diagnosis placing them in D. genei littoralis. All other material from Israel and previously given the name D. genei possesses the stridulatory file and male genitalia characteristic of D. jagoi sp.n. (described next in this paper). It is clear that the ecological requirements of these two very similar small species are quite different, the latter living in inland habitats usually in a rocky terrain.

This subspecies is the only one for which data is available on the chromosome complement. While the amount of material examined is very small it has been considered worthwhile here to tabulate the characters of the ISRAEL, Ziqim samples below. Amongst the most notable features would seem to be the presence of moderately large terminal heterochromatic segments in the larger chromosomes (Figs. 31 A-F; 32 A-E) and the symmetry of the tenth pair of autosomes. This contrasts with D. jagoi jagoi in which the terminal heterochromatic segments are stronger and the tenth pair of autosomes tends to be assymmetrical (Figs. 31 G-M; 32 F-L). More material may show that this assymmetry is present in both species with selection for survival of homozygous individuals in D. genei littoralis.

Locality		Autosome pair number										
Ziqim Israel (Mediterranean coastal area)	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	t	t	t	t	t	t
	Chiasmata: Number	2-3	1-3	1-3	1-3	1-3	(2)-1	1-(2)	1-(2)	1	1	1
	Terminal heterochromatic segments (size)	-	med	med	med	med	med	-	med	-	-	-
	Autosome pair symmetry symmetrical (s) assymmetrical (a)	s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)	24.9	19.7	10.5	10.5	9.2	7.2	6.5	3.9	3.3	2.6	1.7

FIG. 1–4 Head and pronotum from above

1 D. genei genei Ocskay (material from Italy)

2 D. genei littoralis subsp.n. (material from Israel)

3 D. jagoi occidentalis subsp.n. (material from Spain)

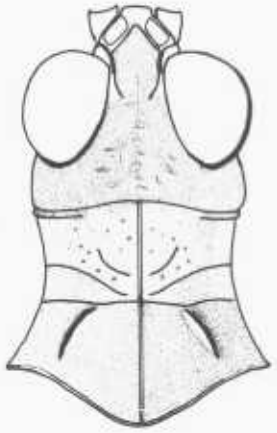
4 D. jagoi jagoi subsp.n. (material from Iran)

FIG. 5 Phallic complex (from above) of D. genei genei

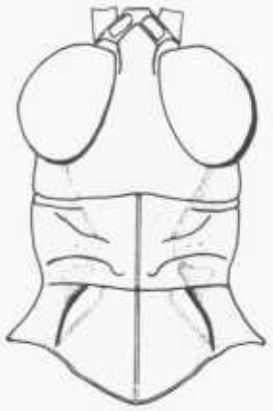
FIG. 6 Basal valves of penis (from above) of D. genei littoralis

FIG. 7 Phallic complex (from above) of D. jagoi occidentalis

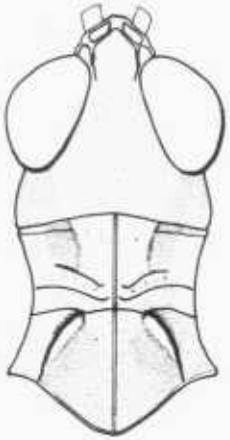
FIG. 8 Basal valves of penis (from above) of D. jagoi jagoi



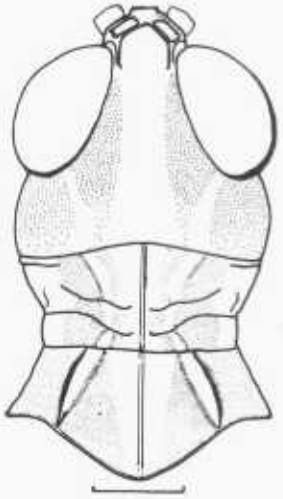
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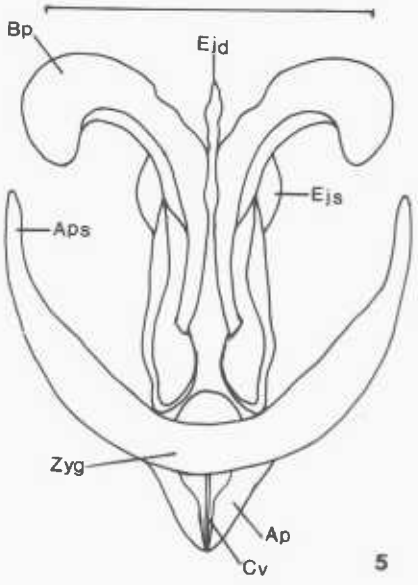
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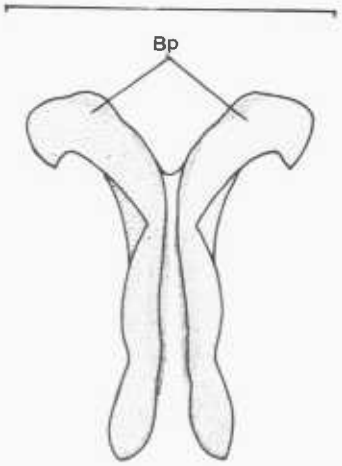
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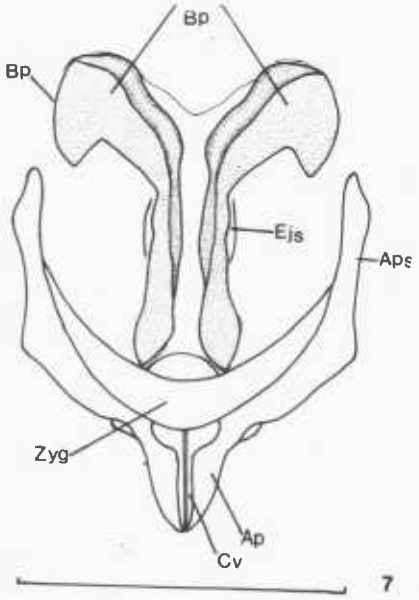
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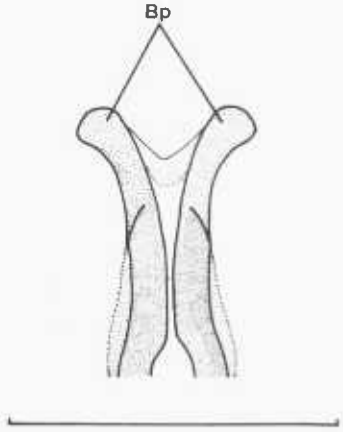
5



6



7



8

FIG. 9-12 Epiphallus (dorsal view)

9 D. genei genei

10 D. jagoi occidentalis

11 D. genei littoralis

12 D. jagoi jagoi

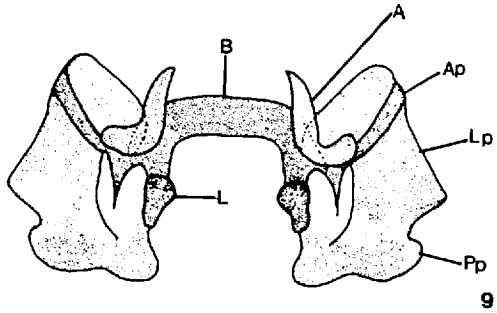
FIG. 13-16 Phallic complex (side view)

13 D. genei genei

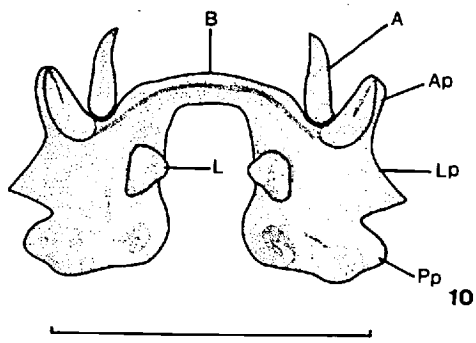
14 D. genei littoralis

15 D. jagoi occidentalis

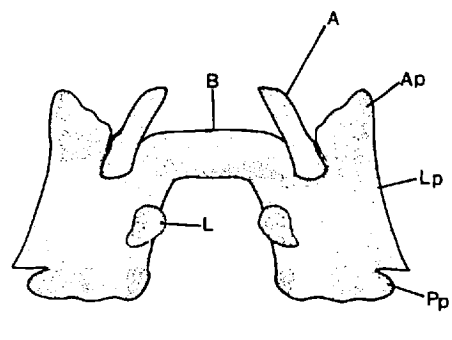
16 D. jagoi jagoi



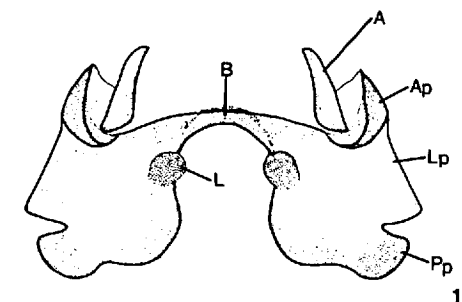
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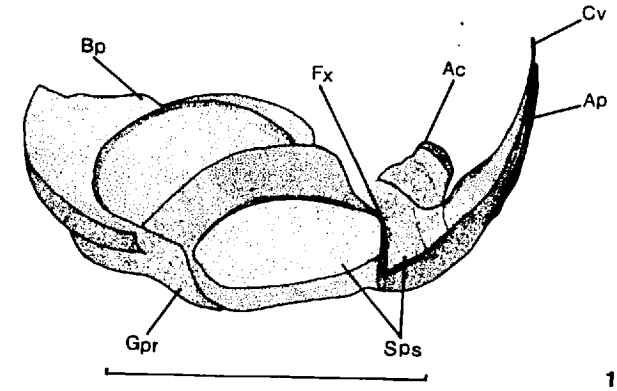
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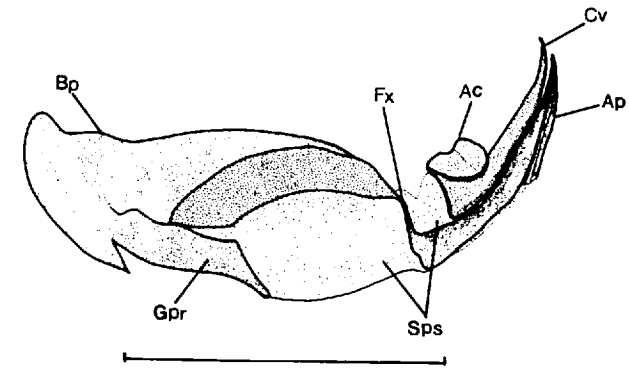
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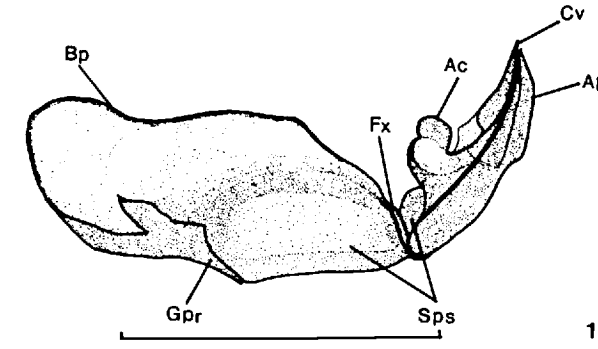
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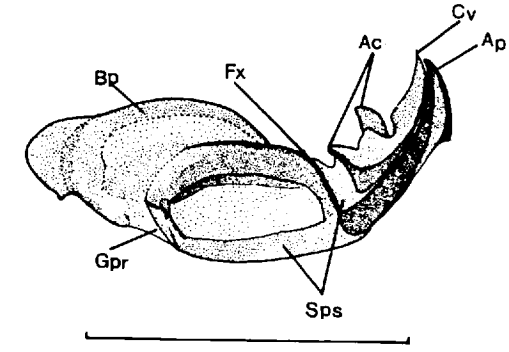
13



14



15



16

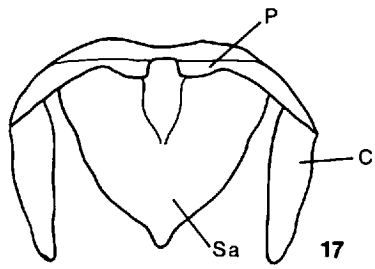
FIG. 17-20 Supra anal plate from above

17 D. genei genei

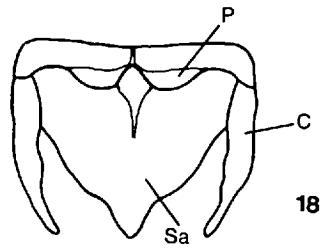
18 D. genei littoralis

19 D. jagoi jagoi

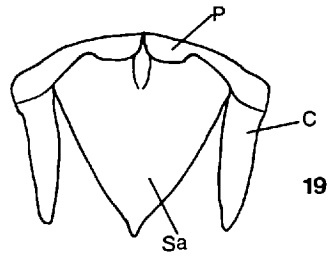
20 D. jagoi occidentalis



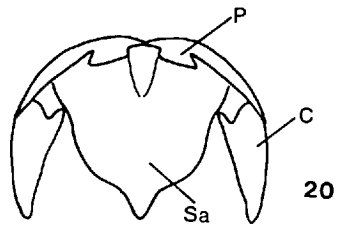
17



18



19

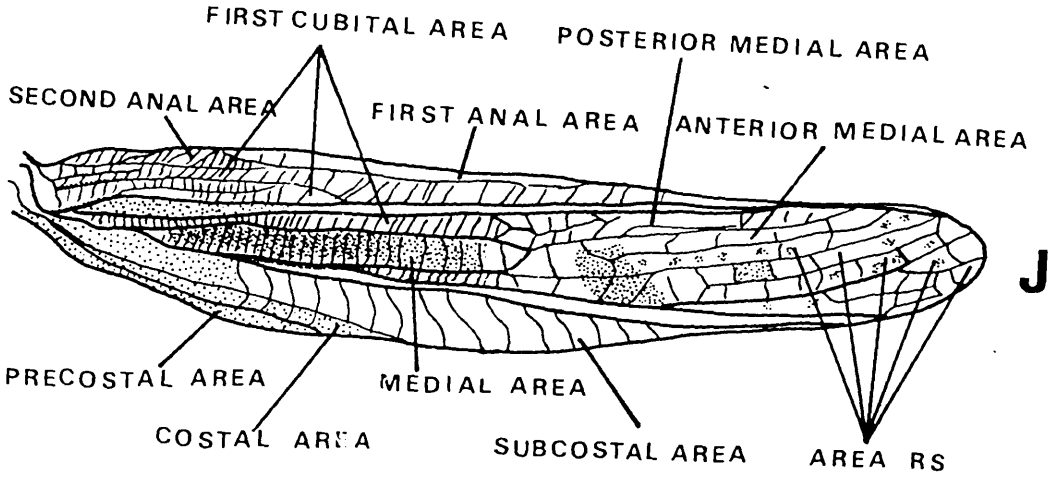


20

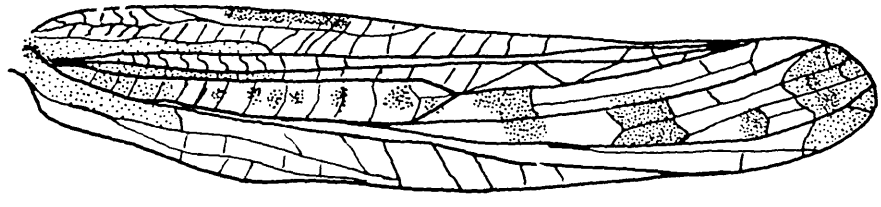
FIG. 20A Tegmen (in folded position on insect)

J D. jagoi occidentalis

G D. genei genei


FIRST CUBITAL AREA
POSTERIOR MEDIAL AREA
SECOND ANAL AREA
FIRST ANAL AREA
ANTERIOR MEDIAL AREA
PRECOSTAL AREA
MEDIAL AREA
COSTAL AREA
SUBCOSTAL AREA
AREA RS

J



G

2. Dociostaurus jagoi sp.n.

Type: ♂, Iran, Kermanshah prov., Mehran, Chalab, 350 m, grassland (stipa capensis), 9.V.73 (A.A. Soltani). Bri. Mus. (Nat. Hist.) London. Paratypes deposited with Hebrew University, Jerusalem and Plant Pest & Diseases Research Institute, Tehran.

DIAGNOSIS. Male:

1. Phallic complex (lateral view Figs. 15, 16) shows apical penis valves (Ap) to be short, blunt and broadly upcurved (in contrast to those of D. genei). From dorsal aspect (Fig. 7) apical penis valves wide and thick. Projecting process on ventro-posterior edge of apical penis valves visible in lateral view near distal end of valves. Cingular valves (Cv) almost same depth as apical valves of penis, but slightly longer with a projection on dorso-anterior edge (same shape as that on (Ap)) and a divided profile near arch of cingulum. Arch of cingulum (Ac) divided into two parts, to upper of which zygoma of cingulum is connected (Zyg) (Fig. 7). Upper section of flexure (Fx) forming a smooth gentle curve. Basal valves of penis (Bp) are variable, comparatively long, wide and excurved as seen from above (Fig. 7) or smaller and less flared (Figs. 8, 16) (compare with D. genei Figs. 5,6; 13,14).

Epiphallus large and wide (Figs. 10, 12). Lateral plates (Lp) well developed, sloping obliquely outwards and forwards and depressed on outer edge. Median lophi (L) smaller than those in D. genei and well sclerotised. Ancorae (A) obliquely directed relative to long axis of body and spaced further apart than in D. genei.

2. General colouration light brown or stramineus with more variation than seen in D. genei.

3. Fastigium verticis small, pentagonal, approximately as long as wide, strongly concave, with very distinct and shiny lateral margins and rounded angles, its frontal angle about 90°.

Temporal foveolae larger than in D. genei, almost quadrangular, but slightly narrower in front than behind (upper side smoothly bent downwards toward frontal ridge) and pitted with thickened margins (Figs. 3 and 4).

4. Frontal ridge flat, clearly narrowed upwards towards fastigium verticis. Surface of ridge punctate with rather rounded lateral margins and hardly depressed on median ocellus.

5. Head elevated above level of pronotum and with frons more vertical than oblique. Occiput and vertex slightly rugose. Two dark bands of colour extending from dorsal edge of compound eyes along lateral margins of fastigium of vertex to back of occiput. Weak trace of median carina present along the middle of vertex and occiput.

6. Eyes large but narrower and set more obliquely than those of D. genei. Vertical diameter of eye about twice as long as subocular groove and ratio of z/m 2.5 to 3.4, i.e. smaller than that of D. genei.

7. Antennae slightly longer than length of head and pronotum together as seen from above with relatively large first segment (scape). Light brown dorsally, dark brown below.

8. Disk of pronotum slender; prozona slightly shorter than metazona. Maximum width of pronotum shorter than length of median carina (Figs. 3 and 4). Transverse sulci 2-4 well developed. Lateral carinae of prozona usually weak and not noticeable. Pronotal metazona with light bands of

colour laterally, which are distinctly forwardly convergent towards median carina. Lateral carinae elevated in metazona. Posterior edge of metazona usually broadly rounded, but sometimes angular.

9. Folded tegmina with apices reaching or slightly extending tips of folded hind femora. Median field (comparison under D. genei) with large numbers of crossveins. Precostal field expanded with sinusoidal crossveins.

10. Posterior femora with 3 dark spots on upper dorso-lateral, inner and outer areas and extending over dorsal carina.

11. Posterior tibiae stramineus or pale blue.

12. Supra-anal plate narrower than in D. genei. Posterior margin of last tergite bearing two clear median lobes whose outer corners slope sharply or at an acute angle into lateral edge of tergite (Figs. 19, 20).

13. Number of stridulatory pegs in this species 39-76, mean 10 (graphs, Figs. 27-30), i.e. file length usually much longer than in D. genei.

14. Chromosomes: pair 10 show asymmetry; terminal heterochromatic segments (t.h.s.) larger than those in D. genei littoralis (see Figs. 31, G-M; 32, F-L). For further details see under discussion.

Female:

1. Vertex narrower than in D. genei. Width of vertex between compound eyes hardly more than or equal to width of frontal ridge between antennal bases. Temporal foveolae narrower in front than behind. Front angle of fastigium verticis about 90° and somewhat rounded.

2. Frontal ridge flat, sometimes with feebly impressed black dots near median ocellus.

3. Compound eyes narrower and less prominent than in females of D. genei as seen from above. Vertical dimension of eye 1.66-1.70 times longer than length of subocular groove.

4. Antennae thin, slightly shorter than length of head and pronotum together. Its first segment (scape) short and fat, but other segments longer than those of male.

5. Pronotum with disc relatively long in metazona. Lateral carinae in prozona obsolete. Light lateral bands of colour in prozona and metazona make an 'X' shaped mark, but metazonal bands fainter than in D. genei. Metazona usually with angular posterior edge.

6. Folded tegmina with apices almost reaching level of tips of folded posterior femora.

7. Hind femora with 3 black spots covering upper carina and carinula, usually extending into inner area.

8. Posterior tibiae stramineus or pale blue, usually with a black pattern on proximal end (inner aspect).

DISTRIBUTION. This specis is more widespread and more continuously distributed than D. genei. It occurs in southern Europe (Portugal, Spain, France, Sardinia, Corsica), northern Africa (Morocco, Algeria, Tunisia, Libya), the Middle East (Turkey, Cyprus, Lebanon, Israel, Jordan, Syria) and Iran.

MATERIAL EXAMINED. Besides the material in the main collections at the British Museum (grouped in those collections under D. genei), all accessious

material was checked for this species. In addition, my own material collected personally during the 1973 season from western Iran (Mehran and Somar) and Israel (Jericho road, Nahel Zin, Azaria, Han Glias, Lun, Bachin and Betgoverin) were used in an examination of male genital structures, stridulatory pegs, chromosomes and external characters.

DISCUSSION. My collections of this insect in Israel showed that, unlike D. genei in that country, it did not frequent dune habitats near the coast. It might be excusable, therefore, if we interpreted its relationship with D. genei as being a subspecific one. That this is clearly not the case is shown by the collections of Sir B.P. Uvarov (from France, Alpes Maritimes, 800 ft, VIII.1930) and Dr D.R. Ragge (from Spain, Sierra de Guadarrama, (17-22).IX.1962) in which both D. genei and D. jagoi were collected sympatrically. The two taxa are clearly separate species.

A taxonomically useful negative correlation exists between the length of the penis valves (Ap), y, and the number of stridulatory pegs on the file of the posterior femur, x. Using the correlation coefficient r, where:-

$$r = \frac{\Sigma(x - \bar{x})\ (y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2\ \Sigma(y - \bar{y})^2}}$$

it was possible to show that the values of r for D. jagoi were significant in material collected from different areas. Thus in 84 specimens collected from Portugal, Spain, France, Corsica and Sardinia r = -.489 (probability exceeding .001 for 84 degrees of freedom) and the negative correlation expressed by the regression line:-

$$y = 85.44 - 0.283x$$

In the 13 specimens from Morocco and Algeria r = -.661 (probability 0.01 for 13 degrees of freedom) and the negative correlation expressed by the regression line:-

$$y = 96.13 - 0.544x$$

These two regression lines are shown in Fig. 25. The different slopes of the negative correlation lines are just some of several characters indicative of subspeciation in this species (see key and further discussion under subspecies).

Note that in D. jagoi jagoi subsp.n. the basal valves of the penis (Bp) are unusually short and narrow. This is often the case in immature adults of other species though it seems to be normal for the mature insects in this special case (Fig. 8).

It is quite clear that D. jagoi has been confused with D. genei in the literature. The two species are small members of the genus with superficially similar external facies. Once separation had been made using the genitalia and stridulatory file as principal taxonomic characters, other external characters could be identified (see keys).

KEY TO SUBSPECIES OF D. jagoi

Males

1. Apical penis valves (Ap) shorter (mean length 0.67 mm) (Fig. 16), with large projecting processes both on ventro-posterior edge of Ap and on dorso-anterior edge of cingular valves (Cv). Arch of cingulum (Ac) divided into two separate lobes (as seen in lateral aspect). Gonopore processes (Gpr) shorter and widened towards spermatophore sac (Sps). Fastigium of vertex wider and parallel sided. Disc of pronotum larger, especially in metazona (Fig. 4). Hind tibiae pale or dirty blue with black pattern at extreme proximal end, though latter pattern often only on inner side. Supra-anal plate triangular, narrowed distally. Lobes on posterior margin of last tergite (Fig. 19) with very narrow interspace. Stridulatory peg file with more uniform peg interval distribution, with smaller mean and standard deviation of interval values (Figs. 27 and 28).

D. jagoi jagoi subsp. n.

(Distr.: Morocco, Algeria, Tunisia, Libya, Cyprus, Lebanon, Syria, Israel, Jordan, Turkey and Iran.)

2. Apical penis valves (Ap) longer (mean length 0.715 mm) (Fig. 15). Gonopore processes (Gpr) longer, narrowing towards spermatophore sac (Sps). Fastigium of vertex narrower, with its borders sometimes extending posteriorly some considerable distance. Disc of pronotum smaller, especially in metazona (Fig. 3). Hind tibiae stramineus or light brown. Supra-anal plate as wide as long. Posterior margin of last tergite divided into two wide angular lobes, with rectangular interspace (Fig. 20). Stridulatory file with larger number of peg intervals whose standard deviations tend to be much greater than in D. j. jagoi and whose mean values vary considerably (graph, Figs. 29 and 30).

D. jagoi occidentalis subsp.n.

(Distr.: Spain, Portugal, France, Sardinia and Corsica.)

2a. D. jagoi jagoi subsp.n.

DIAGNOSIS. See key, p. 70. In addition note that:

1. Bridge of epiphallus (B) narrower and thinner. Median lophi (L) with regular rounded edge (Fig. 12).
2. Head is larger (Fig. 4) in proportion to body. Frontal ridge usually narrower and sometimes slightly depressed along mid-line (material from Algeria and Libya).
3. Apices of folded tegmina usually surpassing tips of folded posterior femora.
4. Posterior femora with whitish testaceous pattern (dorsal view), black knee lobes on inner side and dark crescent (upper genicular lobe) on outer side.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	10.7-12.8	11.3-16.5
Length of hind femur (mm)	8.9-10.3	11-14
Body length (mm)	15-17.1	17.5-24

MATERIAL EXAMINED. All material paratypes unless otherwise stated.

Morocco: 7♂, 12♀ Middle Atlas Mts., Aguelman Sidi Ali, Ou Mohammed, 6500 ft., IX.35 (K.H. Chapman); 2♂, 4♀ Atlas Mts., Ait Bou Guemmez, 6000 ft., VII-VIII.51 (K.W. Miller); 1♂, 1♀ Boumir Ruins, 6.VIII.52 (J. Phillipson & C. Pollock).

Algeria: 2♂, 1♀ Bône, 22.IX.1896 (A.E. Eaton); 5♂, 6♀ Mascara, V.22 (Dr A. Cros); 8♂, 8♀ Djelfa & Boghari, 1-3.X.37 (M.N. Korsakoff); 4♂, 3♀ Chrea, nr. Blida, 1300 m, 25.VII.38 (M.A. Volkonsky); 3♂, 3♀ Djelfa & Hassi Bahba, X.38 (M.N. Korsakoff).

Libya: 6♂, 10♀ Tripolitania: Leptus Magna, 2.VI.51 (K.M. Guichard); 2♂, 2♀ Cyrenaica: Saff Saff, 26.IX.51 (I.A.D. Robertson); 2♂, 5♀ Slonta, Jebal Akhdar, 1.VII.53 (K. Guichard).

Cyprus: 4♂, 5♀ Zakaki, VI.35 (G.A. Mavromoustakis); 2♂ Lia tis hapithon, VI.38 (Th. Shiakides); 3♂, 4♀ Famagousta, 16.VI.47 (G.A. Mavromoustakis);

Lebanon: 1♂, 1♀ Wadi al Harir, 15.VII.52 (A.R. Waterston).

Syria: 1♂ E. of Aleppo, 11.VI.32 (B.P. Uvarov); 1♀ nr. Damascus, Sahl es Sahra, 15.VII.52 (A.R. Waterston).

Israel: 2♂, 2♀ Tel Arad, 21.V.22 (P.A. Buxton); 3♂, 5♀ Jericho, 14.X.22 (P.A. Buxton); 1♂, 1♀ Beersheba, 21.VI.52 (G.A. Mavromoustakis); 1♂, 1♀ Lahav, 21.VIII.66 (Blondheim); 2♂, 2♀ Poniah, 20.X.66 (A. Cohen); 1♂, 1♀ Man Elias, VII.67 (Blondheim & Cohen); 1♂, 1♀ Baith Leehem, 13.IX.67 (Blondheim); 1♂, 1♀ Sheikh-fanah, 28.IX.67 (Blondheim & Cohen); 1♂, 1♀ Azania, 23.VII.68 (Blondheim); 1♂, 1♀ Jericho Rd. Km.16, 9.VI.71 (Blondheim); 2♂ Jerusalem, Ramat Rahel, 17.VII.73 (A. Soltani); 2♂, 2♀ Jericho Rd. Km.16, 20.VII.73 (A. Soltani); 2♂, 3♀ Betgoverin, 22.VII.73 (A. Soltani); 5♂, 6♀ Wadi Bared, 24.VII.73 (A. Soltani); 7♂, 7♀ Babel Hawa, 1000 m, 30.VII.73 (A. Soltani).

Jordan: 5♂, 7♀ nr. El Boweida, 11.VI.51 (A.R. Waterston); 3♂, 5♀ Ain-el Basha, 11.VI.51 (A.R. Waterston); 2♂, 2♀ Deir Alia, 200 m, 20.V.52 (A.R. Waterston).

Turkey: 3♂ Urfa, VII.31 (Eshref Bay); 1♂ Karatas, 2.V.47 (N.Mus.).

Iran: 3♀ Kermanshah, Naft-e-Shah, 8.V.57 (H. Mirzayan); 4♂, 2♀ Kermanshah-Somar, 7.V.73 (A. Soltani); 15♀ Mehran-Chalab, 9.V.73 (A. Soltani).

DISCUSSION. Rather more robust insects than its companion subspecies.

The impression of broader vertex (wider behind) is accentuated by the compound eyes being more oblique and less bulging.

D. jagoi jagoi in Israel lives in the same habitat as D. curvicercus, e.g. in localities like: Jerusalem (Ramat Rahel), Betgoverin and Golan Heights (Bab-el Hawa).

Some observations on the chromosome characteristics of this subspecies are available and are tabulated below. Comparison of this subspecies with sympatric D. genei littoralis is given under the latter subspecies.

Locality		Autosome pair number										
Jericho	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	t	ti	ti	ti	ti	i	ti	ti	t	t	t
	Chiasmata: Number	2-3	2-3	2-3	2	1-2	1-2	1-2	1	1	1	1
	Terminal heterochromatic segments (size)	med L	med	med	med	med	med L	med L	med ?	L	L	-
	Autosome pair symmetry symmetrical (s) assymmetrical (a)	s	s	s	s	s	s	s	s	s?	a	s
	Chromosome length (%)	21.9	15.4	15.4	11.8	7.7	7.3	6.5	4.5	3.7	3.7	2.1
Betgoverin	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	i	ti	ti	t	t	t
	Chiasmata: Number	2-3	1-2	2-(3)	2	1-2	1-2	1-2	1-2	1	1	1
	Terminal heterochromatic segments (size)	med	med	med L	med L	med	med L	med L	med	med	med L	-
	Autosome pair symmetry symmetrical (s) assymmetrical (a)	s	s	s	s	s	s	s	s	a	a	s
	Chromosome length (%)	20.6	16.8	16.2	11.9	7.6	7	6.5	5.4	3.2	3.2	1.6
Somar	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	t	t	ti	i	ti	ti	t	t	t
	Chiasmata: Number	2	2	2	2	1	1-2	1	1	1-2	1	1
	Terminal heterochromatic segments (size)	med	med	med	med	med	med L	med L	med	med	med L	-
	Autosome pair symmetry symmetrical (s) assymmetrical (a)	s	s	s	s	s	s	s	s	s	a	s
	Chromosome length (%)	21.5	20.5	9.3	9.3	8.1	8	6.8	6.4	5.7	2.8	1.6

DISCUSSION. There is a strong resemblance between equivalent autosome pairs of D. jagoi jagoi in Israel (Jericho & Betgoverin) and Iran (Somar). Pair 10 show assymmetry in all localities and terminal heterochromatic segments (t.h.s.) are relatively large or medium size in this species. The percentage size of pairs is similar in Jericho and Betgoverin (Israel) but somewhat different from those in Iran (Somar); this slight difference might be because of different altitude, climate and the stage of maturity.

2b. *D. jagoi occidentalis* subsp.n.

DIAGNOSIS. See key, p. 70. In addition note that:

1. Bridge of epiphallus (B) thicker. Median lophi (L) with an irregular triangular shape (Fig. 10).
2. Head smaller in proportion to body (Fig. 8). Frontal ridge flat.

MEASUREMENTS

	Male	Female
Length of tegmen (mm)	9-11.2	10.5-15
Length of hind femur (mm)	8.7-9.7	9.7-13.3
Body length (mm)	13.3-16.5	16.5-22

MATERIAL EXAMINED. All material paratypes unless otherwise stated.

Spain: 1♂, 1♀ Montarco Bei Madrid, 16.VII.24 (R. Ebner); 2♂, 3♀ Sierra de Guadarrama, VIII.26 (B.P. Uvarov); 3♂, 3♀ Moratalla, 15.IX.35 (M. Burr); 4♂, 5♀ Sierra de Caforla, W. of Nava del Espino, 600 m, 1-3.IX.62 (P.M. Newman); 3♂, 3♀ Cadiz, nr. Sanlucar, Bonanza, 7-12.IX.62 (P.M. Newman); 5♂, 5♀ nr. Madrid, 19.IX.62 (D. & R. Ragge); 6♂, 7♀ Sierra de Guadarrama, 22.IX.62 (D. & R. Ragge); 2♂, 2♀ Auila, Barraco, 15.VIII.68 (R.W. Crosskey); 1♂, 1♀ Bonda, 650 m, 12.IX.73 (K. Guichard).

Majorca: 1♂, 1♀ Balearen, (F.E. Zeuner coll.).

Portugal: 2♂, 3♀ Tapadu da Ajuda, 34 (P.Koller); 5♂, 5♀ Estremadura, Mafra, 10.VIII.72 (John Huxley).

France: 2♂ Alpes. Marit., VIII.10 (Théoule); 2♂, 2♀ Alpes Marit., 800 ft, VIII.30 (B.P. Uvarov); 2♂, 1♀ Var, Montouroux, 350 m, X.46 (M. Korsakoff); 6♂, 6♀ Pyrénées Orientales, Vernet les Bains, VIII.50 (N.Waloff); 4♂, 5♀ Pyrénées Orientales, nr. St. Cyprien Plage, 12.IX.54 (D.R. Ragge &

P.M. Stock) (dry grassland & semi-saltmarsh); 3♂, 4♀ Bouches du Rhone, 22 km S.E. of Arles, nr. Mas Thiberte, 1-17.VII.60 (B.M. Goodings & D.J. Philpot) (oakwood).

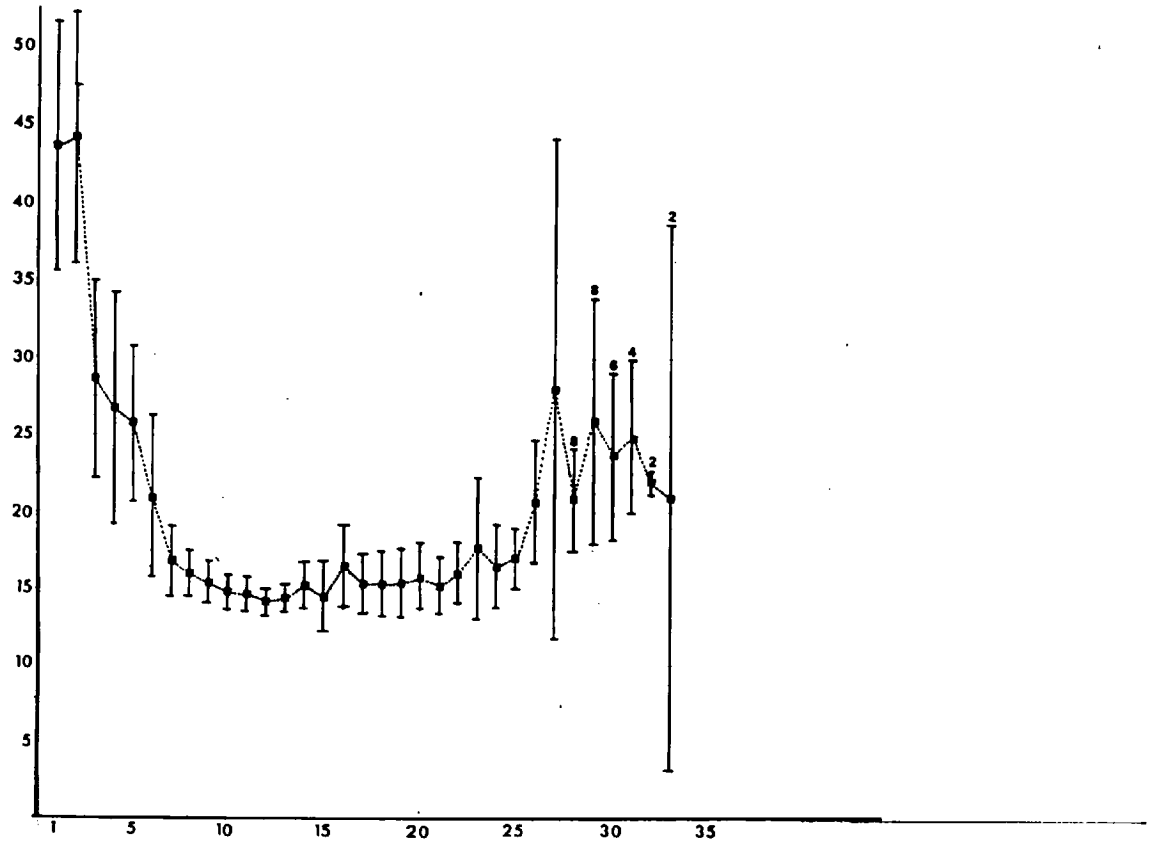
Sardinia: 4♂, 4♀ Tharros, 21.IX.64 (K.M. Guichard).

Corsica: 3♂, 4♀ Calvi, 12.VII.31 (M.E. Mosely); 6♂, 5♀ Calenzana, 300 m, 28.VII.63 (D.H. & D.J. Harvey).

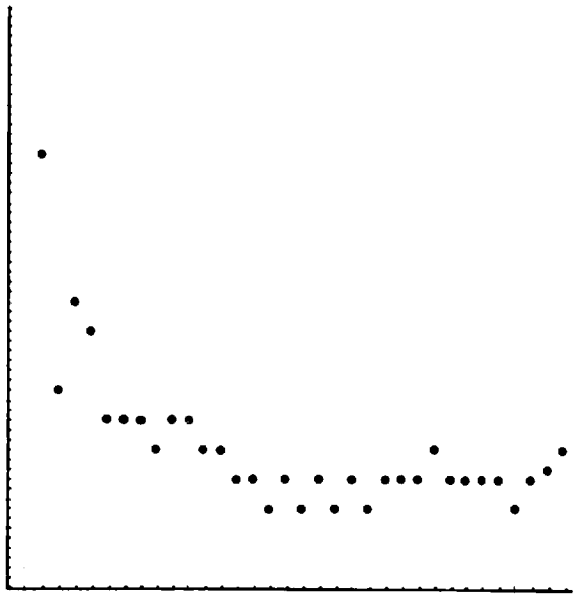
DISCUSSION. Rather more slender, smaller insects than the nominate subspecies. The impression of a narrower vertex (narrower behind) is accentuated by their compound eyes being more convex, bulging and less oblique.

FIG. 21 Stridulatory file pattern from one specimen of *D. genei genei*

FIG. 22 Stridulatory peg graph showing variation in peg intervals of 10 specimens of *D. genei genei*



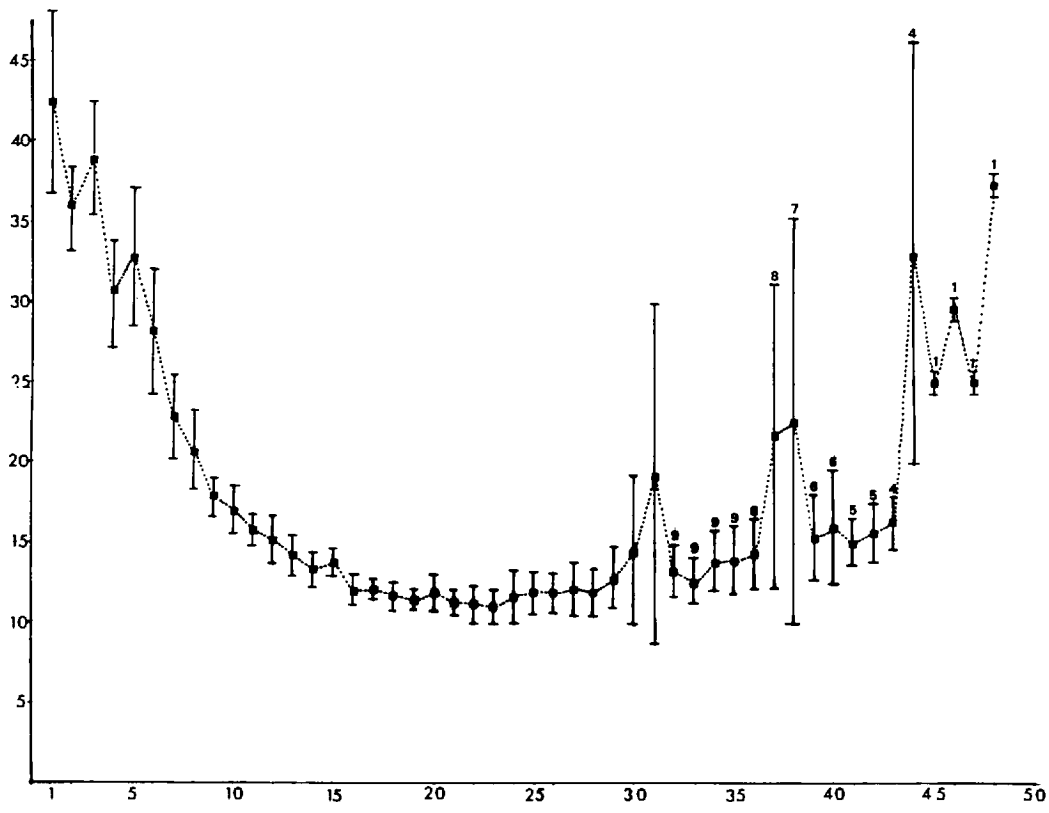
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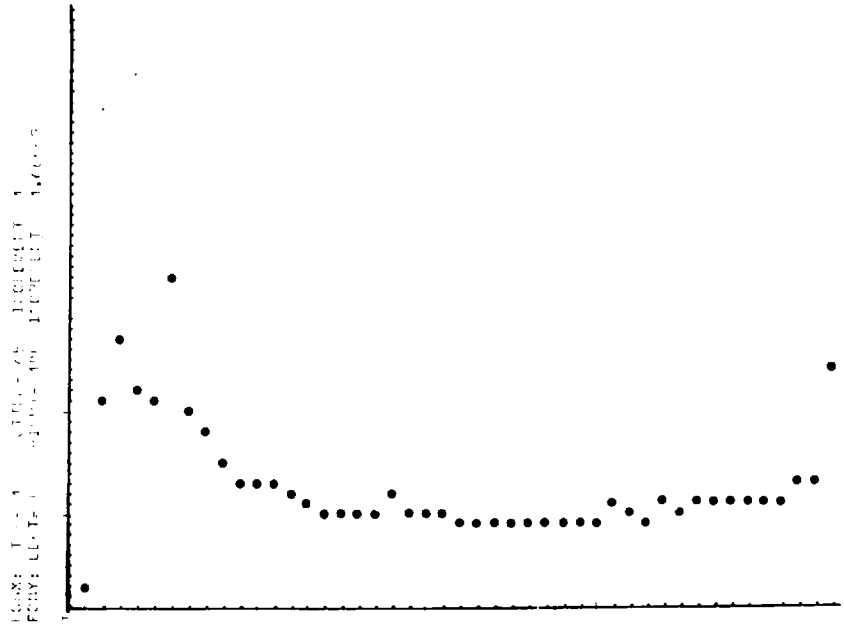
22

FIG. 23 Stridulatory peg graph of D. genei littoralis

FIG. 24 Stridulatory peg pattern of D. genei littoralis



23



24

FIG. 25 Regression lines of negative correlation between the length of penis valves (y) and the number of stridulatory pegs in the file of posterior femur (x) of D. jagoi jagoi and D. jagoi occidentalis.

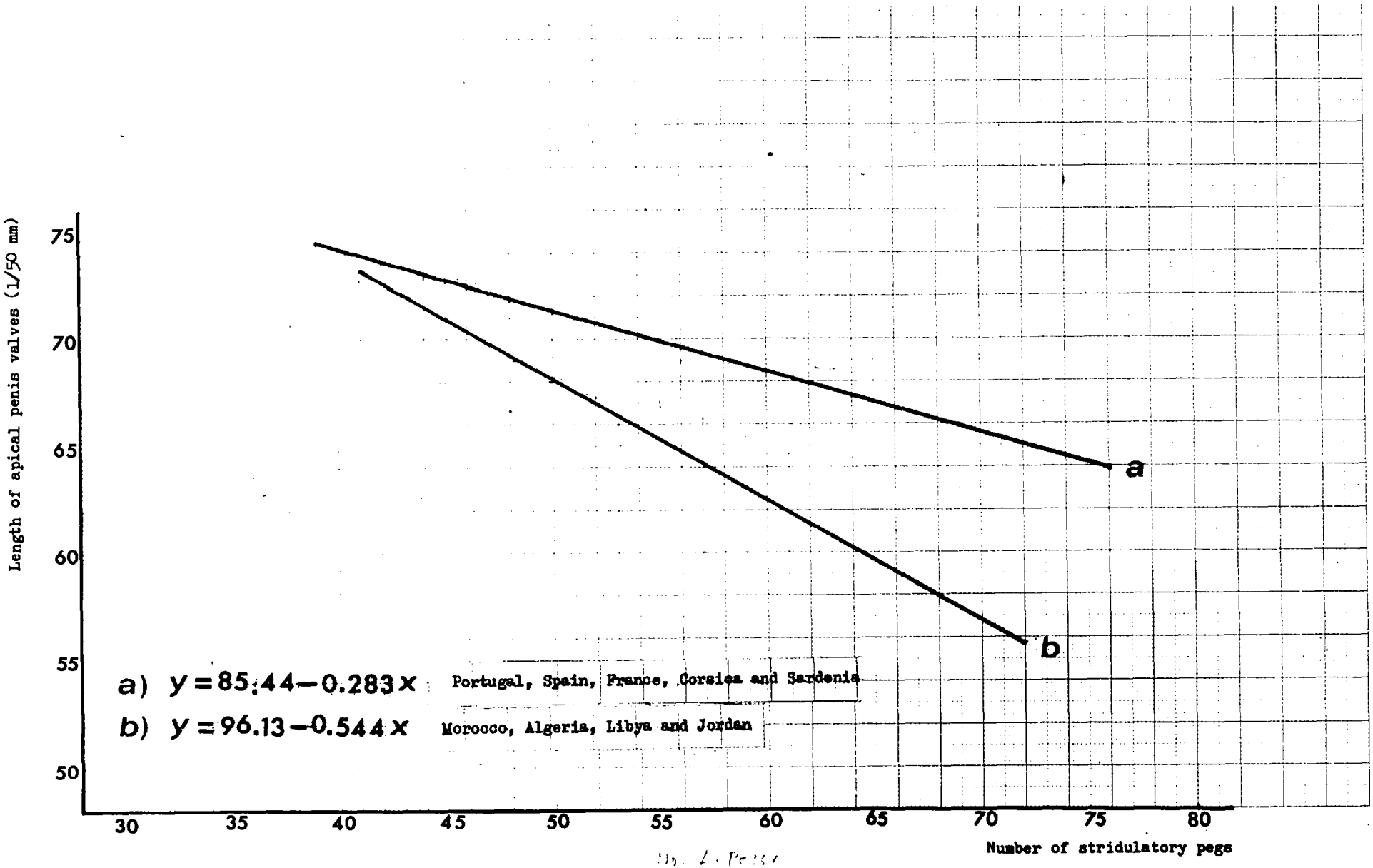

Length of apical penis valves (1/50 mm)
75
70
65
60
55
50
30
35
40
45
50
55
60
65
70
75
80
Number of stridulatory pegs
a
b
a) y = 85.44 − 0.283 x Portugal, Spain, France, Corsica and Sardenia
b) y = 96.13 − 0.544 x Morocco, Algeria, Libya and Jordan

FIG. 26 Geographical distribution map of *D. genei genei*, *D. genei littoralis*, *D. jagoi jagoi*, *D. jagoi occidentalis*, *D. curvicercus* and *D. minutus*. Scale 1:19 million

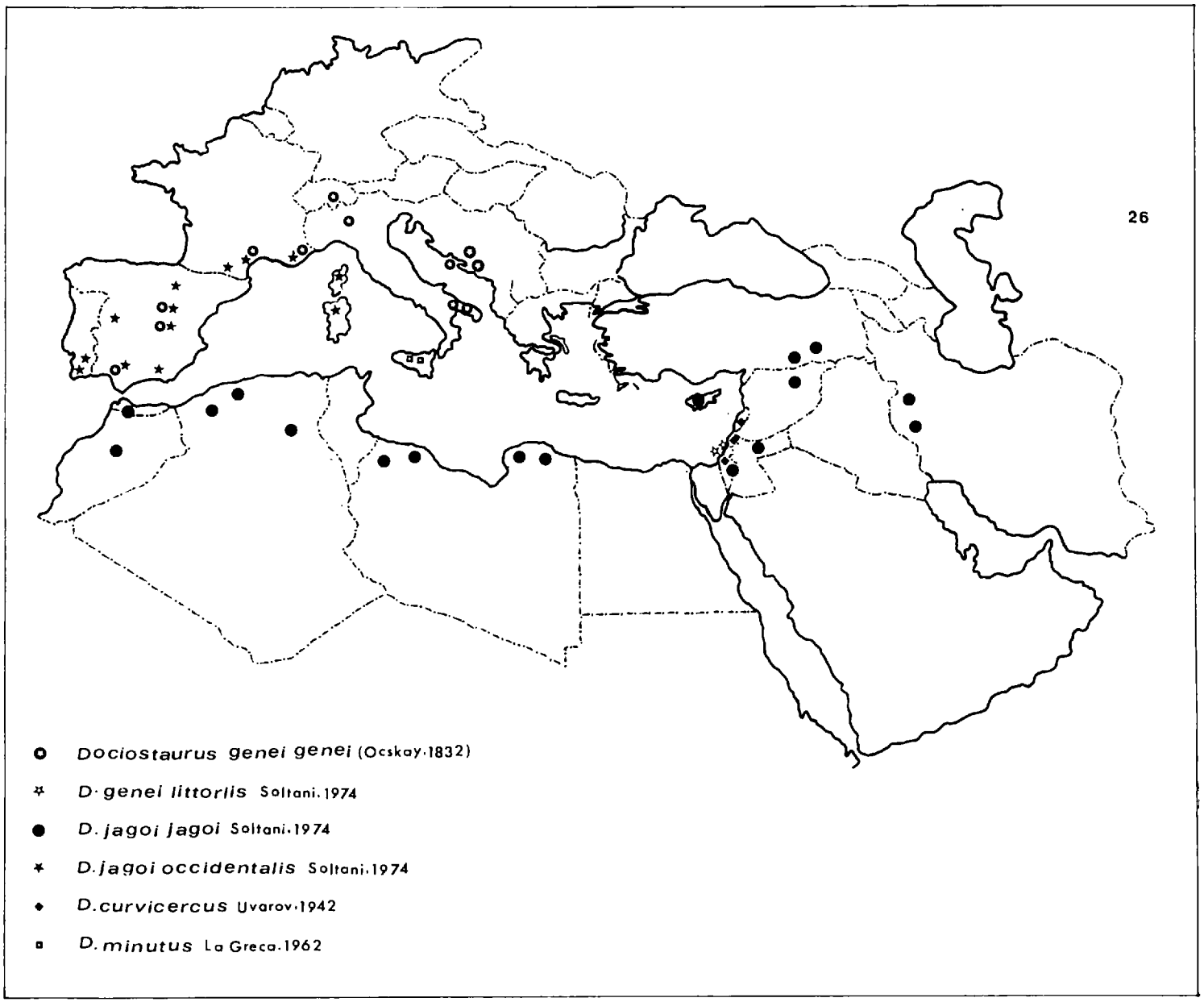
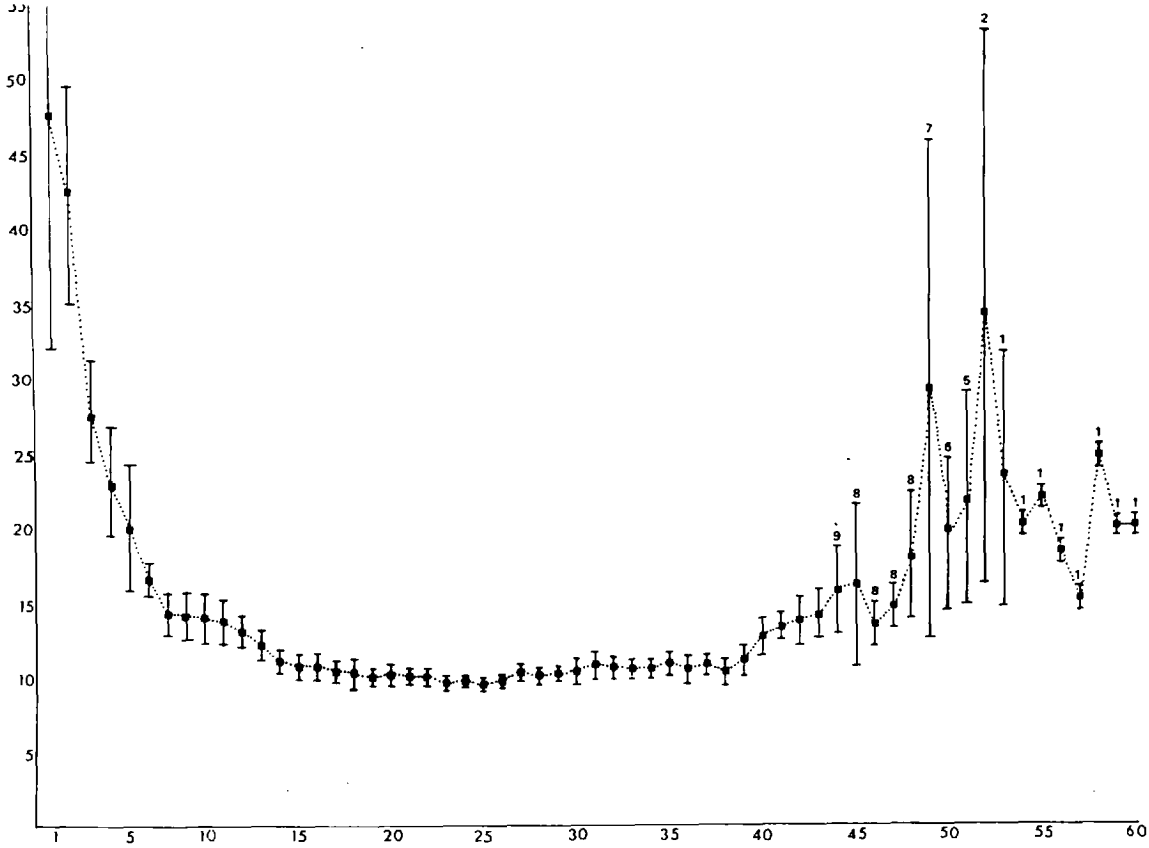
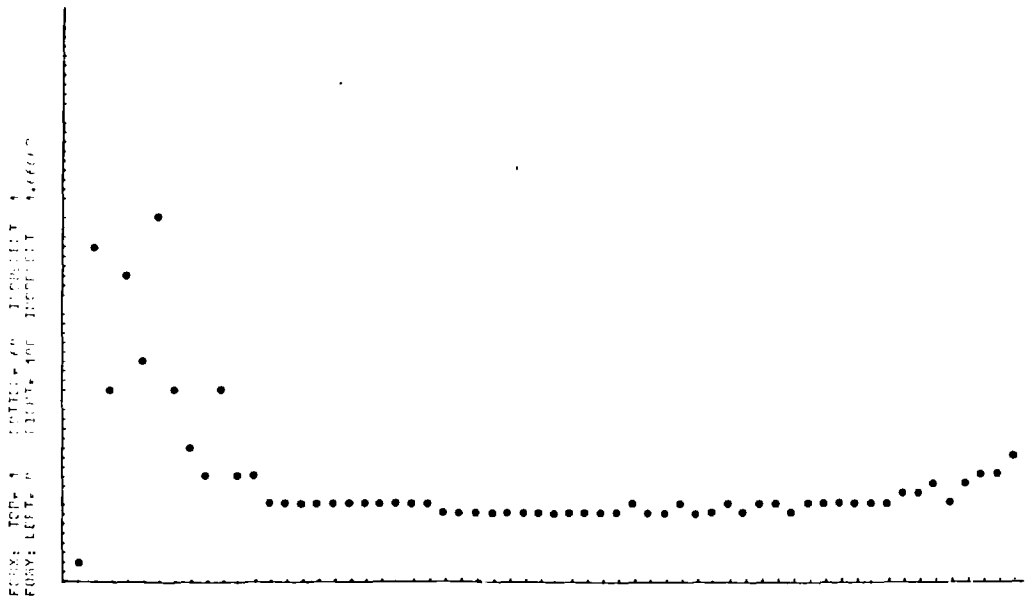

Dociostaurus genei genei (Ocskay,1832)
D. genei littoriis Soltani,1974
D. jagoi jagoi Soltani,1974
D. jagoi occidentalis Soltani,1974
D. curvicercus Uvarov,1942
D. minutus La Greca,1962

FIG. 27 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. jagoi sp.n.

FIG. 28 Stridulatory file pattern from one specimen of D. jagoi sp.n.



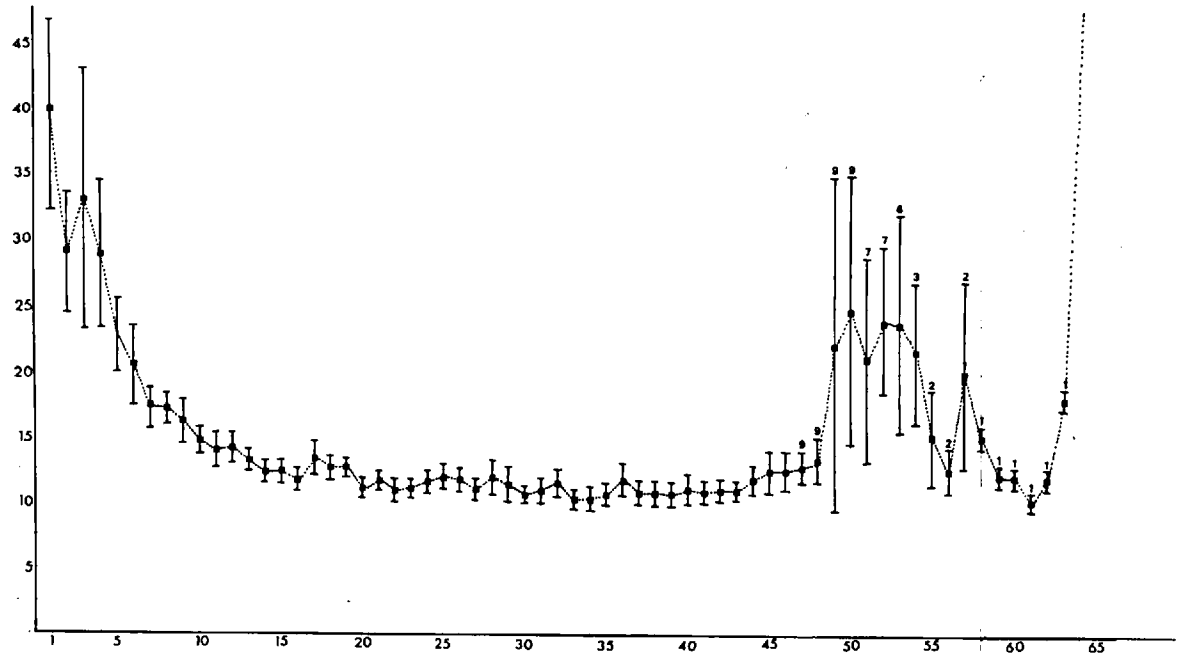
27



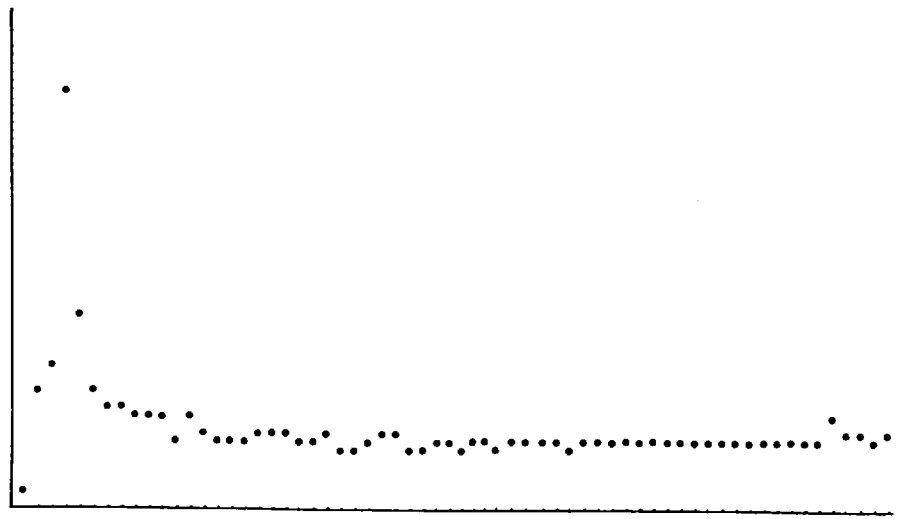
28

FIG. 29 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. jagoi occidentalis subsp.n. from Spain

FIG. 30 Stridulatory file pattern from one specimen of D. jagoi occidentalis subsp.n.



29



30

PLATE 31

Meiosis in the spermatocytes of D. genei littoralis & D. jagoi jagoi

Mag. x 1500

A-F Chromosomes of D. genei littoralis subsp.n., Israel, Ziqim

A-E Diakinesis, A, B, E normal, C & D phase contrast

F One cell at metaphase II (normal)

G-M Chromosomes (diplotene) of D. jagoi jagoi subsp.n., Israel Betgoverin

G, H, J, K, M normal and L phase contrast

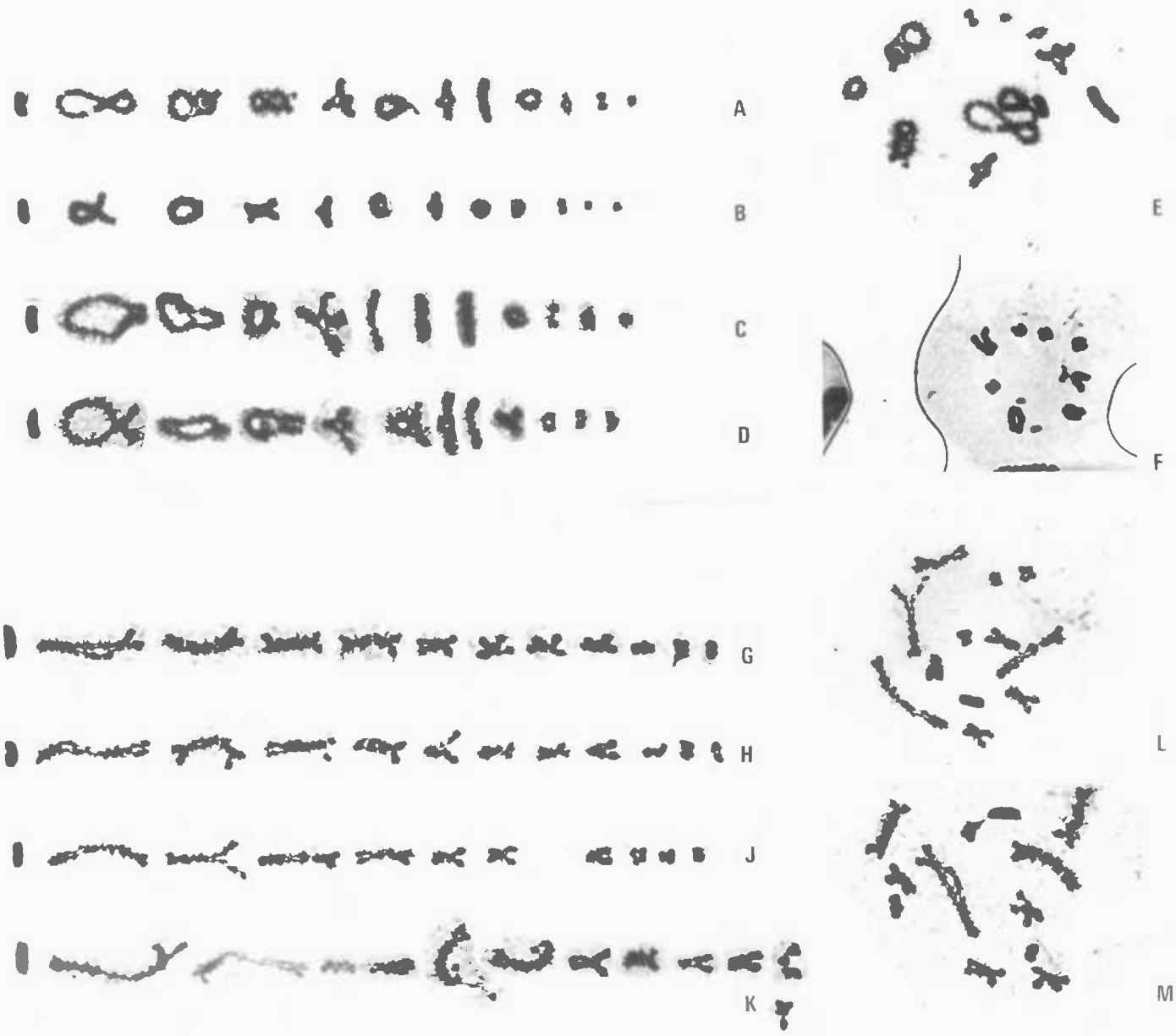

A
B
C
D
E
F
G
H
J
K
L
M

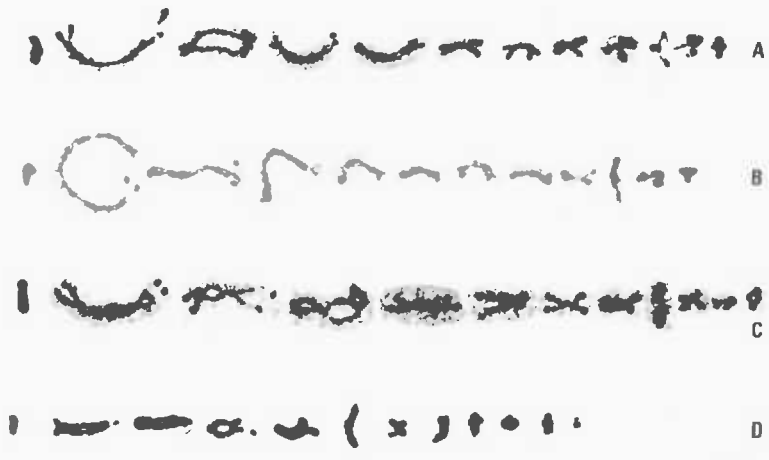
PLATE 31a

Meiosis in the spermatocytes of D. jagoi jagoi subsp.n., Israel, Jericho

Mag. x 1500

A (x 100, normal objective) (phase contrast) early diplotene

D (normal) diplotene



31a

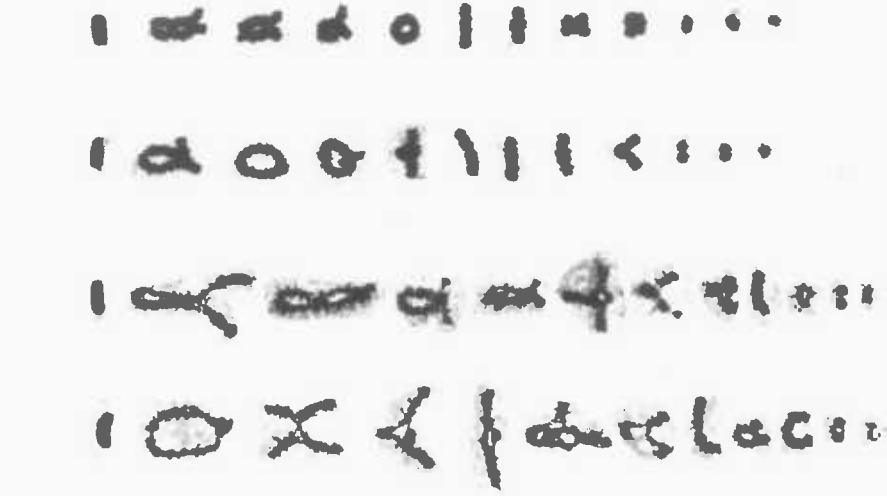
PLATE 32

Meiosis in the spermatocytes of D. genei littoralis & D. jagoi jagoi

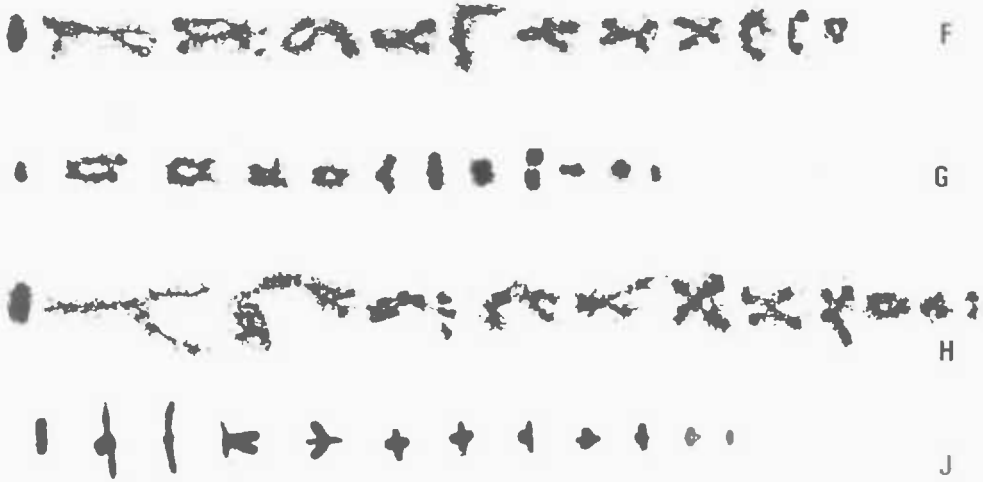
Mag. x 1500

A-E Chromosomes (diakinesis) of D. genei littoralis subsp.n., Israel, Ziqim. Objective used: A, B & E normal, C & D phast contrast.

F-L Chromosomes of D. jagoi jagoi subsp.n., Iran, Somar.
F (phase contrast), G (normal), H (phase) and K (normal) diplotene.
J (normal) metaphase I and L (normal) one cell at metaphase II.


A
B
C
D


E


F
G
H
J


K


L

3. Dociostaurus curvicercus Uvarov, 1942

Type: ♂ Dociostaurus curvicercus Uvarov, 1942b, Trans. Am. ent. Soc., 67: 324-325, pl. 26, Fig. 49. Israel, Rehoboth, nr. Jaffa, ____, (J. Aharoni). Bri. Mus. (Nat. Hist.) London.

DIAGNOSIS. Male:

1. Phallic complex as seen in lateral view (Fig. 36) smaller than that in D. genei. Apical valves of penis (A) shorter and thicker than those in D. genei, with a projecting process along ventro-posterior edge. Cingular valves (Cv) slightly longer and less sclerotised than apical valves (Ap). Arch of cingulum (Ac) bilobed dorsally (unlike D. genei). Flexure (Fx) shallow. Basal valves of penis (Bp) narrower than those of D. genei and excurved as seen from above.

Epiphallus (Eph) large and wide (Fig. 35), maximum width being almost equal to length of entire phallic complex as seen in lateral view (cf. Fig. 36). Lateral plates (Lp) well developed, sloping forwards almost vertically to plane of epiphallus as a whole and parallel to long axis of body. Inner edge of posterior projections (posterior ends of lateral plates of epiphallus Pp) forming very large lobes (median lophi, L) which project strongly inwards towards mid-line of epiphallus. Both posterior projections and median lophi strongly sclerotised. Bridge (B) thick and incurved in situ anteriorly. Ancorae (A) much longer and wider than in closely similar species D. genei and D. jagoi, with blunt tips and obliquely directed inwards (Fig. 35).

2. General colouration light grey overlaid by a dark brown and red brown pattern.

3. Fastigium verticis parallel sided and of a regular pentagonal form

(Fig. 33). Temporal foveolae well defined, slightly narrowed forward and usually only slightly longer than deep.

4. Frontal ridge depressed from level of fastigium verticis down to level of median occelus and sharply narrowed upwards towards fastigium.

5. Head projecting above line of pronotal disc as seen in lateral aspect. Occiput rugose, without a clear median carinula, usually with median line obliterate.

6. Compound eyes moderately convex and widely spread.

7. Antennae slender, slightly thicker towards tip, slightly longer than length of head and pronotum as seen from above. Of last 5 segments, proximal 4 are dark, while last segment is white (especially clear in living material - see discussion). Scape large.

8. Pronotum longer than in closely similar species, e.g. D. genei and D. jagoi (Figs. 1-4 and 33) lateral carinae in prozona being replaced by light bands which are less divergent forwards than in D. genei and D. jagoi. Lateral carinae elevated in metazona and bordered internally by light bands, lateral carinae have less divergent backwards than in D. genei. Metazona longer than prozona (ratio 1.2-1.45 as measured along line of median carina).

9. Folded tegmina with apices extending beyond tips of folded hind femora.

10. Posterior femora with 3 dark brown spots on upper side second and third of which show an extension onto inner area of femur ventrally.

Genicular lobes of posterior femora black on inner side, but on outer side with upper lobe dark and lower lobe lighter with a dark pattern.

11. Posterior tibiae shining blue (darker than in D. jagoi) with a broad pale basal portion. Black at extreme proximal end.

12. Supra-anal plate (Fig. 34) wide, rounded pentagonal, with posterior triangular tip similar to that of D. genei littoralis (Fig. 18). Lacking broad lobe-like structures on back edge of last abdominal tergite but bearing a pair of discrete widely separated appendages instead. Cercus thick and strongly incurved. Subgenital plate hairy, somewhat compressed dorso-ventrally, with apex rounded truncate.

13. Stridulatory pegs 60-85 (Figs. 37-38).

14. Chromosomes. For observations on male meiosis in this species see under discussion section.

Female:

1. Differs from D. genei and D. jagoi in having white tipped antennae. Scape and pedicel with two shallow dots on ventral side.

2. Frontal ridge usually depressed near fastigium.

3. Pronotum relatively longer.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	12.3-15.8	14-19
Length of hind femur (mm)	9-12.2	11.5-14.5
Body length (mm)	15-21	18-26

DISTRIBUTION. The species occurs in Israel and probably extends its range into Jordan and Syria.

MATERIAL EXAMINED.

Israel: 3♂, 4♀ Aqwaabella (nr. Qastal), 21.VI.63 (Pener & Blondheim); 12♂, 9♀ Netanya, Mediterranean coastal area, 13.IX.63 and 13.XI.67 and 29.X.68 and 27.VIII.68 and 17.VI.70 and 30.VIII.70 (Blondheim); 2♂, 3♀ Hahanya, 3.VII.68 (Blondheim); 6♂, 7♀ Jerusalem, 27.VI.66 and 18.VIII.68 and VII.70 (Blondheim); 12♂, 15♀ Jerusalem, Ramat Rahel, VII.73 (A. Soltani); 8♂, 6♀ Bab-el-Hawa, Golan Heights, 1000 m, VII.73 (A. Soltani); 10♂, 12♀ Horon, VII.73 (A. Soltani); 7♂, 9♀ Aqiraba, VII.73 (A. Soltani); 8♂, 7♀ Wadi Bared, VII.73 (A. Soltani); 5♂, 6♀ Betgoverin, VII.73 (A. Soltani).

My sincere thanks are due to Mrs S. Blondheim who not only sent me material from Israel, but enabled me to visit Israel and collect my own specimens from the field.

DISCUSSION. This species is immediately recognisable in the males which have a unique curved cercus (Uvarov, 1942b). Another excellent diagnostic character, however, is the large epiphallus with its heavy sclerotised lophi (L) and large straight ancorae (A). The phallic complex apart from the epiphallus is rather small proportionately and the apical penis valves augmented by special projecting appendages (Pa) (Fig. 36).

The species shows great variability in size. Smaller specimens of the female sex have been confused with D. genei and D. jagoi in museum collections. Inter population variation in size in any particular year is striking (see under measurements). Thus at Jerusalem and Bab-el-Hawa (high altitude up to 1200 m) the size is small in males and females, while

in coastal areas like Netanya and Hahanya the insects are considerably larger (also noted by S.A. Blondheim and A. Shulov, 1969). Changes in climatic and ecological conditions from year to year also cause morphometrical change. In Jerusalem in 1966 specimens were larger and more robust, becoming smaller and more slender in 1970. In spite of these changes in body size the male phallic complex remains much the same size, only the epiphallus becoming slightly larger in the bigger specimens.

The stridulatory file of the male (Figs. 37, 38) is quite long with a high number of evenly spaced pegs. High altitude localities (with smaller insects) tend to have smaller numbers of pegs (maximum 7 in Jerusalem and Bab-el-Hawa material), while larger insects from low altitude habitats may have up to 85 pegs. The actual songs of D. curvicercus, D. genei and D. jagoi are as different from each other as are their files (Figs. 40, A-C). The file of D. genei littoralis is shorter than that of D. curvicercus (Fig. 23) and that of D. jagoi jagoi both shorter and more irregular in its peg spacing. The file of D. jagoi occidentalis is more irregular still in its peg spacing (Fig. 29) with about the same number of teeth. The sonograms (Fig. 40) were prepared from tapes prepared by myself (D. maroccanus) or lent by Mrs S. Blondheim. The oscillograms were prepared in the laboratory at C.O.P.R. under the guidance of Dr Dick Cooter.

Uvarov, 1942b and Bodenheimer, 1935 seem to have misidentified D. genei, D. jagoi and D. curvicercus, confusing the three species especially in the female sex. Bodenheimer in particular seems to have confused D. curvicercus with D. jagoi sp.n. and to have thought that D. genei littoralis and D. jagoi jagoi from coastal localities were subspecies of the same species.

The chromosome characteristics of D. curvicercus (Figs. 39, A-M) from Jerusalem and Betgoverin localities are tabulated below:

Locality			Autosome pair number										
Jericho	Chromosome characteristics		1	2	3	4	5	6	7	8	9	10	11
	Chiasmata	Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	t	t	ti	ti	t	t
		Number	1-2	1-2	1-2	1-2	1	1	1	1-2	1	1	1
	Terminal heterochromatic segments (size)		med	small	small	small	small	small	small	small	small	-	-
	Autosome pair symmetry symmetrical (s) assymmetrical (a)		s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)		21	13	11	11	9	8.5	7	6	6	5.5	2.1
Betgoverin	Chiasmata	Terminal (t) or Interstitial (i)	i	ti	ti	ti	ti	ti	ti	ti	ti	t	t
		Number	2-3	1-2	1-2	1	1	1-2	1	1-2	1	1	1
	Terminal heterochromatic segments (size)		med	med	med	med	small	small	small	small	small	-	-
	Autosome pair symmetry symmetrical (s) assymmetrical (a)		s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)		19.2	15.6	12	12	10	7.5	7	6.6	4	4	2.1

Like D. genei littoralis the autosome pairs all seem to be symmetrical. The terminal heterochromatic segments seem to be intermediate in size between those of D. genei littoralis and D. jagoi jagoi.

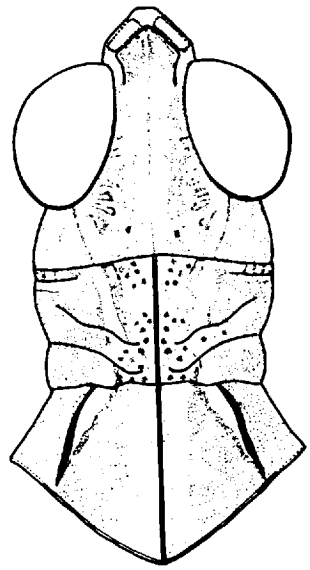
D. curvicercus Uvarov

FIG. 33 Head and pronotum from above

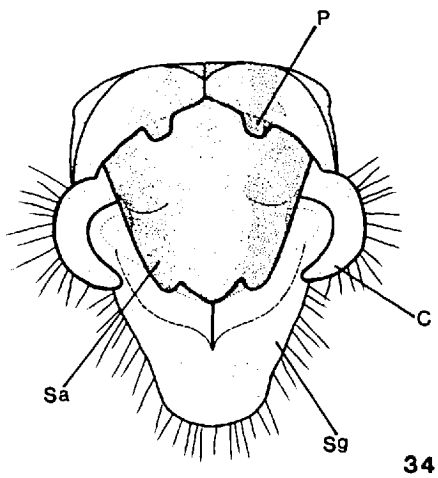
FIG. 34 Supra-anal plate, subgenital plate and cerci from above

FIG. 35 Epiphallus (dorsal aspect)

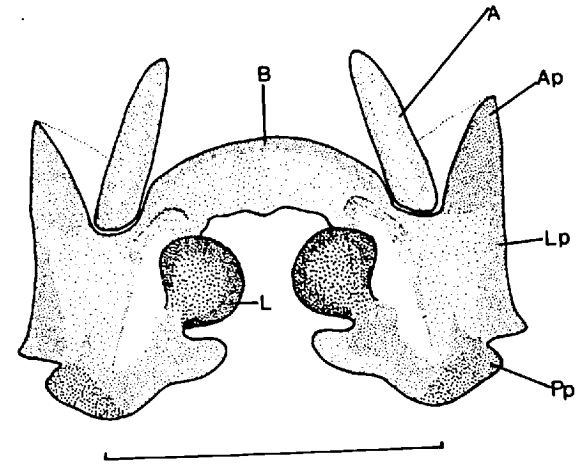
FIG. 36 Phallic complex (lateral view)



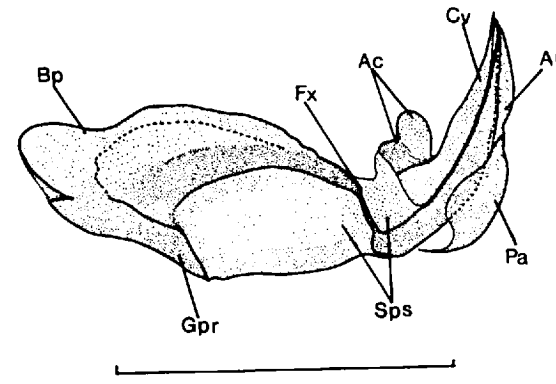
33



34



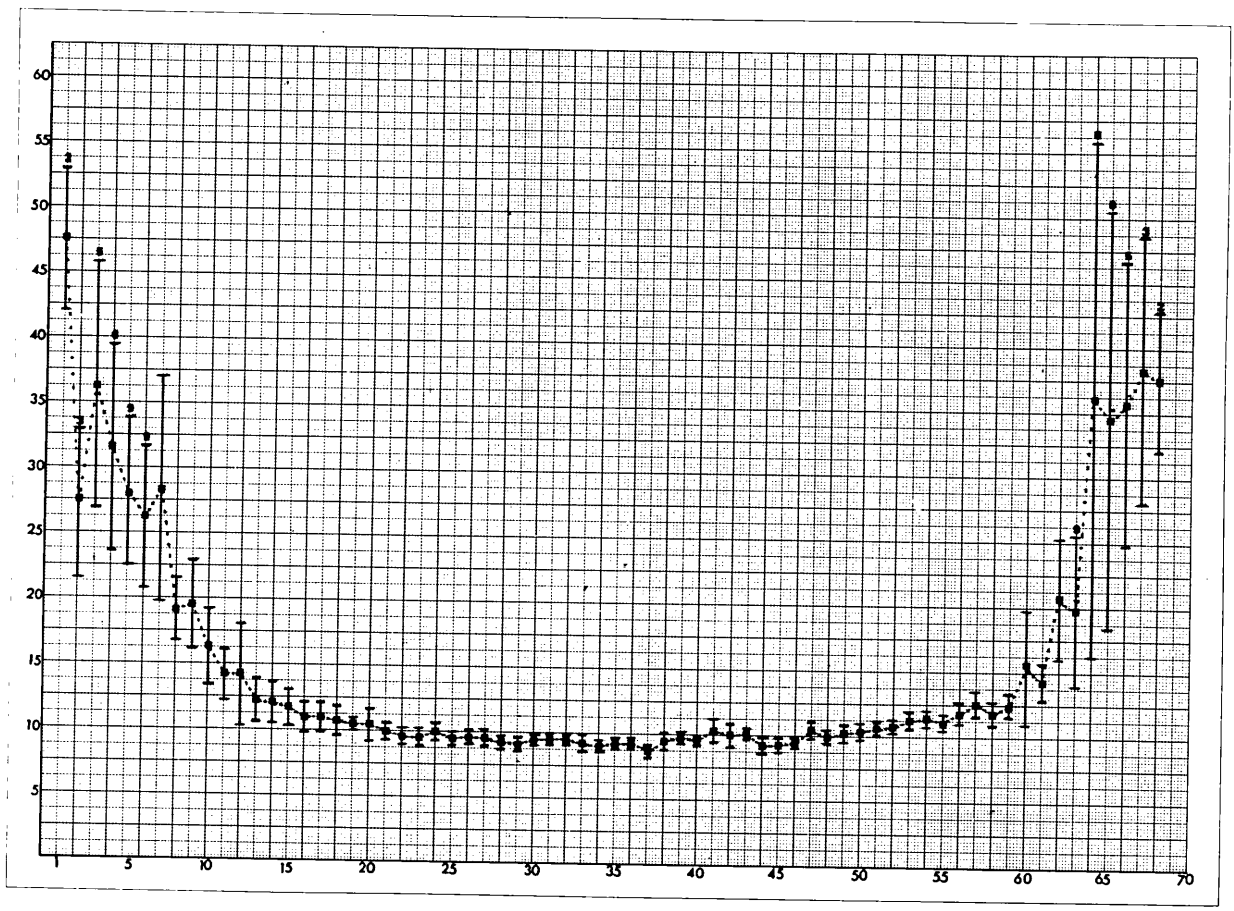
35



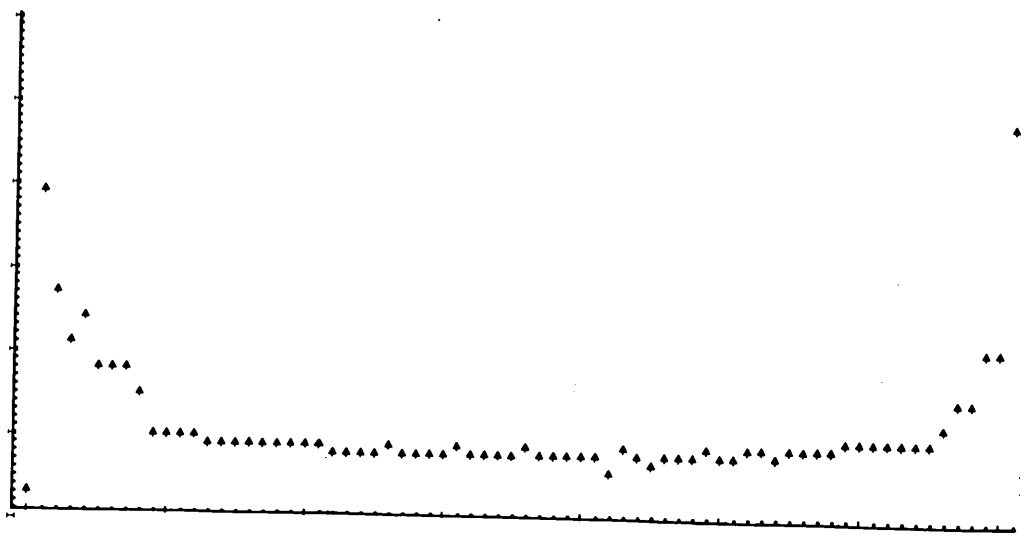
36

FIG. 37 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. curvicercus from Israel

FIG. 38 Stridulatory file pattern from one specimen of D. curvicercus


60
55
50
45
40
35
30
25
20
15
10
5
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70

37



38

PLATE 39

Meiosis in the spermatocytes of D. curvicercus Uvarov (collected from Israel)

Mag. x 1500

A-F Material from Jerusalem

A Diakinesis (normal)

B-D Diplotene (normal)

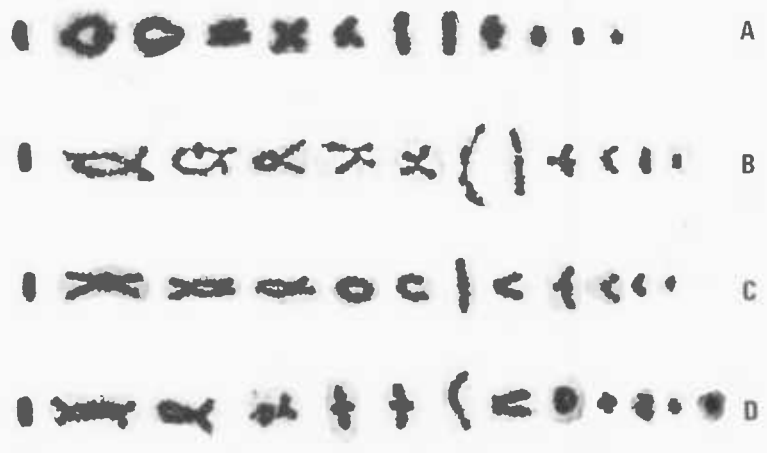
E Diplotene (phase contrast)

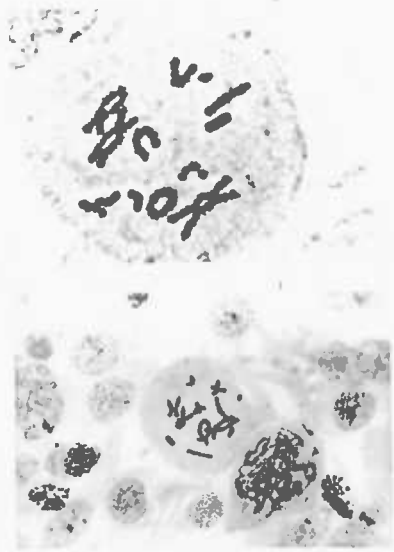
F Diplotene (x 40, normal)

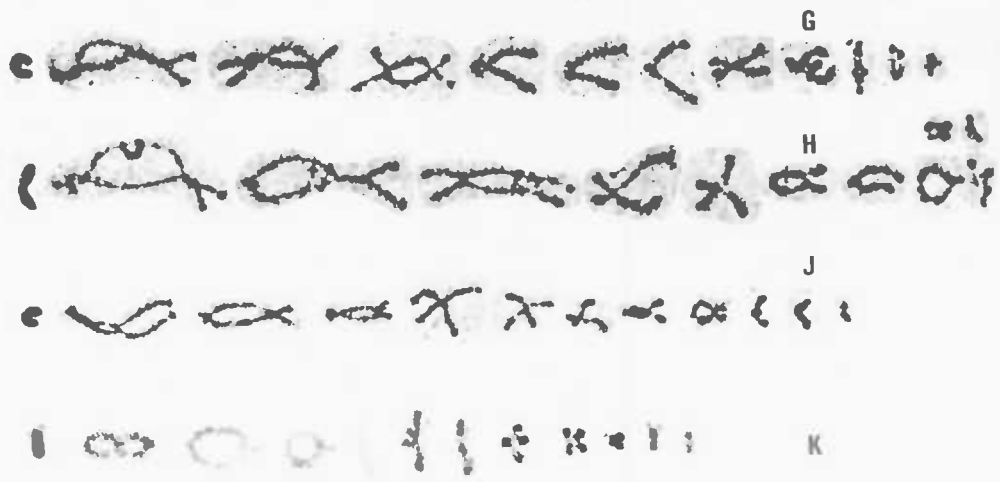
G-M Material from Betgoverin (phase contrast)

G-J Diplotene

K-M Diakinesis


A
B
C
D


E
F


G
H
J
K


L
M

PLATE 40

Oscillograms of some species of the genus Dociostaurus

A & B Courtship songs

A(1-4) D. curvicercus Uv.

B(5,6) D. jagoi jagoi subsp.n.

C-G Calling songs

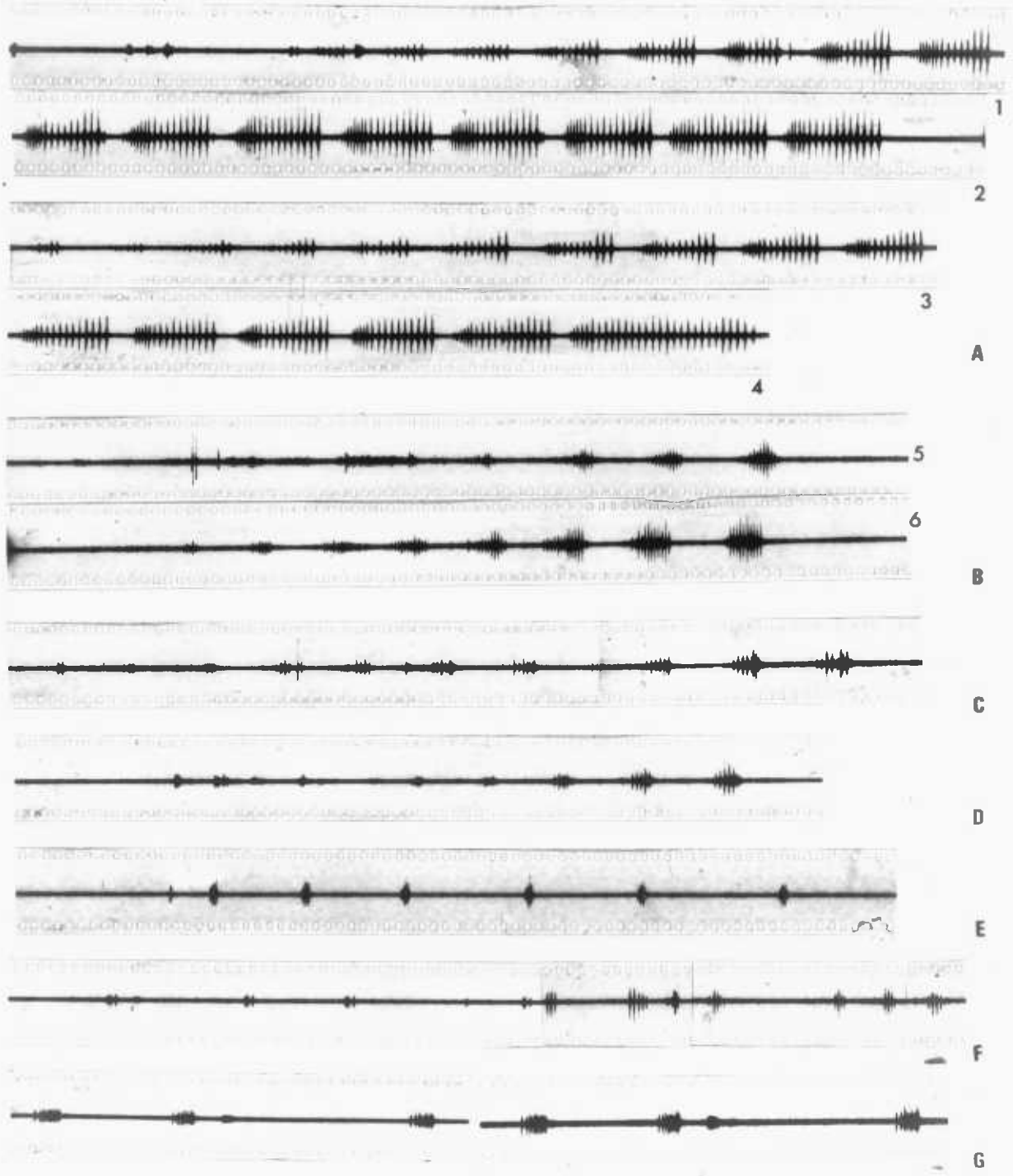
C D. genei littoralis subsp.n.

D D. cephalotes Uv.

E D. maroccanus Thunb.

F D. anatolicus Kr.

G D. hauensteini hauensteini (I.Bol.)


1
2
3
A
4
5
6
B
C
D
E
F
G

4. Dociostaurus minutus La Greca, 1962

Type: ♂ Dociostaurus minutus La Greca, 1962, Boll. Sed. Accad. gioenia Sci. nat. VII: 115-122, figs. 1, 2. Italy, Sicily I, Iblea reg., VII-VIII.62 (La Greca). Academia Gioenia di Scienze Naturale, Catania.

DIAGNOSIS. Male:

1. Phallic complex in lateral view (Figs. 41 and 43) with short, almost straight, apical valves (Ap), not upcurved like those of D. genei or D. jagoi. Valves covered with a thin membrane forming projecting appendages (Pa) both on anterior edge of cingular valves (Cv) and posterior edge of apical penis valves (Ap). Apical valves of penis well sclerotised, blunt and wide as seen from above (as in D. jagoi) with a projecting process on ventro-posterior edge. Cingular valves (Cv) narrow, pointed and with tip only slightly surpassing tips of apical penis valves. Arch of cingulum (Ac) large, sclerotised and, as seen in lateral view, clearly bilobate dorso-anteriorly, its upper part larger than its lower part (cf. D. jagoi, Fig. 15). Apodemes of zygoma (Apd) obliquely truncate, not tapering acute. Basal valves of penis (Bp) long and narrow, weakly excurved as seen from above, similar to D. jagoi jagoi (Fig. 8). Gonopore processes (Gpr) short and relatively narrow.

Epiphallus (Eph) relatively large (Fig. 42) its lateral plates (Lp) wide with anterior projections (Apr) which are more heavily sclerotised near base of ancorae (A). Posterior ends of lateral plates of epiphallus (Ppr) thickened and outwardly produced. Lophi with rounded punctate surface (L). Bridge (B) relatively thick. Ancorae (A) short and narrow, similar in position and proportions to those of D. genei genei (Fig. 9).

2. General colouration yellowish with red-brown and dark brown pattern.

3. Fastigium verticis pentagonal (Fig. 47) with projecting lateral

carinae. Fastigial depression about 1.43 times longer than wide, its surface slanting forwards and downwards to meet vertex in an obtuse angle. Temporal foveolae relatively large, as long as wide and sloping obliquely downwards.

4. Frontal ridge narrow with rounded margins; depressed along mid-line from median ocellus upwards to fastigium verticis. Below ocellus frontal ridge wide and flat with obscure lateral margins. Vertex conical in shape without any clear median carinula.

5. Head large, strongly projecting above level of median pronotal carina. Head bears two dark brown dotted bands which pass along dorsal inner edge of compound eyes and reach posterior edge of occiput. Length of head, as seen from above (Fig. 47), just over 1.2 times length of pronotal median dorsal carina.

6. Compound eyes large, longest axis of eye being twice length of subocular groove and 1.3 times its shortest axis.

7. Antennae slightly longer than length of head and pronotum together as seen from above (La Greca, 1962).

8. Pronotum relatively short with a wide disc and rounded posterior margin to metazona. Metazona equal in length to, or slightly shorter than, length of prozona. Transverse sulci 2-4 well developed. Light yellow bands on inner edge of each metazonal lateral carina fading between sulci 3 and 4, absent between sulci 2 and 3 but present faintly anterior to sulcus 2. Metazonal yellow bands themselves edged along each inner side with a triangular dark band. Median carina edged on each side by lighter ochraceous band along entire length. Lateral carinae only visible in pronotal metazona.

9. Tegmina strongly abbreviated and leathery. Ovoid apices only reach to third abdominal tergite and just reach second dark band of folded posterior femora. E/F ratio about 0.4.

10. Posterior femora relatively long, when folded with their apices surpassing apex of abdomen. Femora bearing 3 dark brown spots on both dorso-lateral areas, though not extending onto inner area of femur. Outer area of posterior femur yellowish with dark brown marks and angular 'herring bone' pattern (Fig. 46). Upper carinula and lower carinula similarly pigmented. Upper lobe of hind knee dark on inner and outer sides. Lower genicular lobe dark on inner side but light with a darker pattern on outer side.

11. Hind tibiae dark dirty grey with light band near knee and black zone at prozimal tip.

12. Supra-anal plate (Fig. 45) wider than long with triangular median tip. Posterior margin of last abdominal tergite divided into two median lobes with acutangular outer posterior corners (as in D. jagoi occidentalis).

13. Number of stridulatory pegs in femoral file 61 (only ♂ paratype available). Middle portion of file very regular in peg spacing (Fig. 44).

Female:

1. General colouration brownish with regular dark oblique patterns on lateral sides of abdominal tergites.

2. Temporal foveolae concave, as wide as long, with distinct lateral margin and rounded angles. Vertex narrow, its greatest width between compound eyes twice as long as the width of frontal ridge between antennal sockets. Head shorter than length of pronotum as seen from above, and strongly prominant from level of pronotum.

3. Frontal ridge punctate with black spots and depression along the

middle (from fastigial pore angle to median ocellus).

4. Compound eyes large slightly oblique, largest axis of eye being about 1.65 times as long as subocular groove.

5. Antennae brownish, as long as length of head and pronotum together as seen from above and with a whitish scape.

6. Lateral carinae of pronotum weak on prozona. Light pigment forming 'X' shaped marking along inner sides of lateral carinae.

7. Brachypterous with apices of folded tegmina only reaching fourth tergite of abdomen. E/F ratio about 0.45.

8. Lower genicular lobes of both sides on tips of posterior femora light in colour. First and third dorsal dark brown spots of posterior femora absent.

MEASUREMENTS (after La Greca, 1962)

	Male	Female
Length of tegmen (mm)	2.7-3.2	3.5-4.7
Length of hind femur (mm)	6.3-7.8	9.5-11.0
Length of pronotum (mm)	1.7-2.0	2.3-2.7
Length of body (mm)	8.5-10	11.9-12.7

DISTRIBUTION. Found by Prof. La Greca on the dunes of southern Sicily. Known only from this region.

DISCUSSION. Material for study in this paper was limited to 1♂ and 1♀ paratype. The genitalia are described here for the first time as

well as the form of the stridulatory file.

From the form of the genitalia and external facies it is clear that this island species is very similar to members of the D. genei, D. jagoi, D. curvicercus complex.

In his original description La Greca compared this species to the brachypterous species D. dantini (Morocco, High Atlas) and D. cephalotes (Israel). They probably resemble each other by convergence consequent upon their adopting brachypterous facies. The genitalia and stridulatory files of these two species are quite different from those of D. minutus, however, and it is more likely that D. minutus has arisen as an island isolate of D. genei or D. jagoi. The epiphalli of the two taxa D. genei genei and D. minutus are very similar (Figs. 9 and 42), while the apical penis valves (Ap) of D. minutus resemble those of D. jagoi occidentalis closely though having a sharper upper curve in the flexure (Fx) which leads the valves to adopt a more posteriorly directed posture (Fig. 43).

D. minutus La Greca

FIG. 41 Phallic complex (from side view) with zygoma and apodemes

FIG. 42 Epiphallus (dorsal view)

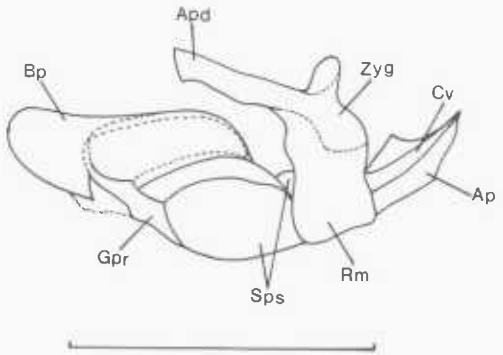
FIG. 43 Phallic complex (lateral view), zygoma and apodemes removed

FIG. 44 Stridulatory file pattern from one specimen of *D. minutus*

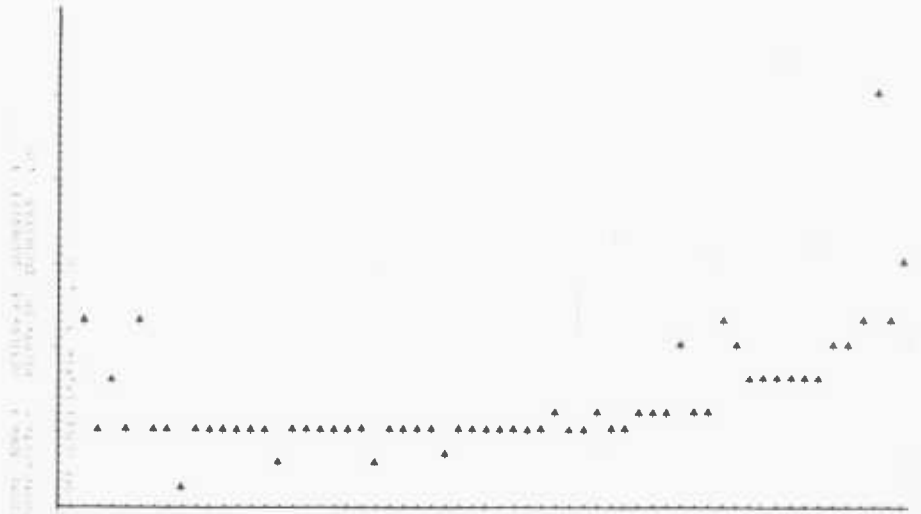
FIG. 45 Supra-anal plate and cerci from above

FIG. 46 Posterior femur (outer side)

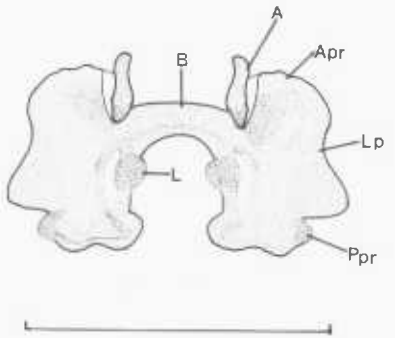
FIG. 47 Head and pronotum from above



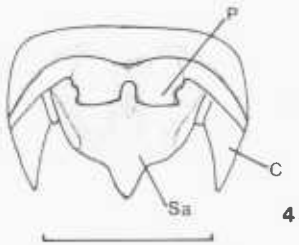
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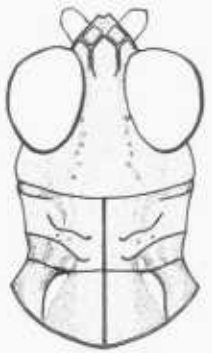
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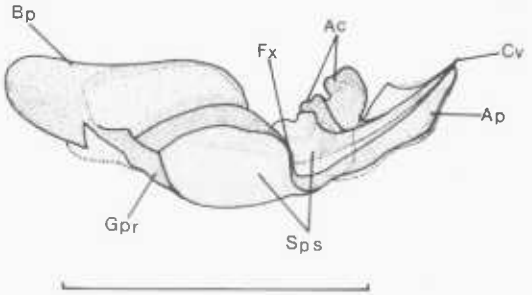
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43

5. Dociostaurus tartarus (Stschelkanovzev, 1909)

Lectotype: ♂ Stauronotus tartarus (Sauss. in litt.) Stschelkanovzev, 1909. Tzv. imp. Warshav. Univ., 1909 (22): 34, sep. repr., USSR, Vallee de Sarafshan, 26 (tartarus, Sauss. det.). Moscow Zool. Mus. Transferred to Dociostaurus by Uvarov, 1921, Bull. ent. Res. 11: 399,403 under the name of D. crucigerus tartarus Stschelkanovzev.

DIAGNOSIS. Male:

1. Phallic complex in lateral view (Fig. 53) shows apical valves of penis (Ap) to be comparatively long, slender and straight. Valves almost vertical in orientation. Apical penis valves and cingular valves (Cv) almost same length, though former more heavily sclerotised and narrower than latter. Arch of cingulum bipartite in profile (Ac, Fig. 53) with anterior lobe pointed. Flexure abrupt at junction with base of apical valves. Basal valves of penis (Bp) broad and forming an expanded median flange at their junction antero-dorsal to flexure (unlike low profile of same region in previous 4 species). Spermatophore sac (Sps) large. Gonopore processes (Gpr) wide, sclerotised with acute tips directed diagonally downwards toward base of sac. Zygomatic apodemes (Aps) narrow. Zygoma (Zyg) rather heavy and wide (compare Figs. 54A and 54B).

Epiphallus (Eph) (Fig. 52) proportionately small. Large lateral plates (Lp) with angular rounded margins. Anterior projections (Apr) horn-like, sclerotised. Posterior projections (Ppr) also well developed. Ancorae (A) small. Bridge only gently curved, almost straight (B).

2. General colouration pale golden brownish but very variable geographically and even within samples from same locality. Usually with a longitudinal median band of lighter pigment on head and pronotum.

3. Fastigium verticis distinct, concave, about 1.5 times as long as broad (Fig. 51). Angles of fastigium rounded, sometimes to a degree where angles are lost. Sides of fastigium may bear linear black pattern. Temporal foveolae about twice as long as deep, their corners being rounded. Front margin of foveolae sloping downwards, its upper angle curving smoothly parallel with front of frontal ridge.

4. Frontal ridge broad, flat and hardly impressed below median ocellus. Widened between antennal bases and hardly narrowed below fastigium of vertex.

5. Head wider than long as seen from above. Not distinctly projecting above line of median carina of pronotum. Usually with two wide dark brown bands of colour starting at back edge of eyes and reaching back of occiput (Fig. 51).

6. Eyes large, longest axis of eye about 2.25 times longer than length of subocular groove and about 1.4 times longer than length of narrowest axis of eye.

7. Antennae light, 1.3-1.45 times longer than length of head and pronotum together.

8. Length of pronotum on mid-line 1.1-1.6 times greater than that of head as seen from above. Pronotum bilaterally compressed. Metazona 1.15 to 1.3 times longer than prozona. Median dorsal carina distinct and elevated. Transverse sulci 2-4 well developed. Lateral carinae usually absent in prozona, weak between sulci 3 and 4, but very distinct in metazona. Colour of pronotum dominated by two dark brown bands

(extension of those seen dorso-laterally on head, Fig. 51) and by light markings on metazona, which converge forwards strongly and extend into space between transverse sulci 3 and 4. Light markings of prozona weak or absent, but if present diverging forwards. Posterior margin of pronotum rounded obtusangulate.

9. Tips of folded tegmina level with, or just surpassing, apices of folded posterior femora. A series of separate dark brown spots present both on medial area and posterior medial area.

10. Posterior femora relatively long proportionally and slender. Upper carina of posterior femora bearing 3 dark brown spots which sometimes extend faintly onto outer area of femur. Genicular area always black.

11. Hind tibiae usually with pale yellow-greenish colour, but variable from population to population. Extreme proximal end of tibia always black.

12. Supra-anal plate (Fig. 56) wide, rather rounded posteriorly. Last abdominal tergite with two small angular lobes (P) with an obtusangulate interspace between them. Subgenital plate large and smoothly rounded.

13. Number of stridulatory pegs high, 80-117 (Fig. 58). Intervals very regular.

14. Chromosomes - refer to discussion section.

Female: Description based on paratype in Brit. Mus. (Nat. Hist.) London.

1. General colouration variable, i.e. pale brown or stramineus in Iranian material and dark brown with distinct dark patterns and pigmentation

in specimens from Kashmir and Afghanistan. Much larger insects than males. Head and pronotum usually with a light median dorsal band of colour.

2. Temporal foveolae small with indistinct margins. Fastigium of vertex as long as wide.

3. Frontal ridge feebly impressed at level of median ocellus. Head short, its length about 0.6 times length of median pronotal carina.

4. Compound eyes of such a size that longest axis 1.6-2 times length of subocular groove.

5. Antennae a little longer than head and pronotum together with a short and thick first basal segment (scape).

6. Pronotum with distinct lateral carinae in metazona and sometimes with weak carinae in prozona. Light pigmentation outlining inner edge of lateral carinae to make an 'X' shaped marking whose upper arms diverge strongly forwards and whose lower arms diverge strongly backwards.

7. Tegminal apices level with or just surpassing level of tips of folded posterior femora. Usually with 4-5 regular dark brown patterns extending across medial area and continuing to posterior medial area of tegmen. Hind wings with small rose coloured area at base in some material (e.g. Iran, Gorgan).

8. Posterior femora with 3 distinct dark brown spots on upper carina usually extending onto outer area and sometimes onto inner area also. Lower outer genicular lobe of posterior femora light in colour with

black spots.

9. Posterior tibiae pale yellow with a black band at the extreme proximal end.

10. Ovipositor valves long and half covered by supra-anal plate, paraprocts and subgenital plate.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	10-15.5	14.5-21.0
Length of posterior femur (mm)	8-11.5	10.8-16.8
Body length (mm)	13-21	20-28

DISTRIBUTION. The species occurs in southern USSR, northern and southern Iran, northern Afghanistan and West Pakistan. It occurs at 350 m above sea level in pastures (Iran, Sarakhs) and high altitudes (W. Pakistan, Ziarat, 2500 m above sea level).

MATERIAL EXAMINED.

Iran: 4♂, 3♀ Gorgan prov., 5.VI.51 (A. Soltani); 2♂, 2♀ Azerbaidjan, Khoi, 6.VIII.64 (M. Descamps); 2♂, 1♀ Mashhad, Akhlamad, 1400 m, 1.VII.64 (M. Descamps); 2♂, 3♀ Kerman, Deh Bakri, 13.VII.64 (M. Descamps); 4♂, 3♀ Varamin-Garaghadj, 22.VII.59 (E.S. Brown); 3♂, 5♀ Gorgan, Agriboghaz, 26.VI.55 (A. Shakoni); 2♂, 4♀ Nairiz-Fars, Halilabad, 10.VII.43 (H. Mirzayan); 5♂, 7♀ Gorgan, Amarlou, 15.VII.66 (A. Soltani); 1♂, 1♀ Gorgan, Aliabad, 4.VII.48 (P. Aellen); 2♂, 1♀ Fars, Dehbid, 8.VII.49 (H. Mirzayan); 2♂, 2♀ Azerbaidjan, Moghan, 10.VI.58 (L.F.H. Merton); 5♂, 7♀ Khorassan, Sarakhs, 23.VI.73 (A. Soltani); 6♂, 6♀ Khorassan,

Darehgaz, 25.VI.73 (A. Soltani); 3♂, 4♀ Mashhad, Aghonge, 18.VI.73, (A. Soltani); 2♂, 2♀ Kerman, Jebal-barez, 7.V.69 (Pazuki - Hashemi); 1♂, 2♀ Fars, Shiraz, 25.VI.63 (H. Mirzayan).

USSR: 2♂, 3♀ Turkistan, 18.VI.13 (_____); 3♂, 2♀ Armenia steppe, 26.VII.25 (_____); 1♂, 1♀ Golodnaya steppe, 28.VI.12 (Shesloperow); 3♂, 3♀ E. Transcaucasia, VI.25 (M. Siazov); 1♂, 2♀ Semirechye, L. Alakul, 14.VIII.25 (N.V. Antonov); 2♂, 2♀ S. Russia, ____1916, (N.L. Sacharow).

Afghanistan: 5♂, 5♀ N. Herat, over 1500 m, 20.V.73 (G. Popov); 4♂, 4♀ Herat, Farah, 16.V.73 (G. Popov); 5♂, 8♀ Nuristan, Ahmed dewan, 2700 m, 23.VII.52 (J. Klapperich).

W. Pakistan: 12♂, 9♀ btwn. Nuski and Quetta, 4.VI.63 (G. Popov); 4♂, 6♀ Baluchistan, Ziarat, 2600 m, (1-15).VIII.30 (W.H. Evans); 5♂, 11♀ Kashmir, Gumari, Darel R., 2000 m, 22.VII.58 (E. Piffl); 2♂, 2♀ Baluchistan, _____, _____1929 (J.W. Evans).

DISCUSSION. Taxonomically this insect has had a complicated career. It was just mentioned as a manuscript name Stauronotus tartarus without proper published description by Redtenbacker, 1889, who quoted Saussure as the author. Subsequently Stschelkanovzev, 1909, described Stauronotus tartarus from the Caucasus and became as a result the first to describe this species.

In 1921 Uvarov published a preliminary revision of the genus Dociostaurus and placed tartarus in combination with crucigerus, as a subspecies. Tarbinsky, 1930, rightly contested this conclusion and claimed that it was specifically distinct from D. crucigerus Rambur. Unfortunately Tarbinsky mislabelled his figures of the epiphallus. His Fig. 6 should

be that of D. brevicollis and his Fig. 7 should be that of D. tartarus. Tarbinsky, 1940, proposed that the name tartarus should be attributed to Uvarov. This Uvarov, 1947d, refused to accept on the ground that Stschelkanovzev had priority.

The published geographical distribution of this species has included Iraq. This is probably incorrect as all material I have examined from Iraq to which the name tartarus has been given should in fact be called D. larensis sp.n. Likewise, the species D. tartarus has only been recorded previously from northern Iran, but it is quite clear that it occurs in southern Iran also.

The species D. tartarus is of interest in possessing the longest stridulatory file in the genus (up to 124 pegs) (Fig. 58).

The chromosomal characteristics of this species are tabulated below (see Figs. 59, A-M; 60, E-H).

Locality		Autosome pair number										
Khorasan prov. Aghonge	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	t	t/i	ti	ti	t	t	t	t	t	t	t
	Chiasmata: Number	2	1-2	1-2	1-2	1	1-2	1	1-2	1-(2)	1	1
	Terminal heterochromatic segments (size)	small	med	med	small	v. small	v. small	-	-	-	-	-
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	a	s	s
Khorasan prov. Daregaz	Chiasmata: Terminal (t) or Interstitial (i)	t	t	t	t	t	t	t	t	t	t	t
	Chiasmata: Number	2	2	2	2	2	1-2	1	1	1	1	1
	Terminal heterochromatic segments (size)	-	-	small	v. small	v. small	v. small	-	-	-	-	-
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	a	s	s
Khorasan prov. Sarakhs	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	t	t	t	ti	t	t	t	t	t
	Chiasmata: Number	2-3	2	2	1-2	1-2	1-2	1	1-2	1	1	1
	Terminal heterochromatic segments (size)	-	-	-	-	-	v. small	v. small	v. small	-	-	-
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	a weak	s	s
	Mean chromosome length (%) from above localities	21.2	21.2	12.2	10.3	9.1	7.4	6.1	5.5	2.5	2.5	2

When compared with D. larensis, the species most closely similar in other respects to D. tartarus, the following differences can be noted.

There is some variation in chromosome sets from different localities. Thus the terminal heterochromatic segments from Aghonge (Fig. 59, A-D, J-M) and Sarakhs (Figs. 59, E-H; 60, E-H).

All show weak asymmetry in chromosome pair 9. The chromosomes show some morphological similarity to those of D. (Notostaurus) albicornis (see Fig. 131, 132).

FIG. 48 D. larensis sp.n. Head and pronotum from above

FIG. 49 Epiphallus (dorsal view) of D. larensis

FIG. 50 Phallic complex (lateral view) of D. larensis

FIG. 51 D. tartarus (Stschelkanovzev). Head and pronotum from above

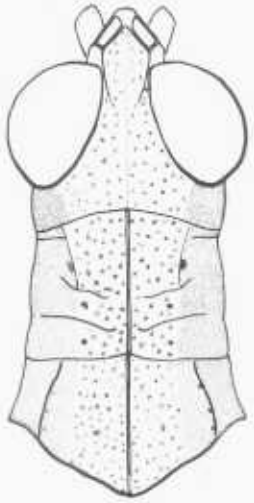
FIG. 52 Epiphallus of D. tartarus

FIG. 53 Phallic complex of D. tartarus

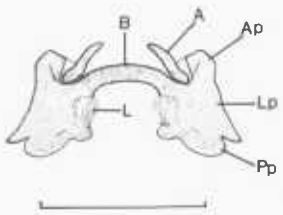
FIG. 54 Zygoma and apodemes (dorsal aspect): A for D. larensis, B for D. tartarus

FIG. 55 Supra-anal plate, subgenital plate and cerci (from above) of D. larensis

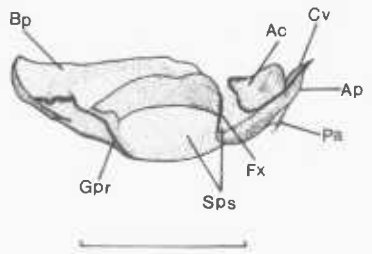
FIG. 56 Supra-anal plate, subgenital plate and cerci (from above) of D. tartarus



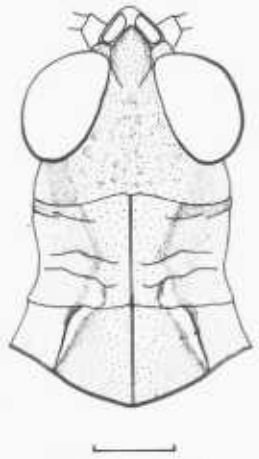
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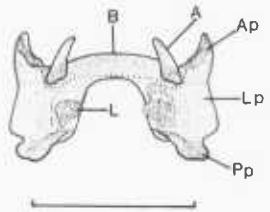
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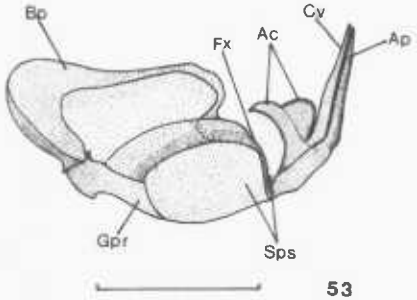
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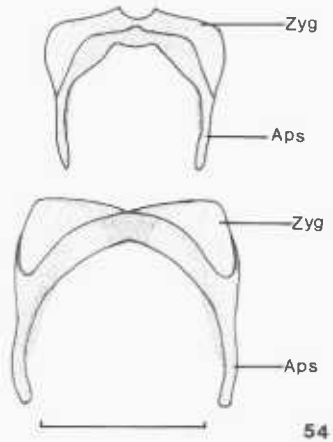
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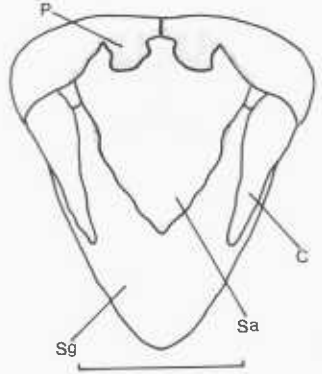
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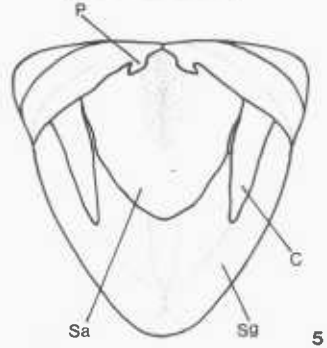
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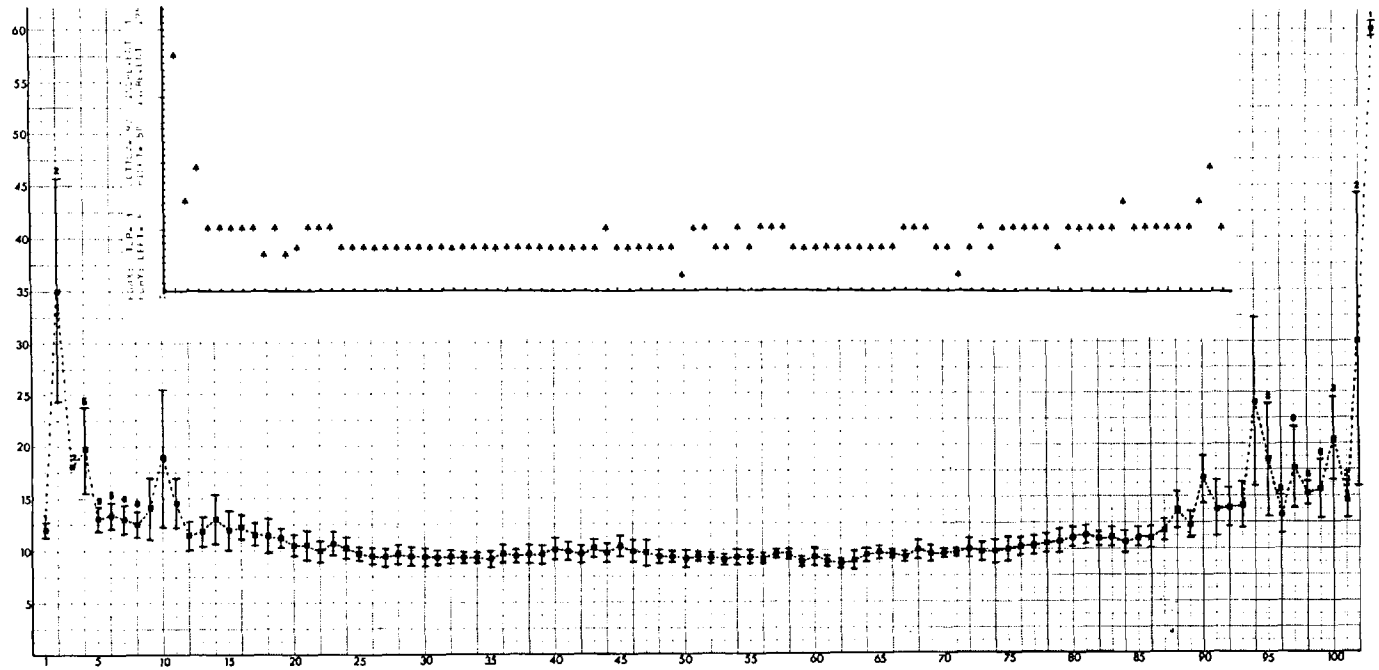
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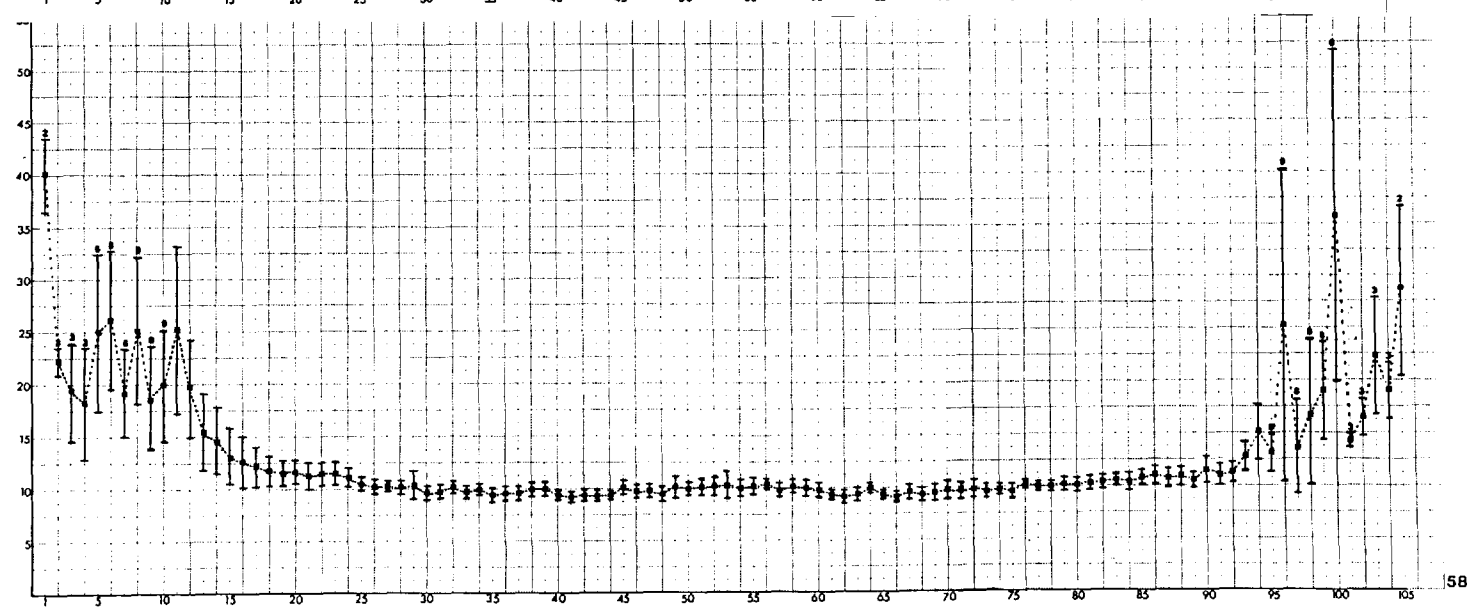
56

FIG. 57 Stridulatory peg graph showing variation in peg intervals of 10 specimens and stridulatory file pattern from one specimen of D. larensis sp.n.

FIG. 58 Stidulatory peg graph of 10 specimens of D. tartarus (Stschelkanovzev)



57



58

PLATE 59

Meiosis in the spermatocytes of D. tartarus (Stschel.) collected from Iran

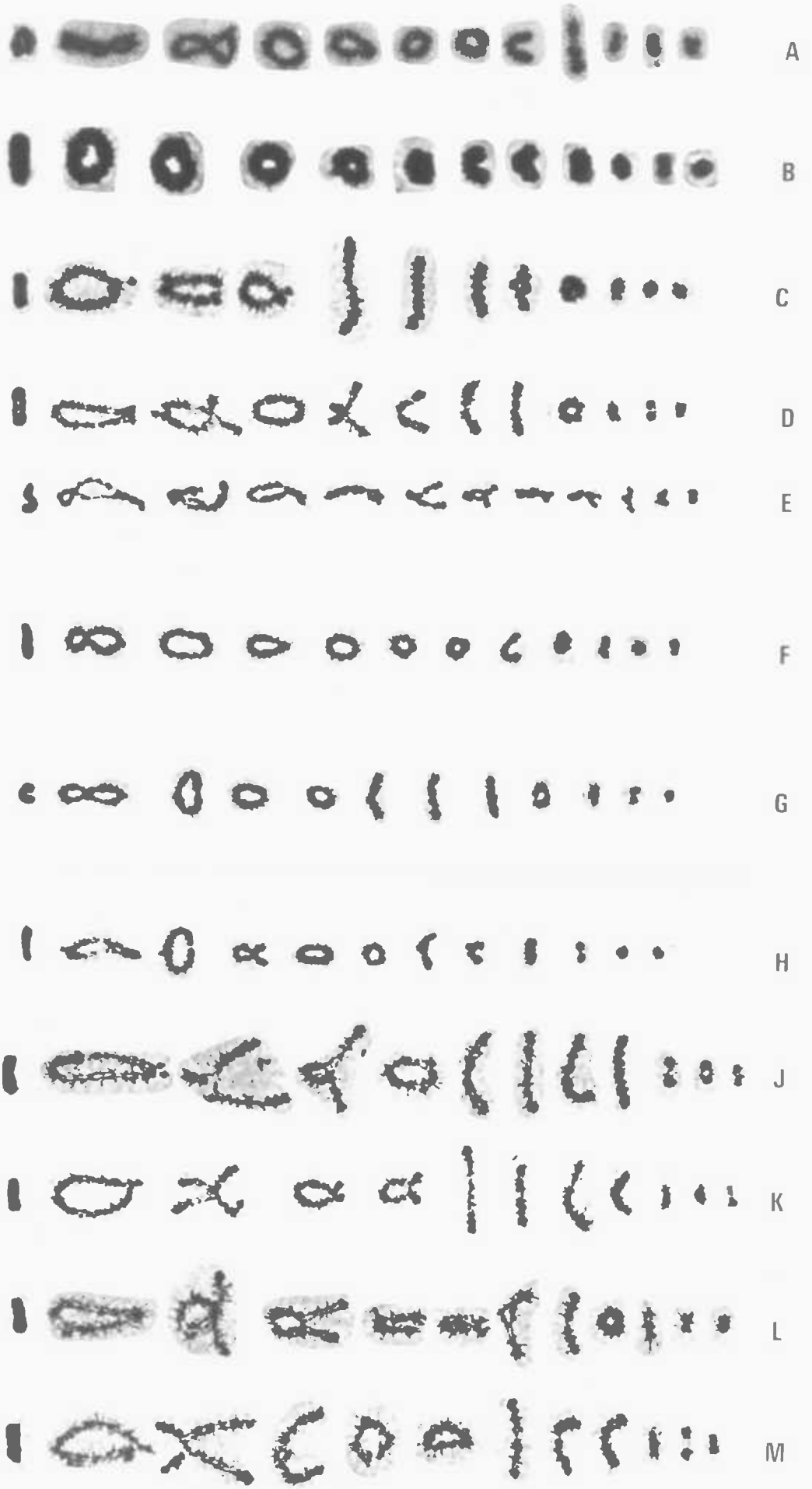
Mag. x 1500

A, B Diakinesis (material from Daregaz)

C Late diplotene and D diplotene (from Mashad, Aghonge)

E-H Diplotene (specimens from Sarakhs)

J-M Diplotene (Mashad, Aghonge)


A
B
C
D
E
F
G
H
J
K
L
M

6. Dociostaurus larensis sp.n.

Type:♂ Dociostaurus larensis Soltani, sp.n. Iran, Fars prov., Mansurabad (between Jahrom & Lar), 21.VI.66 (A.A. Soltani). Brit. Mus. (Nat. Hist.) London.

DIAGNOSIS. Male:

1. Phallic complex with apical valves (Ap) in lateral view (Fig. 50) short with pointed tips directed obliquely upwards. Much shorter than in D. tartarus (Fig. 53). Apical penis valves (Ap) sclerotised, thicker than cingular valves (Cv), above level of cingulum slightly downcurved. Cingular valve slightly longer than apical penis valves. Arch of cingulum (Ac) large, heavily sclerotised and positioned about half-way along length of penis valves (cf. D. tartarus). Flexure thin, abruptly curved at base of penis valves. Dorso-median junction of basal valves (Bp) not produced upwards as in D. tartarus but running smoothly down into upper part of flexure. Basal valves narrow. Spermatophore sac (Sps) small and thin. Gonopore process (Gpr) sclerotised, narrow and strongly attenuated ventro-posteriorly.

Epiphallus (Eph) (Fig. 49) with lateral plates (Lp) narrower than in D. tartarus and set more obliquely leaving epiphallus much wider above than below. Posterior projections (Ppr) large and sclerotised. Bridge (B) narrow and curved. Ancorae thinner and longer in proportion than in D. tartarus, set inwards more obliquely toward mid-line. Apodemes of zygoma (Fig. 54A, Aps) and zygoma smaller and narrower than in D. tartarus.

2. General colouration brownish stramineus with light yellow pattern. Very similar to D. tartarus, but less variable. Two wide brown stripes usually present extending from posterior margins of eyes to posterior

margin of metazona overlapping lateral lobes of pronotum.

3. Fastigium verticis (Fig. 48) elongate, depressed and with distinct lateral margins. Length of fastigium 1.5-1.7 times larger than its widest part; sides usually not parallel so its widest point occurs at a point level with back of temporal foveolae. Angle between fastigium and frons more acute than in D. tartarus. Temporal foveolae long and narrow, nearly rectangular, with thickened, distinct edges. Vertex long and narrow, its width between eyes equal to width of frontal ridge between antennal bases.

4. Frontal ridge flat with distinct lateral edges. Surface punctuate and slightly concave below median ocellus.

5. Head elongate, strongly reclinate, not elevated above level of pronotum. Vertex and occiput with rugose surface (Fig. 48) and indistinct median carina.

6. Eyes large, long axis of eye 2.8 times longer than length of subocular groove and 1.4-1.6 times longer than its narrowest dimension.

7. Antennae light brown, their length 1.25-1.5 times longer than length of head and pronotum together. Scape large.

8. Disc of pronotum slender, longer and narrower than that in D. tartarus. Lateral lobes of pronotum narrower than those of D. tartarus, 1.4 times longer than head as seen from above. Lateral lobes of pronotum hardly bilaterally constricted. Length of prozona equal to that of metazona. Transverse sulci 2-4 well developed, but not as distinct as in D. tartarus. Lateral carinae feebly developed anterior to transverse sulcus 3 and weakly

divergent forwards. Lateral carinae of metazona weak but visible and weakly divergent backwards.

Light colour bands along inner edge of lateral carinae (in other species often forming an 'X' shape) usually absent, but sometimes very weakly developed in prozona and metazona. Light punctate area between lateral carinae of prozona.

Median carina well developed and elevated above level of pronotal disc.

Posterior margin of metazona obtusangular.

9. Tips of folded tegmina slightly surpassing tips of folded posterior femora.

10. Posterior femora with 3 dark brown spots which usually do not extend onto inner and outer areas. Posterior knees black both internally and externally.

11. Posterior tibiae pale yellowish green in colour (similar to D. tartarus) black immediately adjacent to joint with femur.

12. Supra-anal plate (Fig. 55) long and acutangular at apex. Posterior margin of last tergite with two comparatively large median lobes (P) with a rectangular emargination between them. Subgenital plate with an acute but rounded apex as seen from above (sharper than in D. tartarus, Fig. 56). Cerci longer and sharper than those in D. tartarus.

13. Number of stridulatory pegs lower than that in D. tartarus, 85-103 (Fig. 57). Peg spacing similar to that in D. tartarus (Fig. 58).

14. Chromosomes (Fig. 60, A-D). Characters tabulated below:

Locality		Autosome pair number										
	Chromosome characteristics	1	2	3	4	5	6	7	8	9	10	11
Iran Fars (Kazerun)	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	t	t	t	t	t	t	t	t	t
	Chiasmata: Number	2	2	2	2	1	1 or 2	1 or 2	1 or 2	1	1	1
	Terminal heterochromatic segments (size)	-	-	-	-	-	-	-	-	-	-	-
	Autosome pairs symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)	21.2	22.5	12.9	11.6	7.7	7.7	5.1	5.8	2	2	1.3

Unlike D. tartarus this species (D. larensis) lacks terminal heterochromatic segments of any kind. On the other hand the length of the chromosomes (expressed as a percentage of the length of the whole complement) matches that of D. tartarus very closely. Note that there are no asymmetrical bivalents.

Female:

1. General colouration as for male but more variable. A light yellow band sometimes present from front of fastigium verticis, continuing broadly on pronotal disc and running across anal field of tegmina.

2. Temporal foveolae longer than deep; not deeply impressed in centre with thick margins and rounded angles. Vertex with fastigium of pentagonal form, slightly longer than wide. Occiput short, rather rugose with an obliterate median carina.

3. Head short, its horizontal length seen from above 0.5 to 0.65 times length of median carinula of pronotum.

Frontal ridge flat, not excavate near median ocellus.

4. Compound eyes comparatively small, longest axis of eye 1.6 to 1.8 times longer than length of subocular groove.

5. Antennae brownish, as long as head and pronotum together or slightly shorter than the latter. Scape large and light.

6. Pronotum more elongate than in D. tartarus. Lateral carinae usually noticeable in prozona, most strongly developed anterior to transverse sulcus 3. Light bands forming 'X' shaped marking clearer than in D. tartarus but less divergent forwards and backwards (see male, Fig. 48). Maximum distance between lateral carinae in prozona much less than that between lateral carinae in metazona. Median carina strong.

7. Folded tegmina with apices reaching or just surpassing tips of folded posterior femora.

8. Posterior femora with 3 dark brown spots dorsally, sometimes extending onto external area.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	10.5-14.6	15-20
Length of posterior femur (mm)	9.0-11.5	12.3-16.5
Length of body (mm)	16.0-20.0	21.0-26.0

DISTRIBUTION. Southern Iran; south eastern and western Iraq.

MATERIAL EXAMINED. All following paratypes unless otherwise indicated. Iran: 5♂ Marbagh plain, nr. Lingeh, 14.IV.50 (G. Popov); 7♂ Bandar Abbas, Sarkhun, 1.V.50 (G. Popov); 3♂ Haji Abad, 28°30'N, 55°55'E, 28.IV.50 (G. Popov); 2♀ Bandar Abbas, V.50 (Fassihi); 3♂, 3♀ Fars, Mansoor Abad, 2.V.66 (A. Soltani); 2♀ Fars, Firuz Abad, Tang-e-Kish, 16.IV.51 (H. Mirzayan); 3♀ Fars, Jahrom, 16.VII.49 (A. Soltani); 8♂, 5♀ Fars, Jereh-Kazerun, 12.V.73 (A. Soltani).

Iraq: 2♂ Amarah (7-16).VI.18 (P.A. Buxton); 1♂, 2♀ Baghdad, 4.VI.23 (R.W.G. Hingston); 1♀ Karbala, Baghdad, 15.VII.20 (Y.R. Rao); 2♂ Baghdad, 12.VI.46 (E.S. Brown).

DISCUSSION. This species is very similar to D. tartarus and D. tarbinskyi and was usually determined as D. tartarus by previous authors. Although it is a larger insect than D. tartarus the male genitalia are smaller in size (compare Figs. 50 and 53).

The name of this newly recognised species is derived from Lar, a town in Southern Iran (200 km S.E. of Shiraz), near to the type locality (Mansurabad).

PLATE 60

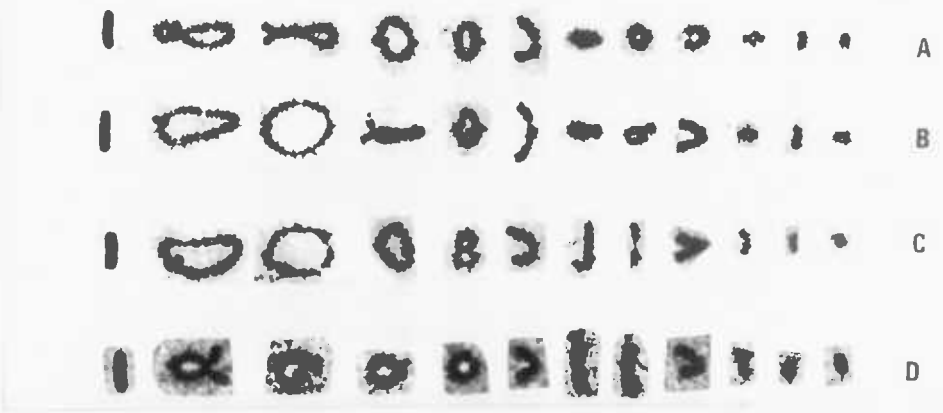
Meiosis in the spermatocytes of *D. larensis* sp.n. and *D. tartarus* (Stschel.) collected from Iran

Mag. x 1500

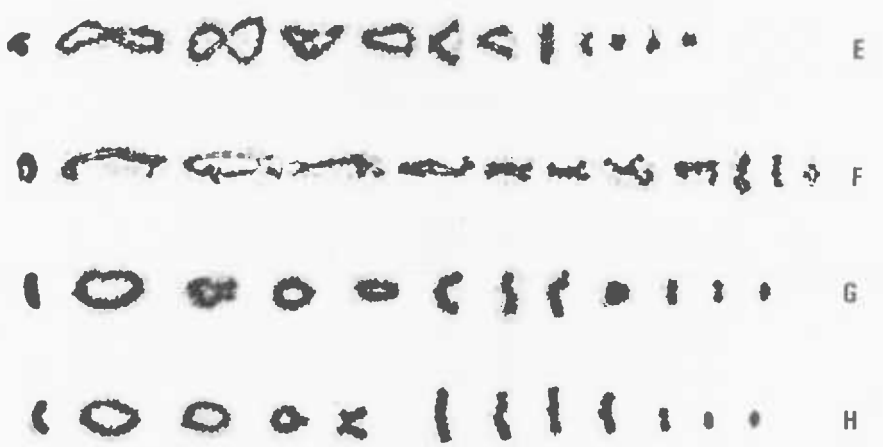
A, B & J (normal), C & D (phase contrast) chromosomes of *D. larensis*

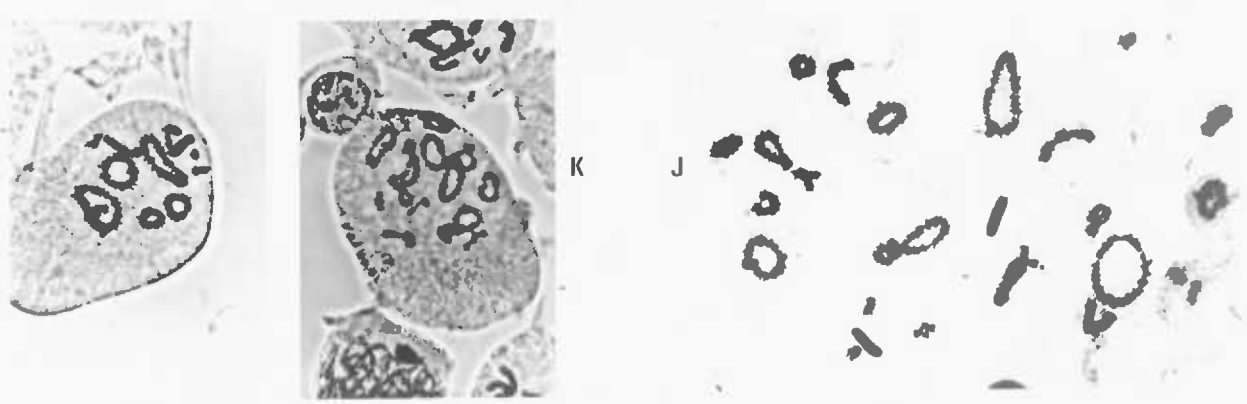
A, B, C & J diplotene, D diakinesis

E, F & K (left) (phase contrast) diplotene and G, H (normal) & K (right) (phase) diakinesis of *D. tartarus*



60





7. Dociostaurus brevicollis (Eversmann, 1848)

Lectotype: ♂ Oedipoda brevicollis Eversmann, 1848. Addit. quaedam laevia ad. Fischer de Waldheim celebr. Orth. Ross.: 11, tab. A, fig. 4. USSR, Kurgan distr., Ural region, 10.VIII.29 (Eversmann), Acad. Sci. USSR, Leningrad.

SYNONYMY. See under subspecies.

DIAGNOSIS. Male:

1. Phallic complex in side view (Fig. 62, 63) with apical valves (Ap) not as smooth and slender as those of D. tartarus (Fig. 53). Ventro-posterior margins with a projecting portion extending along almost half their length. Cingular valves (Cv) thicker but shorter than D. tartarus, its apex turned upward and extended well beyond tips of apical penis valves (Ap) though less sclerotised than latter. Cingular valves inflated about 2/5 from base. Arch of cingulum (Ac) large, sclerotised, depressed in middle with a triangular anterior part (Fig. 63, Ac), thus very similar to D. tartarus. Front edge of cingular arch thus parallel with flexure in profile. Flexure (Fx) sharp, forming an acute angle at base of penis valves. Flexure in profile thus very similar to that of D. tartarus. Basal valves of penis (Bp) very large and excurved at anterior end as seen from above. Crest formed by junction of base of basal valves projects forwards in a dorso-posterior lobe which meets upper part of flexure at an acute angle. Arch of cingulum lodged in space between this lobe and penis valves. Spermatophore sac (Sps) large with thick margin. Gonopore processes (Gpr) sclerotised and longer than that in D. tartarus (compare Figs. 62 and 53).

Epiphallus with relatively large lophi (L) (Figs. 61, 68). Posterior projections (Ppr) long, sclerotised and well differentiated

(differing from D. tartarus). Ancorae (A) large and more vertical than oblique.

2. General colouration grey, brown or dark brown with darker patterns.

3. Vertex relatively wide (Fig. 64) its width between eyes 1.3-1.6 times greater than width of frontal ridge at level of antennal bases. Fastigium verticis wide, not always parallel sided. Ratio of its length to width very variable. Temporal foveolae longer than deep, margins distinct.

4. Frontal ridge flat, slightly depressed near median ocellus.

5. Head slightly projecting above line of pronotum as seen in side view. Occiput rugose below the posterior margins of compound eyes.

6. Eyes large and vertical as seen from sides, longest axes of eye 2-2.5 times length of subocular groove.

7. Antennae brown, thickened near apex, longer than length of head and pronotum together (1.5-1.75 times) as seen from above.

8. Pronotum (Fig. 64) wide but over 1.3 to 1.55 times longer than head as seen from above. Lateral lobes constricted at level of transverse sulcus 3. Metazona slightly longer than prozona. Transverse sulci well developed. Median carina distinctly elevated above pronotum. Lateral carinae well developed in metazone, bordered on inner edges by light bands, and sometimes extending onto area between transverse sulci 2 and 3. Light bands of pigment, if developed, forming a distinct 'X'

shaped marking.

9. Apices of folded tegmina hardly reaching to slightly surpassing tips of folded posterior femora.

10. Posterior femora with 3 dark brown spots extending across three upper carinae.

11. Hind tibiae red with black ring at extreme proximal tip.

12. Supra-anal plate (Fig. 67) slightly longer than wide with acutangular posterior tip. Margin of most posterior tergite with 2 small separate projections (P) with a deep median incision between. Subgenital plate expanded (compare D. tartarus, Fig. 56) with conical and weakly blunted apex, cerci thus only extending along half of its length as seen from above. Cerci relatively thick and short.

13. Number of stridulatory pegs (Fig. 70) very variable with 58 to 90 pegs. Spacing of pegs in middle of file more irregular than D. tartarus or D. larensis.

Female:

1. Fastigium verticis large, as wide as long, its corners rounded.

2. Frontal ridge flat, widened between antennal sockets, slightly compressed on sides of median ocellus and its surface somewhat punctate.

3. Compound eyes relatively small, longest axes of eye 1.45-1.85 times as long as subocular groove.

4. Antennae dark and a little longer than head and pronotum together.

5. Prozona of pronotum with clear lateral carinae bordered by light bands on their inner sides and diverging forwards. Disc of pronotum distinctly constricted at level of sulci 3 and 4. Median carina more elevated in metazona. Metazona longer than prozona. Lateral carinae of metazona diverging backwards bordered along their inner edges by light pigment.

6. Folded tegmina with apices falling short of tips of folded posterior femora. Dark markings present on medial area.

7. Posterior femora with 3 distinct dark brown patterns on upper carinae and forming indistinct dark patterns on inner and outer areas of femora. Knees with black upper lobes, a dark inner lower lobe but light external lower lobe with black spots.

8. Hind tibiae usually red, rarely pale yellow, with black ring at proximal end.

MEASUREMENTS. See under subspecies.

DISTRIBUTION. Wide geographical range, occupying high altitude regions of USSR, north-western Iran, Turkey, Greece, Yugoslavia, Austria, Czechoslovakia, Spain and the Somali Republic.

MATERIAL EXAMINED. See under subspecies.

DISCUSSION. Of great interest is the discovery that this species extends

its range into Somalia in north-eastern Africa. The discovery was made after careful examination of the accessions collections at the British Museum. The insects are smaller than average, dark in colour and had been misidentified as Oedaleus species. The male genitalia are typical for the species D. brevicollis.

The male genitalia of this species are remarkably uniform throughout its entire geographical range except in Spain. Colour forms previously given published names in this species (var. purpureata, ab. lineatus, ab. sychrovae and ab. nigrinus) appear to be genetic forms without corresponding differences in genitalia or stridulatory file to suggest subspecies status.

Specimens kindly lent to me by Dr M. Donskoff (Musee d'Histoire naturelle, Paris) bearing labels D. crucigerus (Rambur) and from Yugoslavia are definitely specimens of D. brevicollis. The name brevicollis has been erroneously put into combination with the name crucigerus Rambur by many authors, but as discussed earlier (under D. genei) it is clear that D. brevicollis is not conspecific with D. crucigerus (Rambur) which can be best linked with D. genei (Ocskay). This matter is discussed at length, and I believe resolved, by the arguments set out in Uvarov, 1927. Clearly D. crucigerus brevicollis and D. crucigerus hispanicus, combinations published by Morales Agacino in 1941, are wrong.

KEY TO SUBSPECIES OF D. brevicollis

Males.

1. General habitus more robust. Compound eyes smaller. Apical penis valves (Ap) (Fig. 69) widened considerably just distal to flexure (Fx). Cingular valves sinuous with tip curved strongly forwards (Cv). Basal valves (Bp) extended anteriorly more strongly than in nominate subspecies so that phallic complex is longer. Gonopore process (Gpr) thick, sclerotised, with a large projection on its ventral side. Epiphallus large with broad lobate anterior and posterior projections (Apr, Ppr). Bridge (B) thinner (Fig. 68). Antennae about 1.75 times longer than length of head and pronotum as seen from above. Pronotum less constricted bilaterally at transverse sulcus 3. Metazona broad with wide light bands bordering its lateral carinae. Mesosternal interspace (Fig. 66, Msi) twice as wide as deep. Apices of folded tegmina level with or surpassing tips of folded posterior femora; E/F ratio about 1.05. Medial area of tegmen containing short wide light brown spots of pigment. Posterior femora deeper and longer.

- brevicollis hispanicus (Bolivar) comb.n.

(Spain: north and north-west of Madrid.)

- General habitus more slender and eyes larger. Apical penis valves (Ap) less sclerotised than in subsp. hispanicus and less widened just distal to flexure (Fig. 63). Cingular valve (Cv) straighter. Basal valves (Bp) broad, excurved widely anteriorly and as a result leading to whole complex being shorter. Gonopore process (Gpr) thinner, longer and smoothly developed on its ventral side. Epiphallus with narrower anterior (Apr) and posterior (Ppr) projections (Fig. 61). Lateral plate (Lp) narrower with angular ventro-posterior angles. Bridge (B) thicker (Fig. 61). Ancorae more robust. Antennae shorter about 1.5

times longer than length of head and pronotum as seen from above. Compound eyes longest axis about twice length of subocular groove. Light bands on metazona (if developed) narrower. Width of mesosternal interspace much less than twice its depth (Fig. 65, Msi). Apices of folded tegmina not reaching tips of folded posterior femora (E/F about 1.25). Medial area of tegmen with longitudinal dark patterns. Posterior femora shorter and not as deep.

- brevicollis brevicollis (Eversmann)

(USSR, Iran, Turkey, Greece, Yugoslavia, Austria, Czechoslovakia, Somali Republic.)

7a. Dociostaurus brevicollis brevicollis (Eversmann, 1848)

Type - for details see under species.

SYNONYMY.

Stauronotus annulipes Turk, 1862, Ent. Mon. VI: 81. Type ? probably in Wien. Nat. Hist. Museum. Synonymy by Kirby, W.F., 1910. A synonymic catalogue of Orthoptera, Vol. 3, Part 2: 153.

DIAGNOSIS. See key, p. 126.

MEASUREMENTS.

	Male	Female
Length of tegmina (mm)	8.8-14	12.3-16.5
Length of hind femur (mm)	8.0-10.7	10.8-14.7
Length of body (mm)	12.7-19.0	16.5-23.5

MATERIAL EXAMINED.

USSR: 1♂, 1♀ Kurgan distr., Ural reg., 10.VIII.29 (Eversmann) syntypes of O. brevicollis Eversmann; 7♂, 4♀ Omsk prov., Siberia, _____ (_____).

Iran: 3♂, 5♀ Moghan, 15.VII.57 (A. Soltani); 2♂, 2♀ Khalkhal, 27.VII.49 (Makuii); 3♀ Ariz, Sanandaj, 2200 m, 4.VII.71 (Terme).

Turkey: 5♂, 8♀ Ala Dagi, 2000 m, 15.VII.62 (Guichard & Harvey); 4♂, 5♀ Angora, ____30 (Sureya Bey); 4♂, 6♀ Uludag, 1500 m, 7.VIII.62 (Guichard & Harvey); 3♂, 4♀ Acem Dag, 1300 m, 28.VII.62 (Guichard & Harvey); 5♂, 6♀ Elma Dagi, 1800 m, (7-12).IX.59 (Guichard); 3♂, 3♀ Mt. Kai Dagh, N. of Ankara, 1300 m, (10-13).VIII.31 (Uvarov); Antitaurus, Maras, Goksun, Binboza dag, 27.VII.52 (_____); 7♂, 8♀ Koyna area, 1000 m, 23.VI.60 (Guichard & Harvey); 3♂, 4♀ Antitaurus,

Adana, Saim beyii, Bojoglan dag, 1700 m, 12.VII.52 (_____); 6♂, 8♀ Konya, 17.VII.72 (Popov).

Greece: 15♂, 10♀ Mt. Chelmos, nr. Kalavryta, 1500-2000 m, VII.38 (O. Grebenchikoff); 7♂, 6♀ Mt. Hortiat, nr. Salonika, 600 m, 8.VIII.38 (O. Grebenchikoff).

Yugoslavia: 2♂, 3♀ Macedonia, Lembet, VI.16 (M. Burr); 6♂, 5♀ Banat, Velik-Kikinda, 29.VI.47 (M. Gradjevic); 1♂ Macedoin, Florina, ____17 (H. Marcelet); 1♀ Brod and Bach, Cerna R., S.E. of Monastir, ____17 (Martinez & Lanoue); 1♀ Macedoine, Excissu, ____18 (Marthey); 1♂, 5♀ N. Serbia, nr. Kikinda, 60 m, (7-8).VIII.54 (N. Waloff); 3♂, 4♀ S. Serbia, Kozub Mts., Dvonsije Mt., nr. Gevegli, 1500-1900 m, (13-17).VII. 37 (_____); 3♂, 5♀ Porech-Istra, 20.VI.47 (V. Zhivanovich); 10♂, 7♀ Serbia, Tazova, Kikinda, Banat, 28.VII.71 (all subsequent specimens Z. Adamovic); 5♂, 8♀ Macedonia, Kumanova, 12.VII.71; 4♂, 5♀ Macedonia, Stobi, 14.VII.71; 2♂, 5♀ Serbia, Kosovo, Pristina, 9.VI.71.

Austria: 4♂, 3♀ Burgenland nr. Neusiedler, 20.VIII.60 (D. & R. Ragge) semi saltmarsh.

Czechoslovakia: 3♂, 5♀ Slov. mer., 20.VII.60 (Cejchan).

Somali Rep.: 20♂, 10♀ Tajobo, 2.VII.49 (E. Burtt).

7b. Dociostaurus brevicollis hispanicus (I. Bolivar, 1898)

Type: ? Stauronotus brevicollis var. hispanicus Bolivar, 1898. Ann. Sci. Nat. Porto. 5: 67. Spain, near Madrid, depository probably Madrid.

DIAGNOSIS. See key, p. 126.

MEASUREMENTS.

	Male	Female
Length of tegmina (mm)	9-11.3	13.0-14.6
Length of hind femur (mm)	9.5-11.4	13.3-15.2
Length of body (mm)	13-17	20.0-22.6

MATERIAL EXAMINED.

Spain: 5♂, 5♀ El Pardo, N. Madrid, _____21 (Bolivar); 1♂, 1♀ N.W. of Madrid, Salamanco, Negrilla, _____ (C. Escribano); 1♂ Jaen, Bailen, nr. Zocueca, 200-300 m, 11.V.67 (R. Rumhlar).

D. brevicollis (Eversmann)

FIG. 61 Epiphallus from dorsal view

FIG. 62 Phallic complex, lateral aspect

FIG. 63 Valves of penis, from side view

FIG. 64 Head and pronotum from above

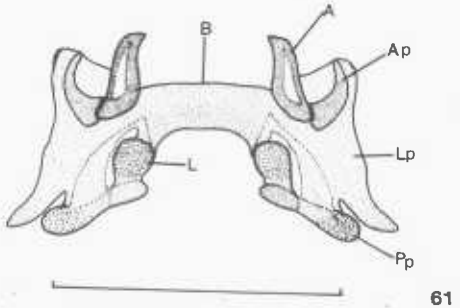
FIG. 65 ♂ Meso- and metasternum of D. brevicollis brevicollis

FIG. 66 ♂ Meso- and metasternum of D. brevicollis hispanicus

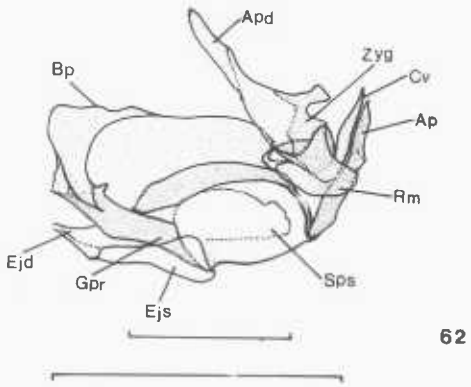
FIG. 67 Supra-anal plate, subgenital plate and cerci (from above) of D. brevicollis

FIG. 68 Epiphallus of D. brevicollis hispanicus (dorsal view)

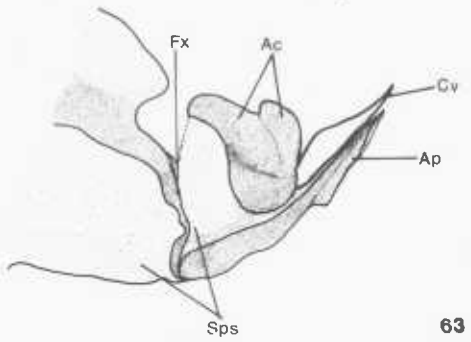
FIG. 69 Phallic complex of D. brevicollis hispanicus (lateral view)



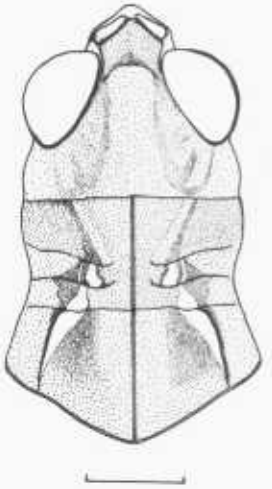
61



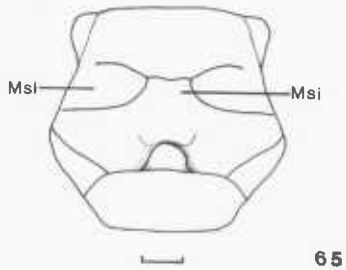
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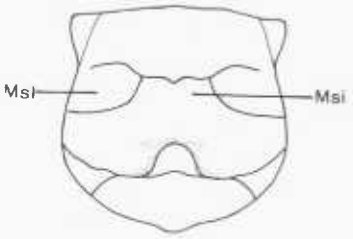
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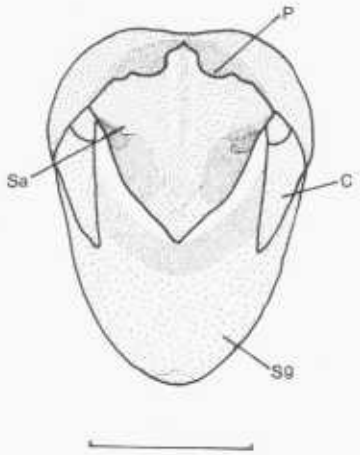
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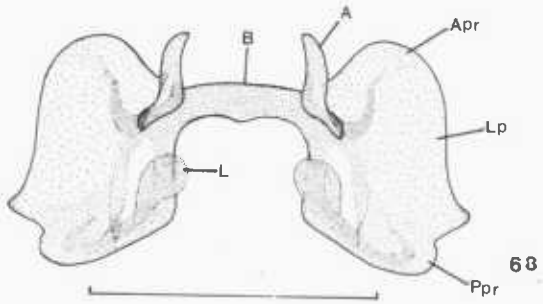
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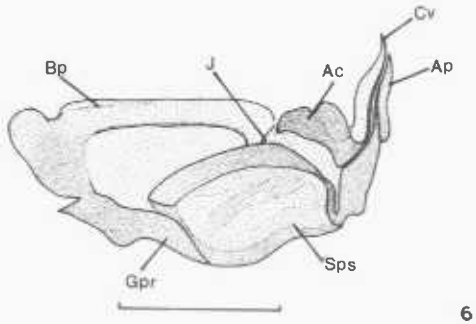
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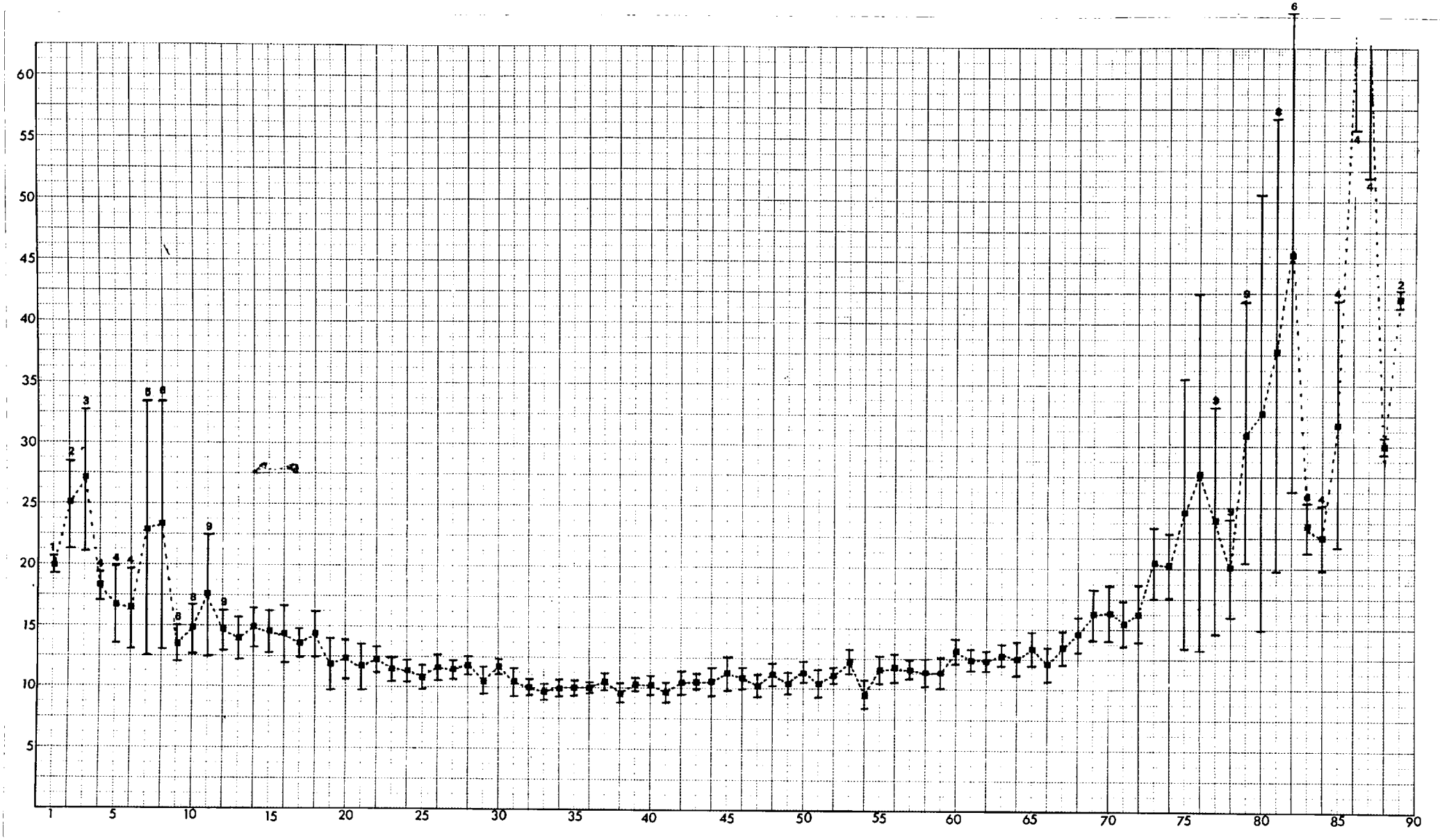


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FIG. 70 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. brevicollis (Eversmann)


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15
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75
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8. Dociostaurus tarbinskyi (Bei-Bienko, 1933) comb.n.

Type:♂ Kazakia tarbinskyi Bei-Bienko, 1933b. Bol. Soc. Esp. Hist. nat., 33: 332-335, figs. 12, 13. USSR, S. Kazakstan, Syr-Darja, ar. 60 km S.E. of Kzyl-Orda, Solo Tiube (26.VI)-(1.VIII).28 (Mistshenko & Obufjev). Acad. Sci. USSR, Leningrad.

DIAGNOSIS. Male:

1. Phallic complex in side view (Fig. 75) resembles that in D. brevicollis. Apical penis valves (Ap) similar to those in D. brevicollis hispanicus but smaller and more strongly sclerotised posteriorly. Cingular valves (Cv) thinner, longer and less sclerotised than apical valves of penis, being curved upwards apically. Arch of cingulum (Ac) strongly sclerotised, projecting upwards antero-dorsally to form an irregular wedge shape in profile. Flexure (Fx) relatively thick; smoothly sinuous. Basal valves of penis (Bp) slender anteriorly and excurved as seen from above. Profile of posterior part of basal valves, just anterior to flexure, very similar to that in D. brevicollis (Fig. 67). Spermatophore sac (Sps) large with a thick margin. Gonopore process (Gpr) thick, strongly sclerotised and smoothly attenuated downwards: only slightly expanded on its ventro-anterior margin. Zygoma (Zyg) (Fig. 74) with large lateral plates; concave on its posterior margin. Apodemes (Aps) long and well sclerotised.

Epiphallus typical for genus Dociostaurus. Lateral plates (Lp) slender, its posterior projections (Ppr) thick and concave posteriorly. Lophi (L) relatively large with granular surfaces. Bridge (B) slender, sclerotised. Ancorae (A) thick, short and obliquely incurved being similar to those of D. tartarus (compare Figs. 73 and 52).

2. General colouration light brownish grey with dark brown patterns.

3. Fastigium verticis elongate, 1.8 to 2.1 times longer than wide, strongly concave and sloping downwards anteriorly. Sharp distinct margins to fastigium are roughly parallel posteriorly but slightly incurved at level of front edge of compound eyes. Front end narrowed and rounded close to frontal ridge. Temporal foveolae long, narrowed towards frontal ridge, with dorsal and posterior margins sharply defined. Length of each foveolus (measured along its dorsal margin) twice its depth (as measured along its posterior margin). Vertex and occiput usually marked with black spots.

4. Frontal ridge narrow, flat, with punctate surface and sharply defined margins above median ocellus. Slightly impressed below median ocellus.

5. Head small, frons sloping backwards quite steeply. Fronto-genal ridges prominent. Top of head elevated above level of pronotal median carina.

6. Compound eyes large, prominent. Long axis of eye about 2.4 times longer than length of subocular groove.

7. Antennae filiform, about 1.5 times longer than length of head and pronotum together as seen from above. Colour dark brown ventrally, light brown dorsally, usually with a black spot on base of scape on its ventro-anterior side close to frontal ridge.

8. Pronotum slightly longer than head as seen from above. Lengths of prozona and metazona subequal (Fig. 71). Median carina distinctly elevated in metazona, almost obliterate in prozona. Lateral carinae of prozona very weak, feebly divergent forwards with darker pigment along

their inner margins. Lateral carinae of metazona weakly divergent posteriorly but elevated. Prozonal disc with small dark spots. Posterior margin of pronotum rounded obtusangular.

9. Folded tegmina with apices reaching or slightly surpassing knees of folded posterior femora. Tegmina with faded brown spots.

10. Posterior femora with 3 black dorsal spots, anterior one being faint, middle one continued onto inner area of femur. Lower outer carina with 4-5 small black spots. Hind knees black.

11. Posterior tibiae greyish blue with lighter band near base and black at extreme proximal tip. Third segment of hind tarsus long and narrow.

12. Supra-anal plate wider than long with a distinct separate median apical point (Fig. 72, Sa). Interspace between paired projections (P) of last abdominal tergite very wide. Cerci (C) very slightly incurved with apical half tapered. Subgenital plate conical, rounded apically as seen from above.

13. Number of stridulatory pegs 90-95.

Female:

1. General habitus slender.

2. Temporal foveolae with distinct margins and narrowing anteriorly. Fastigium verticis wide, parallel side, 1.3 times longer than wide. Not as elongate as that in male.

3. Frontal ridge wide with punctate surface. Not strongly oblique. Slightly convex above median ocellus, but indented at level of median

ocellus. Margins of frontal ridge rounded.

4. Compound eyes not as prominent as those of male. Longest axis of eye about 1.8 times longer than length of subocular groove.

5. Antennae brownish (darker ventrally) and slightly longer than head and pronotum together. Scape and pedicel relatively large with a black spot on base of scape facing frontal ridge.

6. Disc of pronotum large, median carina and lateral carina (between sulci 3 and 4) visible on prozona.

7. Posterior femora with 3 dark dorsal spots, anterior one being abbreviated, upper marginal area (external side) dotted, lower carinula (outer aspect) with a series of black dots. Genicular lobes dark internally but lower external lobe light. Upper surface of hind knees dotted.

8. Posterior tibiae dirty grey and light near the base with blackish proximal end.

9. Ovipositor valves (Fig. 76) much more slender than in D. brevicollis, distinctly sharper and more curved. Upper valve with small tooth-like projection about $\frac{1}{3}$ from its distal tip. Lower valve with deeply emarginate profile along its ventral edge, its ventro-lateral border expanded into a tooth (compare Fig. 77).

MEASUREMENTS.

	Male	Female
Length of pronotum (mm)	2.25-2.5	3.5-3.9
Length of tegmina (mm)	9.3-11.4	15.0-17.0
Length of posterior femora (mm)	7.5-8.3	11.0-12.0
Length of body (mm)	11.9-14	14.8-15.0

DISTRIBUTION. USSR (southern and south eastern Kazakhstan).

MATERIAL EXAMINED.

USSR: 1♂, 1♀ (paratypes), Kara-Ketken, Kzyl-Orda, 17.VII.28 (N. Olsufjev).

DISCUSSION. This species was first described by Bei-Bienko, 1933 in the genus Kazakia. It is interesting to note that the male specimen bears a label "D. tarbinskyi Bei-Bienko" indicating perhaps that the author had some doubts about its generic distinctiveness.

According to Bei-Bienko there is a strong resemblance between Dociostaurus tarbinskyi and the genera Eremippus and Bodenheimerella. The genitalia of representatives of these two genera have been examined (Figs. 78-81) (Eremippus valtistshevi Miram and Bodenheimerella hemiptera (Uv.)). There are resemblances between Eremippus and Bodenheimerella, but the genitalia of Kazakia tarbinskyi are typically those of a member of the genus Dociostaurus.

(i) In both Bodenheimerella and Eremippus the posterior projections of the lateral plates on the epiphallus are situated much nearer the mid-line than is usual in most Dociostaurus (i.e. more like those seen in ochrilidia where the posterior projections (Ppr) are well sclerotised and posteriorly rather than laterally directed) and are strongly sclerotised

(Figs. 80, 81 and 73).

(ii) Penis valves of Bodenheimerella and Eremippus are ensheathed by lateral appendages (Pa) (Figs. 78 and 79) which extend ventro-anteriorly to cover more than half of apical penis valves between their tips and the flexure. In Dociostaurus this hatchet-shaped profile is never developed and the appendages of the penis valves, if present, extend ventro-anteriorly to cover less than half length of penis valves.

Note that the external characters used to describe and differentiate Kazakia by Bei-Bienko are in fact common to D. brevicollis, D. tartarus and D. larensis. The phallic complex of D. tarbinskyi is very close morphologically to that of D. brevicollis and its epiphallus and zygoma similar to those of D. tartarus. I, therefore, take the view that this species cannot usefully be separated off in a unique monotypic genus and is best placed within the genus Dociostaurus.

FIG. 71 D. tarbinskyi (Bei-Bienko) head and pronotum from above

FIG. 72 Supra-anal plate and cerci (from above)

FIG. 73 Epiphallus (dorsal view)

FIG. 74 Zygoma and apodemes (from above)

FIG. 75 Phallic complex (side view)

FIG. 76 Ovipositor (lateral aspect)

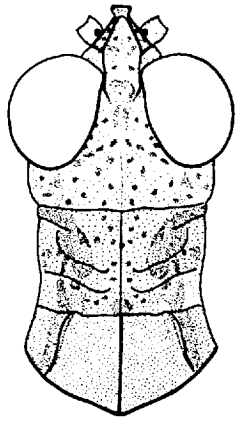
FIG. 77 Ovipositor of D. brevicollis (lateral view)

FIG. 78 Phallic complex of Bodenheimerella hemiptera Uvarov (lateral aspect)

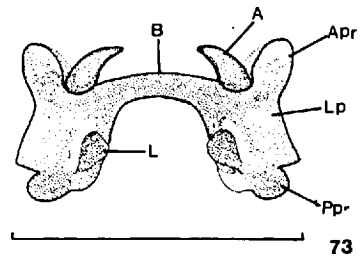
FIG. 79 Phallic complex of Eremippus veltistshevi Miram (lateral aspect)

FIG. 80 Epiphallus of Eremippus veltistshevi Miram (dorsal view)

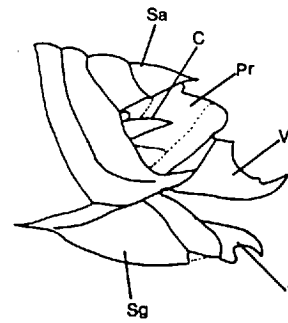
FIG. 81 Epiphallus of Bodenheimerella hemiptera Uvarov (dorsal view)



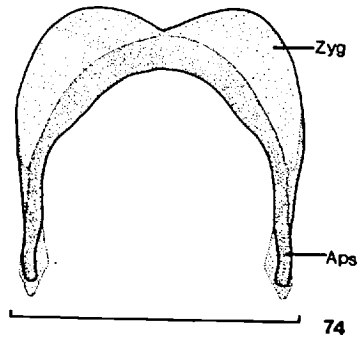
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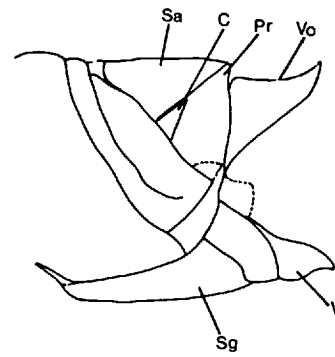
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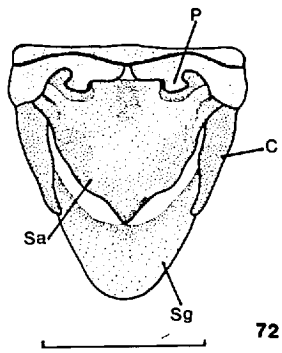
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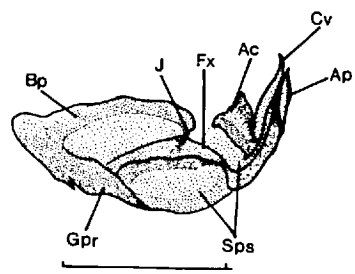
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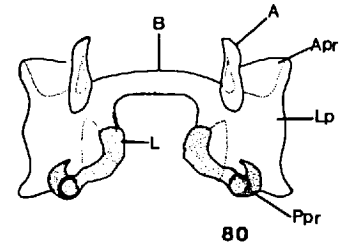
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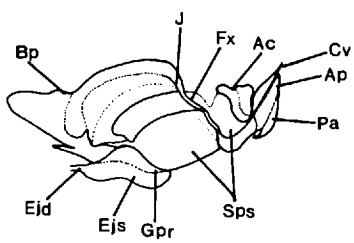
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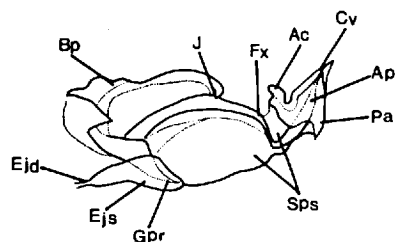
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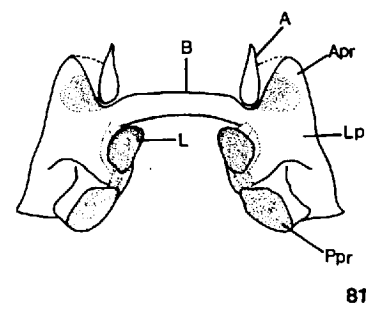
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9. Dociostaurus dantini I. Bolivar, 1914

Type: ♂ Dociostaurus dantini I. Bolivar, 1914. Mem. R. Soc. Esp. Hist. nat., 8(5a): 186. Morocco, Atlas Mts., _____, (_____). Madrid Mus.

DIAGNOSIS. Male:

1. Male genitalia (Fig. 89) large. Apical valves posteriorly rather than vertically directed (Ap) with projecting ventro-posterior margins (P). Proximal end of apical valves lightly emarginate below just distal to flexure. Cingular valves (Cv) slightly longer and less sclerotised than apical valves with a thin projecting process on dorso-anterior edge. Cingular valves closely applied to apical valves distally and proximally but curving away from them at their middle. Arch of cingulum (Ac) sclerotised with anterior pointed angle directed towards median flange of basal valves (Bp). Flexure very acute at junction of apical valves. Median dorsal flange of basal penis valves forming an elevated crest whose posterior end meets upper end of flexure at a right angle. Basal valves large, strongly excurved on antero-ventral edges. Spermatophore sac (Sps) large with thickened margins. Gonopore process (Gpr) sclerotised with a narrow ventral apex towards the spermatophore sac (Sps) and with an angular projection on ventro-anterior margin. Zygoma relatively small with rounded posterior margin (Fig. 88). Epiphallus with large lateral plates (Lp) (Fig. 87). Lophi (L) large and sclerotised. Bridge (B) thick. Ancorae widely spaced (A) and weakly inturned, apically blunt and thicker than in D. avicennai sp.n.

2. General colouration pale browmish stramineus with dark brown pattern.

3. Fastigium verticis (Fig. 91) pentagonal, deeply concave, parallel at sides, about 1.5 times longer than wide and sloping downwards gently.

toward frontal ridge. Temporal foveolae subrectangular with thick margins, very slightly narrowed anteriorly.

4. Frontal ridge flat with distinct margins, hardly narrowed at upper end.

5. Head thick and bulky. Head not markedly elevated above level of pronotum dorsally. Median dorsal carina weakly visible on vertex and occiput.

6. Compound eyes relatively large, longest axis of eye being about 1.9 times longer than length of subocular groove.

7. Antennae slightly clavate, rather short, 1.2 times length of head and pronotum together as seen from above. Colour dark brown.

8. Pronotum feebly constricted as seen from above (Fig. 91), anterior part of median carina being slightly elevated. Surface rugose. Prozona longer than metazona (ratio 1.2). Lateral carinae present in prozona and metazona, being strong just anterior to transverse sulcus 2. Lateral carinae of prozona weakly divergent forwards to parallel. Lateral carinae of metazona and their accompanying light markings weakly divergent backwards. Light markings of metazona rather narrow. Lateral carinae of prozona and metazona not aligned.

Two dark brown bands, starting at dorso-posterior margins of compound eyes pass along outer side of prozonal lateral carinae and both sides of metazonal lateral carinae. Median carina of pronotum well developed. Transverse sulci 2-4 well developed, but sulcus 1 entirely absent above and only weakly visible in side view. Hind margin of pronotum rounded.

9. Brachypterous. Apices of folded tegmina level with or just surpassing second dark spot on upper side of folded posterior femora. E/F ratio 0.66-0.70. Length of hind wing shorter than that of tegmen. Ratio of length of hind wing to length of tegmen 0.6.

10. Posterior femora bright yellow stramineus with three dark brown spots on upper carina. Posterior spot extends onto inner area and sometimes for a short distance onto outer area. Middle spot usually continued onto outer area. Series of black spots usually present on lower outer carina. Hind knee entirely black.

11. Hind tibiae light red (or yellowish) with light yellow band above most proximal spine and with a black ring adjacent to knee. Third segment of posterior tarsi long and slender (about 2.3 times as long as the median segment).

12. Supra-anal plate (Fig. 93) ovoid with rotund triangular apex set apart from rest of plate. Last abdominal tergite divided but without projections. Cerci pointed, short and very thick.

13. Number of stridulatory pegs reaches a maximum of 61. Peg spacing high with little variation in peg intervals 14-48 (Fig. 90).

Female:

1. General habitus robust.

2. Temporal foveolae concave, longer than deep, ratio of length to depth about 2. Fastigium verticis as wide as long, its maximum width equal to that of frontal ridge between antennal bases. Occiput and

vertex short, length of head from above being about 0.6 times length of pronotum.

3. Frontal ridge wide, slightly convex above median ocellus and punctate. Widened between antennal bases and strongly constricted near temporal foreolae.

4. Compound eyes rather small in proportion, long axis being 1.2 times length of subocular groove.

5. Antennae brownish with light longitudinal edges, almost as long as head and pronotum together, with somewhat flattened apicis.

6. Pronotum broad, elevated along median carina. Lateral carinae distinct in prozona anterior to transverse sulcus 2. Dark brown stripes sometimes covering space between transverse sulci on lateral lobes of pronotum. Prozona slightly longer than metazona.

7. Mesosternal furcal suture (Msf) straight. Interspace comparatively broad, as is metasternal interspace (Mti). Latter square (Fig. 85).

8. Apices of folded tegmina reaching to level of second dark spot on folded posterior femora. E/F ratio 0.5.

9. Posterior femora with three distinct dorsal dark brown spots, median one extending halfway down outer area; third spot extending down both sides of femur. Posterior genicular lobes on inner side black; external upper lobe black but lower lobe light with black spots.

10. Posterior tibiae red with black ring at its proximal tip.

MEASUREMENTS.

	Male	Female
Pronotal length (mm)	2.77-4.23	4-5.6
Tegminal length (mm)	5.3-8.00	6.5-8.0
Length of posterior femur (mm)	8.9-10.00	12.3-14.5
Length of body (mm)	15.4-18.0	21.0-25.7

DISTRIBUTION. Northwest of Morocco (Great Atlas Mts. up to 2500 m).

MATERIAL EXAMINED.

Morocco: 1♂ Atlas Mts., _____12 (H. Vaucher) (paratype); 1♂, 1♀ Atlas, Tizi, Tichka, 2800 m, 22.VI.20 (Ebner); 2♀ Tadjit, 2250 m, 20.VI.30 (Werner); 5♂, 8♀ Gt. Atlas Mts., Tizi N'Test, 7150 ft, __VI.36 (K.H. Chapman & G.A. Bisset); 4♂, 6♀ Gt. Atlas Mts., Ijoukak, 3900 ft, __VI.36 (K.H. Chapman & G.A. Bisset); 1♂, 1♀ Haut Atlas, Tizi N'Test, __VII.49 (_____); 4♂, 4♀ Rhirhaia-Oukaimeden Sud, Marrakech, Ait Ourir, 25.VII.54 (_____).

DISCUSSION. Only the males have been fully described in the past by I. Bolivar, 1914, Uvarov, 1927 and K.H. Chapman, 1938. This paper to some extent corrects this bias.

Number of stridulatory pegs (Fig. 90) reaches 61 as a maximum, being 45-50 with more irregular intervals in the related new species D. avicennai. Both these species are montane isolated species. The irregularity of the files may reflect the reduced evolutionary pressure on this anatomical feature as an isolatory mechanism. There seems to be greater selection for regularity of peg spacing pattern in more widespread species which overlap with each other and consequently have to differentiate more precisely between their own and other species in

the same genus.

The characters of the pronotum in this species, i.e. less constriction as seen from above; shorter pronotal length relative to head and rest of body; shorter metazone than prozone of pronotal disc, are all reflections of the brachypterous state in this species and are traits common, not only to other brachypterous members of the genus Dociostaurus, but to other Gomphoeerinae as well. The shorter more powerful build of these insects also seems to lead to larger more powerful male genitalia, possibly as a result of the need to be more firmly linked to the female while copulating. Unfortunately little is known of the mating behaviour and ecological restraints put upon this species. Note that similar levels of brachypterousness can lead to convergent evolution, e.g. D. minutus, D. dantini and D. plotnikovi all share external facies which may not represent phyrogenetically close relationships. Thus D. minutus is clearly closely related to the D. genei-D. jagoi-D. curvicercus complex in its male genitalic characters, not to D. dantini as has been suggested by La Greca, 1962.

FIG. 82 Epiphallus of D. avicennai sp.n. from dorsal view

FIG. 83 Zygoma and apodemes of D. avicennai sp.n. from above

FIG. 84 Phallic complex of D. avicennai sp.n. from side view

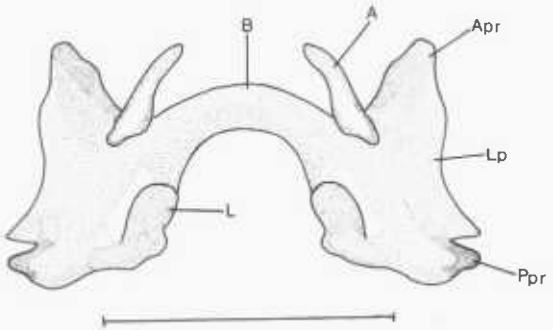
FIG. 85 ♀ meso- and metasternum of D. dantini Bolivar

FIG. 86 ♀ meso- and metasternum of D. avicennai sp.n.

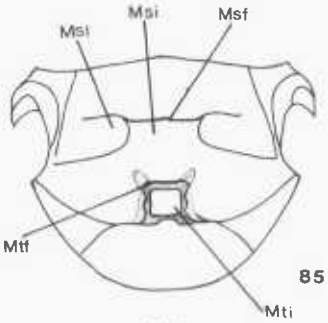
FIG. 87 Epiphallus of D. dantini (dorsal view)

FIG. 88 Zygoma and apodemes of D. dantini (from above)

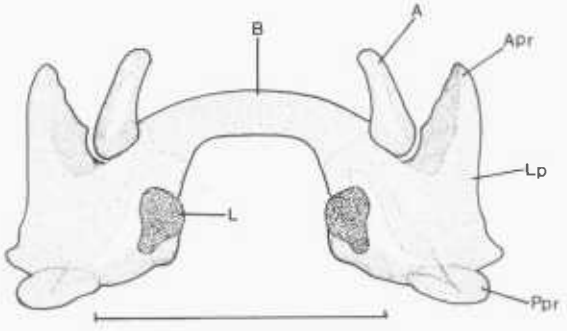
FIG. 89 Phallic complex of D. dantini (side view)



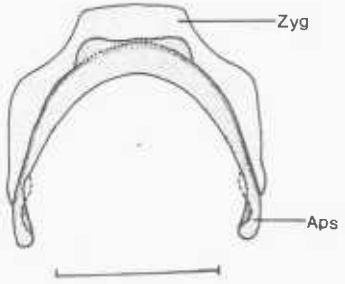
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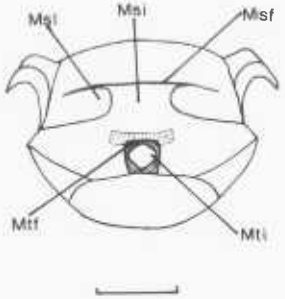
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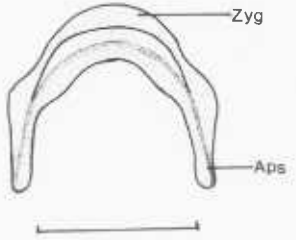
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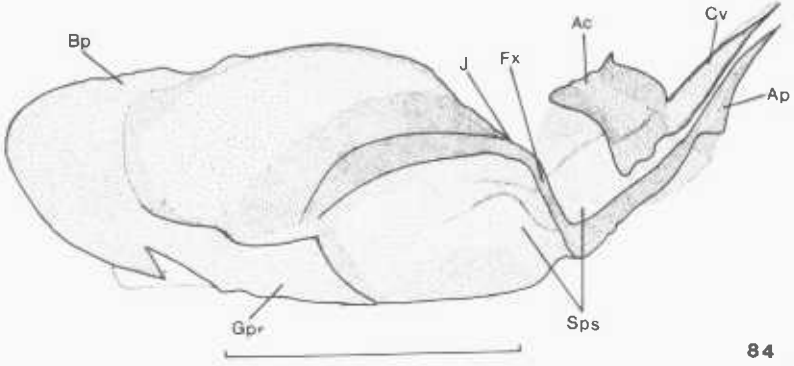
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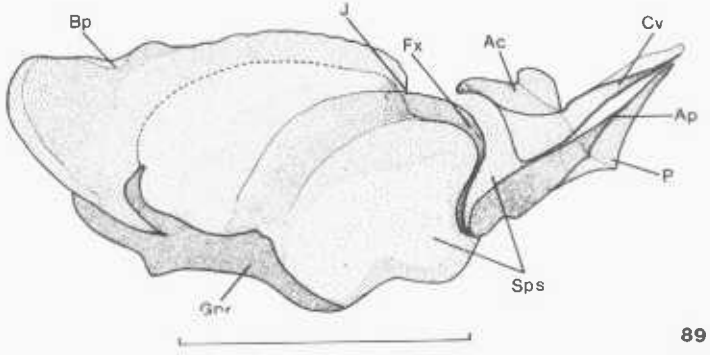
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10. Dociostaurus avicennai sp.n.

Type: ♂ Morocco, Middle Atlas Mts., Agaelman, Sidi Ali ou Mohammed, 6500 ft., —IX.35 (K.H. Chapman). Brit. Mus. (Nat. Hist.) London.

DIAGNOSIS. Male:

1. Phallic complex (Fig. 84) with apical penis valves (Ap) longer than those of D. dantini (Fig. 89), relatively narrow. Cingular valves (Cv) appressed to apical valves except at tip. Angle between apical valves and flexure approximately 90°. Apical penis valves with a ventro-posterior flange but this smaller than in D. dantini. Arch of cingulum (Ac) more massive, strongly sclerotised with dorso-anterior surface less emarginate in profile. Flexure robust but not sharply curved (Fx). Median posterior dorsal flange of basal penis valves sloping down smoothly into anterior part of flexure. Basal penis valves (Bp), long, weakly sclerotised and excurved as seen from above. Spermatophore sac (Sps) with a strongly sclerotised ventral margin. Gonopore process (Gpr) long sclerotised and very broad at attachment to spermatophore sac. Zygoma (Fig. 83) large with wide angular posterior part. Apodemes longer than in D. dantini (Aps) (compare Fig. 88).

Epiphallus (Fig. 82) with lateral plates (Lp) narrower than in D. dantini. Lophi (L) sclerotised with rounded smoother surfaces. Posterior projection (Ppr) thick and sclerotised. Bridge (B) curved anteriorly. Ancorae more closely set, slender and directed inwards.

2. General colouration dull brown with darker pattern.

3. Fastigium verticis broad (Fig. 92) with rounded angles at sides, slightly wider than long. Strongly excavate. Vertex as a whole convex, vertex and occiput being rugose. Temporal foveolae broad, concave, slightly longer than deep, ovoid.

4. Frontal ridge longitudinally concave, especially above median ocellus, with thick rounded margins. Ridge widened between antennal bases, gradually narrowing upwards above this level to a conical apex. Surface above median ocellus with scattered black spots.

5. Head large. Faint median carinula visible on rugose occiput in some specimens.

6. Compound eyes relatively broad as seen from side view. Longest axis of eye about 1.65 times length of subocular groove and almost 1.37 times as long as its greatest horizontal axis.

7. Antennae slightly clavate, dark brown. Scape short, thick and light coloured. Antennae slightly longer than head and pronotum together as seen from above.

Two parallel black bands between anterior margin of eye and frontal ridge, above base of antennae and below ventral margin of temporal foreolae.

8. Pronotum broad, rugose. Sides hardly constricted as seen from above but pronotal disc strongly constricted (Fig. 92). Lateral carinae strong, diverging sharply forwards in prozona and sharply backwards in metazona. Light colour bands of metazona wide and extending onto zone between transverse sulci 3 and 4. Broad dark bands of colour originate at ventro-lateral side of each prozonal lateral carina and envelop light markings of metazona. Length of prozona equal to or slightly shorter than that of metazona. Three posterior transverse sulci well developed. Posterior margin of pronotum obtusangular with a marginal series of black dots.

9. Folded tegmina short, more slender than in D. dantini. Tips of

tegmina short, more slender than in D. dantini. Tips of tegmina surpassing median dorsal dark spot on folded posterior femora (E/F ratio 0.7).

10. Posterior femora light dull brown with 3 dark brown spots of which most distal one extends over inner surface. Lower outer carina with series of black dots. Hind knee black.

11. Posterior tibiae pinkish with lighter band proximal to spine nearest knee. Proximal tip black. Third segment of hind tarsus shorter than that of D. dantini (about twice as long as the median segment).

12. Supra-anal plate wide triangular; ratio length to width about 1. Projections on posterior dorsal edge of last abdominal tergite absent. Tips of cerci (C) projecting well beyond apex of supra-anal plate (Sa), more slender than in D. dantini and slightly outcurved.

13. Number of stridulatory pegs 45-50, fewer than in D. dantini with more irregular peg intervals.

Female:

1. General habitus more slender than in D. dantini.

2. Temporal foveolae almost flat, shallow. Length to depth ratio 1.3. Fastigium verticis 1.26 times wider than long, its maximum width 1.75-2 times width of frontal ridge at level of antennal bases.

3. Frontal ridge narrower than in D. dantini with distinct rounded margins and rugose surface. Widened between antennal bases.

4. Compound eyes small, longest axis of eye nearly equal to or slightly longer than subocular groove and about 1.27 times more than its smaller axis.

5. Antennae shorter than length of head and pronotum as seen from above.

6. Pronotum with constricted disc. Prozona rugose. Lateral carinae elevated throughout; strongly divergent forwards in prozona and backwards in metazona. Light bands on metazona broad extending onto zone between transverse sulci 3 and 4.

7. Mesosternal interspace narrower than that in D. dantini with somewhat curved furcal suture. Metasternal interspace smaller (Fig. 86).

8. Tegmina narrower and slightly longer than those in D. dantini. Folded tegmina with apices hardly surpassing median dark spot on upper carinae of hind femora. E/F ratio 0.68.

9. Posterior femora with 3 dark brown spots on its upper carinae, median and third spot extending onto inner and outer areas as well. Knee black, its lower lobe on outer side light with dark patterns.

10. Hind tibiae pinkish with a light band proximal to proximal spine, black at its proximal tip close to knee.

MEASUREMENTS

	Male	Female
Pronotal length (mm)	4.15	4.8
Tegminal length (mm)	7.5	8.5
Length of posterior femur (mm)	10.2	12.2
Length of body (mm)	18.0	23.4

DISTRIBUTION. Morocco, Middle Atlas Mts., up to 2200 m.

MATERIAL EXAMINED. Morocco: 1♂, 1♀ Boulemanc rd., 15 km to Ifrane, 1800 m, 11.VII.65 (————————); 2♂, 1♀ Middle Atlas Mts., Aguelman, Sidi Ali ou Mohammed, 6500 ft, —IX.35 (K.H. Chapman).

DISCUSSION. Clearly these insects were misidentified as D. dantini both by Chopard, 1943 and K.H. Chapman, 1938. The material from the Boulemanc road locality was lent by Monsieur M. Donskoff from Paris. Attention was drawn to the difference between this new species and D. dantini initially because the peg number in the stridulatory files was different. The differences between the other characters were noted subsequently.

Derivation of the name (avicennai) is from Avicenna (980-1037 AD), Iranian philosopher and physician whose canon of medicine had an enormous influence on mediaeval Europe.

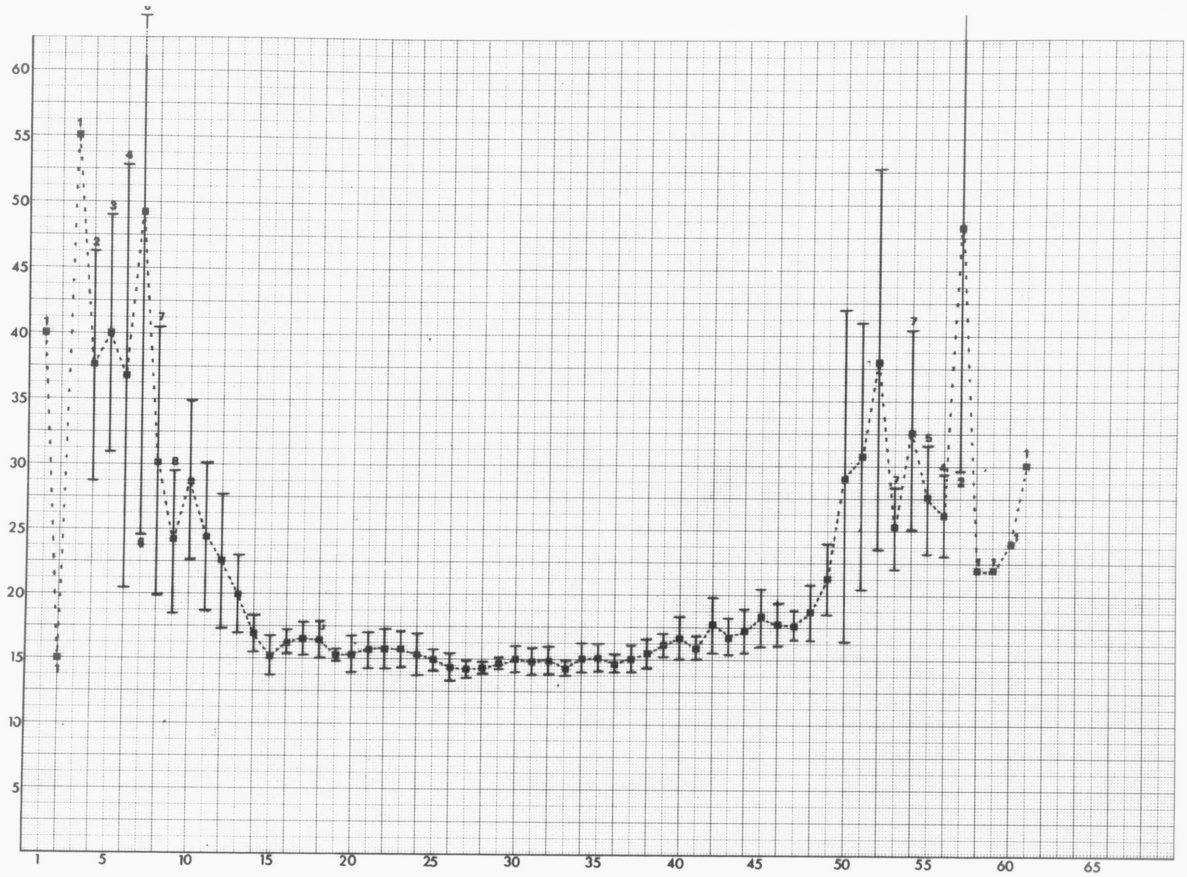
FIG. 90 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. dantini

FIG. 91 D. dantini Bolivar (paratype), head and pronotum from above

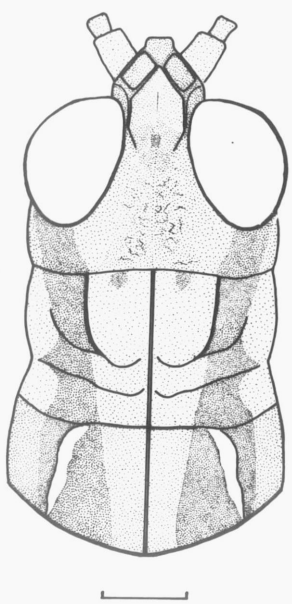
FIG. 92 D. avicennai sp.n. head and pronotum from above

FIG. 93 Supra-anal plate and cerci of D. dantini from above

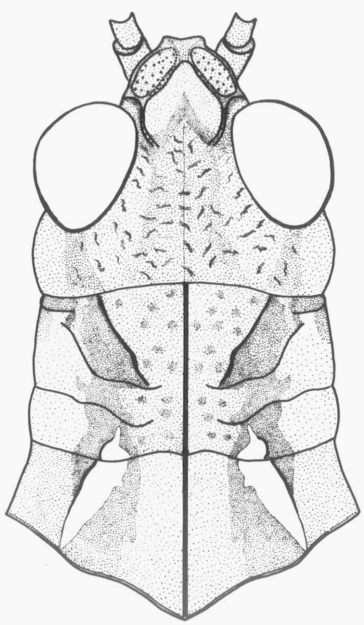
FIG. 94 Supra-anal plate and cerci of D. avicennai from above


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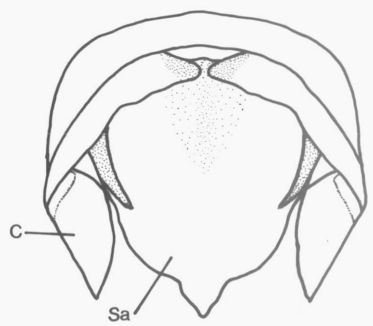
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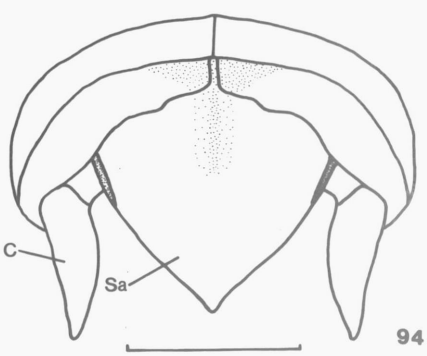
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11. Dociostaurus plotnikovi Uvarov, 1921

Type: ♂ Dociostaurus plotnikovi Uvarov, 1921c. Bull. ent. Res., 11(4): 400, 405. USSR, Turkestan, Golodnaya steppe and Bokhara, Mirshade, Karatag (coll. of V. Plotnikov). USSR Acad. Sci. (Leningrad).

DIAGNOSIS. Male:

Genitalia in side view (Fig. 95) large in proportion to body. Apical penis valves (Ap) oblique, strongly sclerotised, slightly expanded on its ventro-posterior margin, concave at distal posterior edge, emarginate just distal to flexure (Fx). Cingular valves (Cv) nearly as long as apical valves of penis (Ap), slightly thicker and less sclerotised. Arch of cingulum (Ac) large, strongly sclerotised with a conical anterior apex directed anteriorly towards junction of basal valves with upper end of flexure (Fx). Arch of cingulum bilobed above. Flexure slender (Fx), narrow, strongly sclerotised and joined at a sharp angle to base of apical penis valves. Basal valves of penis (Bp) elongate, and excurved anteriorly. Spermatophore sac (Sps) large, strongly convex dorsally with a very thick margin. Gonopore process (Gpr) elongate and markedly attenuated toward base of spermatophore sac (Sps).

Epiphallus with large sclerotised lophi (L), bridge (B) thick and straight. Ancorae (A) relatively thin with blunt apices inclined towards each other.

2. General colouration greyish to pale brown, with dark brown patterns on head.

3. Fastigium verticis regular pentagonal (Fig. 97) as wide as long, impressed, with distinct and elevated margins. Temporal foveolae impressed, slightly longer than deep and markedly narrowed forward

(upper margin of foveolus curved downward and forward).

4. Frontal ridge narrow, usually pitted on mid-line. Margins rounded, not fading below level of median ocellus.

5. Head fairly elongate, moderately elevated above, its upper margin higher than level of median pronotal carina when viewed in profile. Vertex rugose, lacking a median carinula. Occiput with two brownish linear patterns extending from dorsal edge of compound eye to front of pronotum.

6. Compound eyes large, inflated, longest axis 2.2 times length of subocular groove.

7. Antennae slender, 1.3-1.5 times as long as head and pronotum together as seen from above.

8. Pronotum weakly constricted as seen from above (Fig. 97). Prozona 1.25 times longer than metazona. Median carina distinct, strongly elevated on metazona. Prozona straw-colour with two faint light bands between transverse sulcus 2 and front of pronotum. Darker markings usually visible on anterior inner margins of these light lines. Metazonal disc brown. Lateral carinae of metazona clear, weakly divergent backwards; inner margins lined by light line of pigment triangular in shape. Light lines marking obsolete lateral carinae anteriorly only weakly divergent forward. Hind margin of pronotal disc rounded. Lateral lobes with shiny black spot covering area between, and overlapping, sulci 2 and 3.

9. Apices of folded tegmina falling short of tip of abdomen and just surpassing second dark spot on dorsal side of folded posterior femora. Length 0.66-0.86 times length of hind femora. Tegmina rather transparent. Hind wings very short, only half length of tegmina.

10. Posterior femora slender with 3 dark brown spots on their upper carina. These extend obliquely on both inner and outer sides of femur, but reaching lower edge of outer area and only half way down inner side. Knee dark brown or black.

11. Hind tibiae dull grey or creamy colour.

12. Supra-anal plate (Fig. 98) triangular with bluntly triangular apical point. Processes on posterior edge of last abdominal tergite well developed and widely spaced (P) or close together. Cerci (C) slender, slightly incurved, relatively long, their apices level with or surpassing tip of supra-anal plate.

13. Maximum number of stridulatory pegs (Fig. 99) 60. Peg intervals 14-27 rather regular, but peg interval 28 onwards less regular and gradually rising in value.

Female:

1. General colouration lighter than that for male.

2. Temporal foveolae short. Fastigium verticis about 1.4 times wider than long, slightly concave with short vertical sides and rounded angles.

3. Frontal ridge flat or slightly longitudinally sulcate and hardly

depressed near median ocellus. Distinctly widened at level of compound eyes.

4. Compound eyes elongated, long axis of eye 1.5 to 1.75 times longer than length of subocular groove.

5. Antennae slightly (1.25 times) longer than length of head and pronotum together as seen from above.

6. Lateral carinae of prozona feebly elevated. Light 'cross shaped' marking of prozona and metazona distinct, width of metazonal bands being nearly twice that of bands in prozona.

7. Folded tegmina with apices only just attaining level of second dark dorsal spot of folded posterior femora. Ratio E/F 0.5. Tegmina leathery, not transparent. Apices rounded acute.

8. Lower genicular lobes of posterior femora, on inner and outer sides, light in colour.

9. Posterior tibiae pale stramineus.

MEASUREMENTS.

	Male	Female	
		Micropterous	Macropterous
Length of tegmen (mm)	5.8-8.0	6.4-7.5	16.5
Length of posterior femur (mm)	8.0-9.6	11.16-13.5	13.9
Body length (mm)	14.6-16.1	19.2-23.2	25

DISTRIBUTION. South-western USSR (Turkistan, Uzbekistan, Tadzhikistan),

north-eastern Iran (Mashad, Sarakhs), northern Afghanistan.

MATERIAL EXAMINED.

USSR: 2♂, 2♀ Turkistan, Golodnaya steppe, 25.IV.12 (Djetysai); 1♂, 1♀ Transcaspia, Kopetolagh, Chuli, 25.V.14 (Golbeck); 1♂, 2♀ Tedzhen, 14.VI.23 (_____) f. macroptera (♀); 1♂, 3♀ Transcaspia, Farab, 19.VI.27 (Ushinskiy).

Iran: 6♂, 4♀ Sarakhs, 5.VI.58 (A. Soltani); 1♀ Sarakhs, 6.VI.69 (A. Soltani) f. macroptera; 2♀ Kalat, 11.VI.69 (A. Soltani); 1♂ Esmail-Abad, Mashad, 24.VI.57 (Mirzayan).

Afghanistan: 2♀ Farah, 20.VII.27 (Ushinsky).

DISCUSSION. D. plotnikovi Uvarov resembles D. dantini Bolivar very closely, e.g. in the form of phallic complex including epiphallus, morphology of the head including temporal foveolae and fastigium verticis, pronotal shape, length of tegmina, and form of stridulatory file (both number and distribution of the pegs). The cuticular colouring on vertex, occiput and pronotum is very similar in each species.

The macropterous form was briefly described by Uvarov, 1926h. There seems to be a tendency for this form to occur in the female. It seems likely that tegminal length is continuously variable. I have collected a female whose E/F ratio is 0.86 (normally about 0.6-0.7), but unlike the true f. macroptera the hind wings are not developed.

If, as their morphology suggests, D. dantini and D. plotnikovi are closely related, their present geographical discontinuity is of evolutionary interest.

D. plotnikovi Uv.

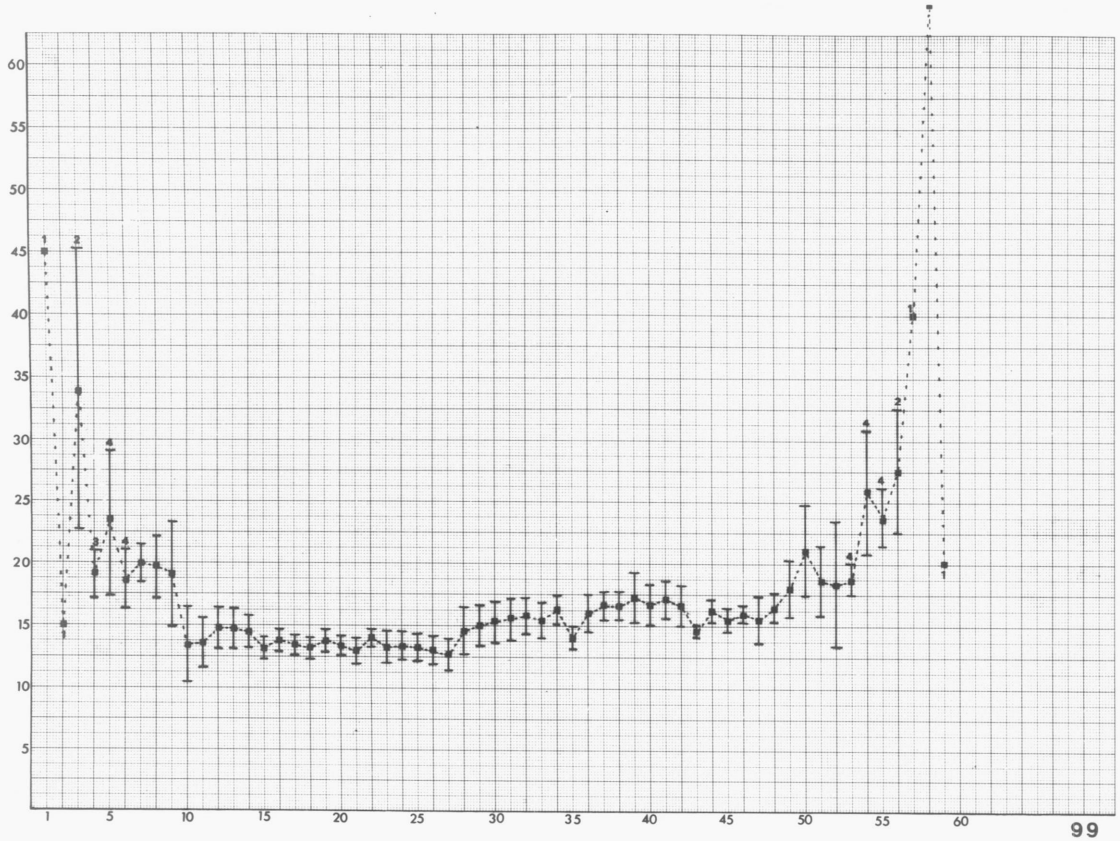
FIG. 95 Phallic complex from lateral view

FIG. 96 Epiphallus from dorsal aspect

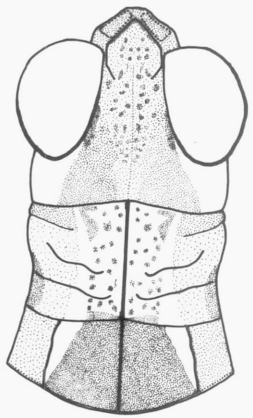
FIG. 97 Head and pronotum from above

FIG. 98 Supra-anal plate and cerci from above

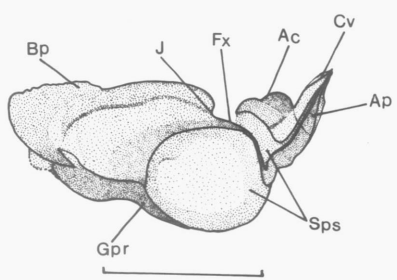
FIG. 99 Stridulatory peg graph showing variation in peg intervals of 10 specimens (collected from Iran)


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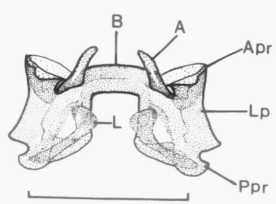
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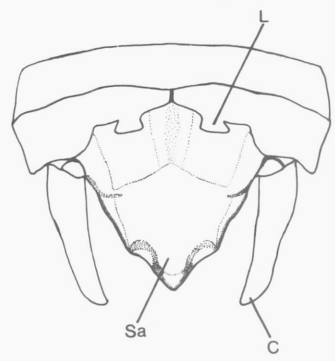
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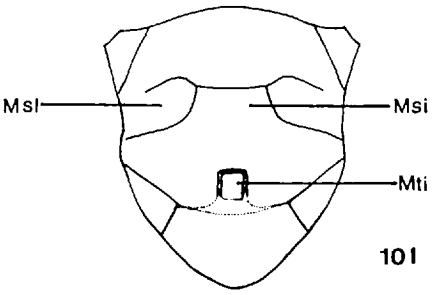
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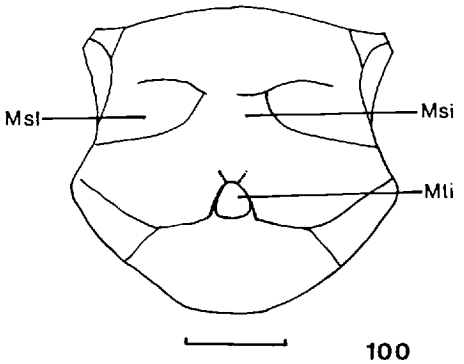
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FIG. 100 ♂ meso- and metasternum of D. plotnikovi Uvarov

FIG. 101 ♂ meso- and metasternum of D. diamesus Bei-Bienko



101



100

12. Dociostaurus diamesus Bei-Bienko, 1948

Type:♂ Dociostaurus diamesus Bei-Bienko, 1948. Proc. R. ent. Soc. Lond., (B) 17: 68, fig. 3. N. Iran, Tehran province, Elburz mountains, 7.VII.30 (S.A. Predtetshensky), Zoological Institute of the Academy of Sciences of USSR (Leningrad).

DIAGNOSIS. Male:

1. Phallic complex (Fig. 104) large in proportion to body size. Apical penis valves (Ap), in lateral view, finely pointed and obliquely oriented postero-dorsally; posterior edge with a projection at mid-point. Strongly sclerotised. Cingular valves (Cv) less sclerotised, slightly longer and thicker than apical valves. Arch of cingulum (Ac) relatively small, less sclerotised in middle, slightly impressed on its dorsal surface, narrowed in profile posteriorly. Flexure forming a sharp angle with base of apical penis valves, but curving gently in its upper part. Basal valves of penis forming an elevated mid-dorsal flange and meeting flexure posteriorly at an angle slightly less than 90°. Basal valves of penis (Bp) elongated, narrowed gradually towards posterior part and excurved as seen from above. Spermatophore sac (Sps) large, strongly arenate dorsally with thick rounded margins. Gonopore process (Gpr) long, sclerotised with a strong expansion in middle of its ventro-posterior margin.

Epiphallus with large sclerotised lobes (L) (Fig. 105) with moderately strong, curved bridge (B). Ancorae (A) long, leaning towards mid-line at 45° at base but with apical portions much more erect with blung apices. Posterior projections (Ppr) sclerotised with margins distinct and strongly divergent ventrally.

Male genitalia show strongest affinity with D. plotnikovi and rather

less with D. dantini (see Figs. 89, 95 and 104; Figs. 87, 96 and 105).

2. General colouration brown with darker brown patterns.

3. Fastigium verticis (Fig. 102) elongated, about 1.57 times longer than wide, usually sloping forwards and downwards, decidedly concave and parallel-sided posteriorly. Vertex prominent with an obliterate median carina. Temporal foveolae depressed, longer than wide, narrowed in front and sides straight, but margin curving downwards near frontal ridge.

4. Frontal ridge narrow, usually sulcate with punctate surface markedly impressed at median ocellus. Marginal carinulae of frontal ridge thickened with rounded edges and visible below level of median ocellus but fading near clypeus.

5. Head slightly elevated.

6. Eyes relatively large and inflated as seen from side view. Long axis of eye 2-2.5 times as long as subocular groove.

7. Antennae 1.3-1.5 times as long as length of head and pronotum together as seen from above. Scape and pedicel large.

8. Disc of pronotum feebly constricted before fourth transverse sulcus. Prozona about 1.25 times as long as metazona. Lateral carinae of prozona weak but visible. Lateral carinae of metazona not strongly elevated. Transverse sulci 2-4 strongly developed. Light 'X' shaped pronotal markings bordered on both sides by darker bands of brown or black. Light

and dark pronotal bands are extensions of bands originating from dorsal and dorso-posterior part of compound eyes. Posterior pronotal margin rounded.

9. Tegmina short. Apices of folded tegmina not attaining tip of abdomen (like those of D. plotnikovi) but surpassing second dark spot on dorsal surface of hind femora. E/F ratio about 0.75. Hind wings about half length of tegmina.

10. Posterior femora with three dorsal spots often extending onto external surface but hardly at all onto inner side. A few small black spots usually present on lower outer carina. Upper genicular lobes dark and lower lobes light on both inner and outer sides.

11. Hind tibiae dull dirty pink though sometimes pale creamy blue. Third segment of hind tarsi longer than in D. plotnikovi.

12. Supra-anal plate similar to that in plotnikovi (compare Figs. 103, 98).

Female:

1. General colouration as for male.

2. Temporal foveolae weakly pitted, about twice as long as wide and upper margin gently bent towards frontal ridge. Fastigium verticis concave, as long as wide. Head rather stout. Vertex elevated.

3. Frontal ridge flat, widened between antennal sockets, slightly depressed at median ocellus. Surface punctate, with row of black dots on inner edges of both lateral margins above level of median ocellus.

4. Compound eyes small (long axis about 1.6 times longer than subocular groove).

5. Antennae relatively short, length as long as head and pronotum together or slightly shorter with apical segments flattened.

6. Pronotum with prozona slightly longer than metazona and slightly inflated on mid-line. Light 'X' shaped pronotal markings wider in metazona than prozona.

7. Tegmina short, attenuated towards apex.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	5.4-6.0	5.4-8.0
Length of posterior femora (mm)	7.7-8.8	9.9-12.0
Length of body (mm)	11.0-15.3	14.6-20.0

MATERIAL EXAMINED.

Iran: 7♂, 5♀ Ab-Ali 60 km. N.E. of Teheran, 14.VII.50 (G. Popov);
6♂, 5♀ Imamzadeh-Hashem, N. of Teheran, 2500 m, 28.VI.64 (M. Descamps);
5♂, 4♀ Dehbakri, Jabal-Barez, Kerman, 2200 m, 13.VI.67 (A. Soltani);
1♂, 1♀ Damavand, 8 km. N. of Teheran, 2700 m, 25.VII.66 (A. Hashemi);
2♂, 1♀ Natanz, 150 km. S. of Teheran, 4.VI.70 (H. Mirzayan and M. Abaii);
2♂, 1♀ Esfarayen, Ruine, N.E. of Iran, 27.VII.73 (Ayatollahi).

DISCUSSION. This species was well described by Dr G. Bei-Bienko and was said to be related to D. kraussi and D. hauensteini. Later it was put in a subgenus Stauronotulus Bei-Bienko & Mistschenko, . This is probably incorrect. The genital morphology seems to suggest a close relationship with other brachypterous D. dantini, D. avicennai and particularly with D. plotnikovi. (Compare Figs. 89, 84, 95 and 104).

The most significant differences between D. diamesus and the others are:

(i) smaller size, especially in the females.

(ii) larger number of pegs, up to 75. Other species never have more than 61.

(iii) Mesosternal and metasternal interspaces (see Figs. 100, 101).

(iv) shape of fastigium verticis (see Figs. 91, 92, 97 and 102).

(v) flattening of apical segments of antennae in D. diamesus.

Despite the slight differences in external characters and size of specimens from northern, central and southern Iran the male genitalia are morphologically stable from all localities.

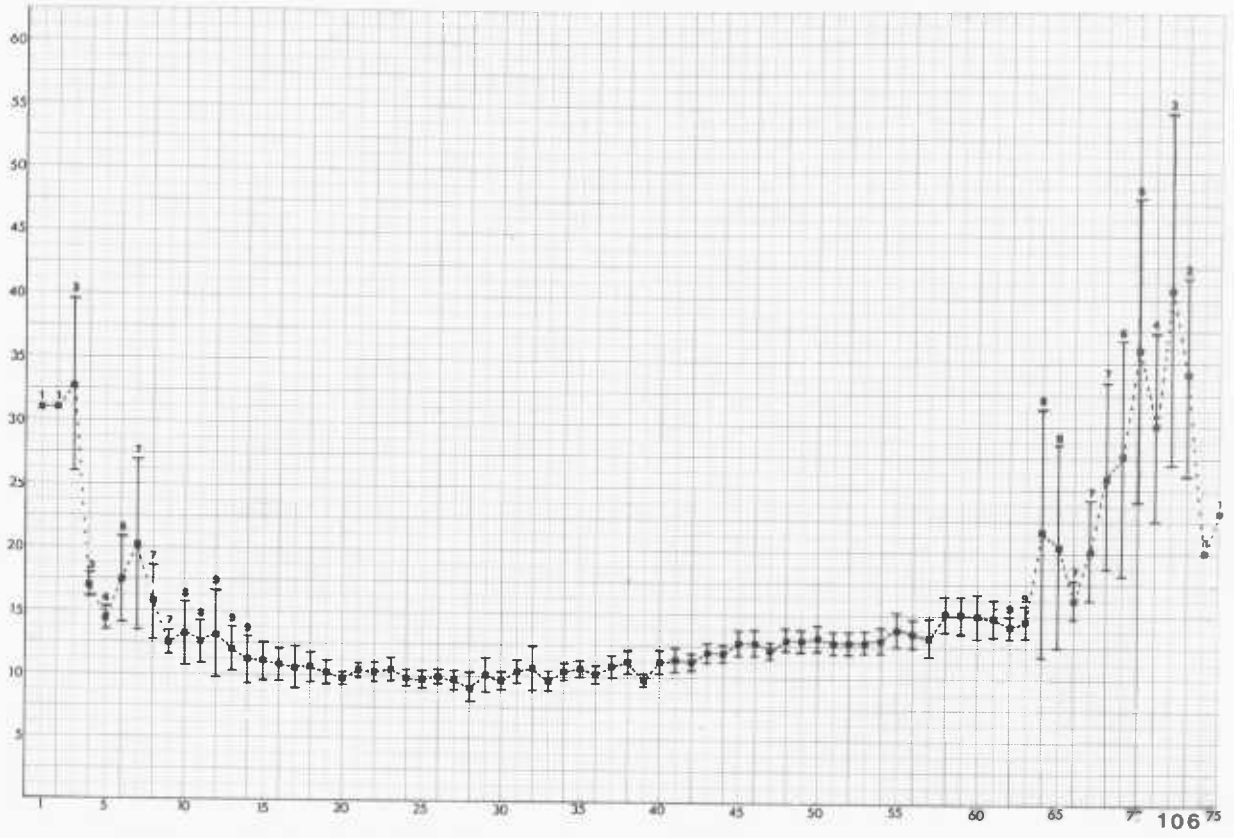
FIG. 102 D. diamesus Bei-Bienko, head and pronotum from above

FIG. 103 Supra-anal plate from above

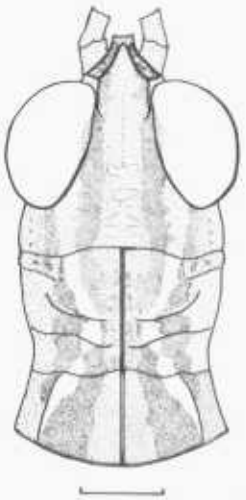
FIG. 104 Phallic complex, side view

FIG. 105 Epiphallus, dorsal view

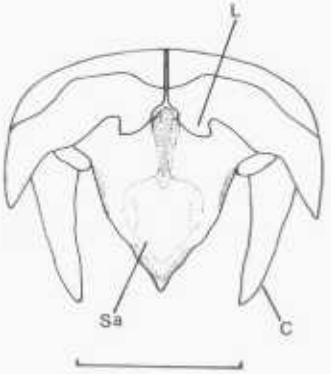
FIG. 106 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. diamesus (collected from Iran)



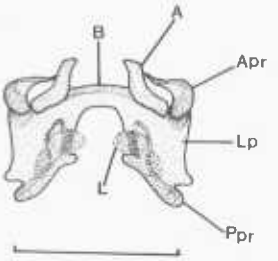
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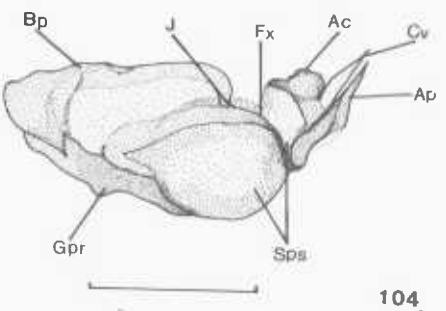
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103



105



104

13. Dociostaurus (Notostaurus) cephalotes Uvarov, 1923

Type: ♀ Dociostaurus cephalotes Uvarov, 1923. Bull. Soc. Roy. ent. Egypte, 7: 187-190, fig. 1. Israel, Huleh, Galilee, 24.V.22 (P.A. Buxton), British Museum (Natural History) London.

DIAGNOSIS. Male:

1. Phallic complex relatively small. In lateral view (Fig. 109) apical penis valves (Ap) sclerotised, widened in middle and moderately narrowed downward, each ventro-posterior margin bearing an angular projecting process (typical of penis valves in subgenus Notostaurus). Valves of penis blade-shaped, as seen from above, more vertically than horizontally directed in profile and short but sharply pointed. Cingular valves (Cv) thin, less sclerotised than apical penis valves but slightly longer than them. Arch of cingulum (Ac) large, with two superimposed parts, bilobate in profile dorso-anteriorly, upper part being attached to zygoma. Flexure forming an abrupt angle with base of apical penis valves, smoothly curved dorso-anteriorly. Median posterior flange formed by union of basal penis valves dorsally, sloping smoothly into upper part of flexure (Fx). Basal valves of penis (Bp) long with extended upper anterior lobes whose edges are irregular. Anteriorly strongly outcurved with edges, as seen in profile, obscuring about $\frac{2}{3}$ length of gonopore processes (Gpr). Gonopore processes narrow with pointed apex near base of spermatophore sac (Sps).

Epiphallus (Fig. 110) rather small with relatively large lophi (L), thick posterior projections (Ppr) and narrow lateral plates (Lp). Ancorae (A) thin with blunt apices standing with half their length exposed above level of bridge (B). Bridge sclerotised with upcurved upper margin.

2. General colouration stramineus with light and dark pattern (at low altitude and sea shore habitats) but dull brown in high altitude localities.

3. Fastigium verticis (Fig. 107) rather narrow, subhorizontal with lateral margins parallel or curved. Fastigium concave with two black patterns usually present against inner anterior margins. Temporal foveolae small, almost rhomboid or slightly longer than deep. Weakly pitted with distinct margins. Anterior margins rounded.

4. Frontal ridge usually flat, punctate and with black dots. Lateral margins in form of carinulae, narrowed gently upwards to an acute apex between temporal foveolae.

5. Head large and elevated above. Occiput convex adjacent to vertex with a distinct to feeble median carinula which lies between two decumbent irregular elevations which arise from posterior lateral edges of fastigium and diverge caudad. Surface between these lateral ridges light in colour with short transverse rugosities, their outer margins flanked by two dark brown bands, originating at eyes and fading just before back of occiput.

6. Compound eyes large, higher than long, oblique, longest axis about 1.5 times its shortest axis and 2.75 times length of subocular groove.

7. Antennae robust filiform, dark in colour, slightly longer or equal to length of head and pronotum together as seen from above. Scape not noticeably inflated with a black pattern on its upper surface close to frontal ridge.

8. Pronotum (Fig. 107) narrower than width of head across genae as seen from above. Disc of pronotum greatly constricted in middle. Lateral carinae well developed except between transverse sulci 2 and 3. Lateral carinae of prozona curved outwards. Light shaped lateral markings of disc, if present, narrower in prozona than metazona. Length of prozona about 1.25 times that of metazona. Posterior margin of pronotum rounded obtusangulate. Median light pigment of occiput continued onto median line of pronotal disc. Lateral lobes of pronotum markedly punctate and rugose.

9. Apices of folded tegmina usually reaching about $\frac{2}{3}$ of way along abdomen, though sometimes reaching middle of supra-anal plate (E/F ratio 0.75). Apical anterior part of tegmina shiny. Wings shorter than tegmina (W/E = 0.8).

10. Posterior femora relatively robust with 3 typical dark brown dorsal spots of which third distal one is usually faint. Proximal two usually extending indistinctly onto inner and outer areas of femur. Upper genicular lobes of both sides dark, lower lobes dark on inner side only with a blackish pattern.

11. Hind tibiae dull blue with black markings proximally adjacent to knee (especially on its inner aspect). Tarsal claws widely angled with large triangular arolium between.

12. Supra-anal plate (Fig. 108) regularly triangular. Lobes of last abdominal tergite subrectangular (p), widely separated. Cerci swollen basally, often slightly outcurved apically and with apices falling short of tip of supra-anal plate (C).

13. Stridulatory file with low peg number (Fig. 111 graphical peg interval profile of 10 individuals; Fig. 112 ditto for single specimen). Peg intervals rather uniform proximally, intervals 20-36 becoming progressively wider and more irregular. Number of pegs 38-45. Mean of intervals 5 to 40 rather high (about 1?5) - compare with graphs of D. plotnikovi and D. diamesus, Figs. 99 and 106.

Female:

No redescription is necessary as that by the original author is adequate. Size and colouration are variable.

MEASUREMENTS.

	Male	Female
Length of tegmin (mm)	5.1-6.3	6-7.8
Length of posterior femur (mm)	8.2-9.4	10.75-12.75
Length of body (mm)	14.3-15.7	17.2 - 22.0

DISTRIBUTION. Northern Israel, south western Syria and probably southern Lebanon.

MATERIAL EXAMINED.

Israel: 2♀, Galilee, Huleh, 24.V.22 (P.A. Buxton), type and paratype; 1♂, 1♀ Sassa, 2.X.67 (Blondheim); 5♂, 4♀ Man Zura, 27.V.68 (Blondheim); 2♂, 2♀ Eim Zeyhim rd., Rosh Pinna, 17.VI.69 (Blondheim); 1♂, 2♀ Majdi Champs, 7.VIII.69 (Blondheim); 2♂, 3♀ Mt. Hermon, 1650 m, 10.VIII.70 (Blondheim); 15♂, 15♀ Bab-el-Hawa, Golan Heights, 1000 m, 30.VII.73 (A. Soltani).

Syria: 1♂, 1♀ Jebel Mazar lake, 25.VII.45 (K.P. Whitehorn).

DISCUSSION. A male 'allotype' was described by Morales Agacino in 1950, from Israel, Yebel Cheikh, Mansour, 26.IX.49. The material collected by myself (Golan Heights) and that lent by Mrs S. Blondheim from Mt. Hermon is typical of high altitude populations. It is darker in colour and smaller in size than the type specimens collected in Galilee. Genitalia and morphometric ratios, however, are identical in low altitude and high altitude forms with the exception that some low altitude populations e.g. Sassa and Manzura, the tegmina are bigger, their apices when folded reaching the abdominal apex. This is a tendency found in many grasshopper species, reflecting perhaps the need for greater mobility in the low altitude forms.

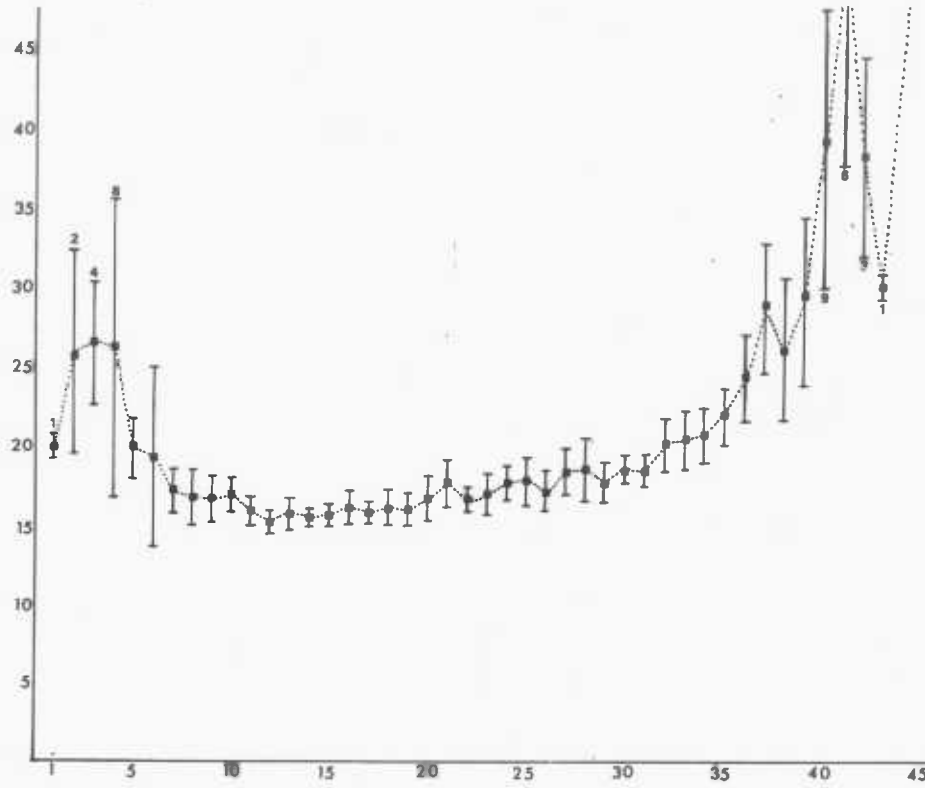
FIG. 107 D. cephalotes Uvarov, head and pronotum from above

FIG. 108 Supra-anal plate and cerci from above

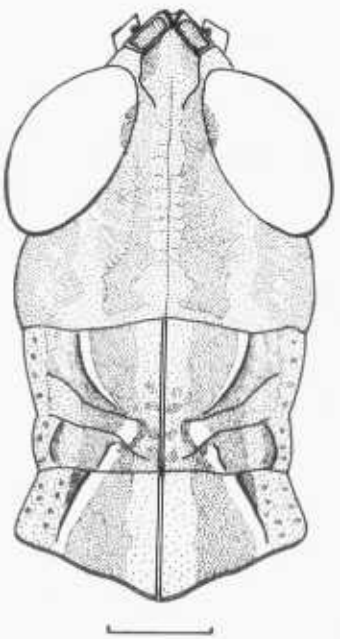
FIG. 109 Phallic complex from lateral view

FIG. 110 Epiphallus from dorsal view

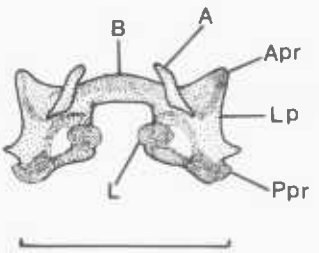
FIG. 111 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. cephalotes (collected from Israel)



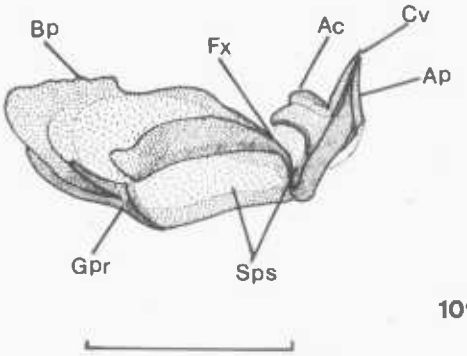
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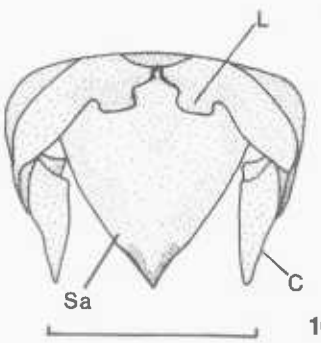
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109



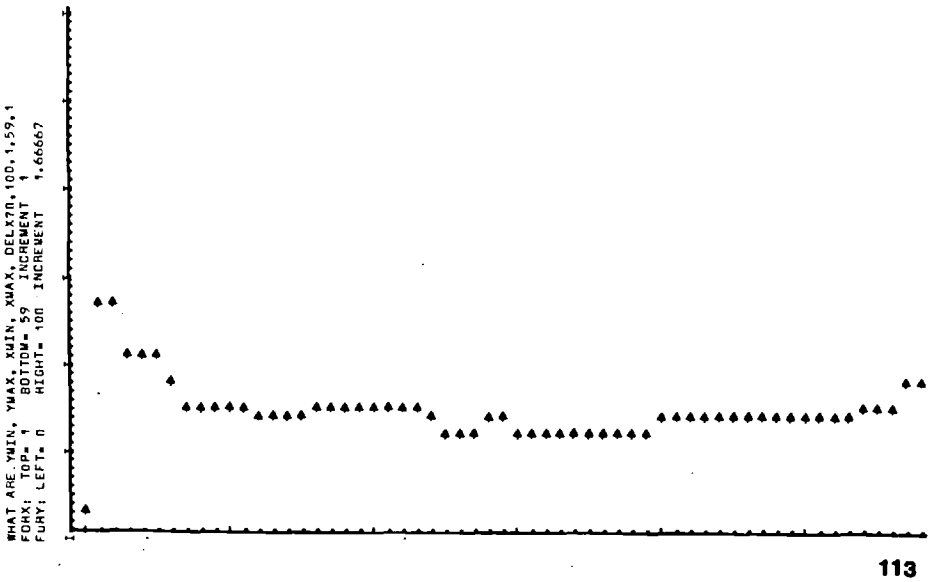
108

Stridulatory file pattern from one specimen of:

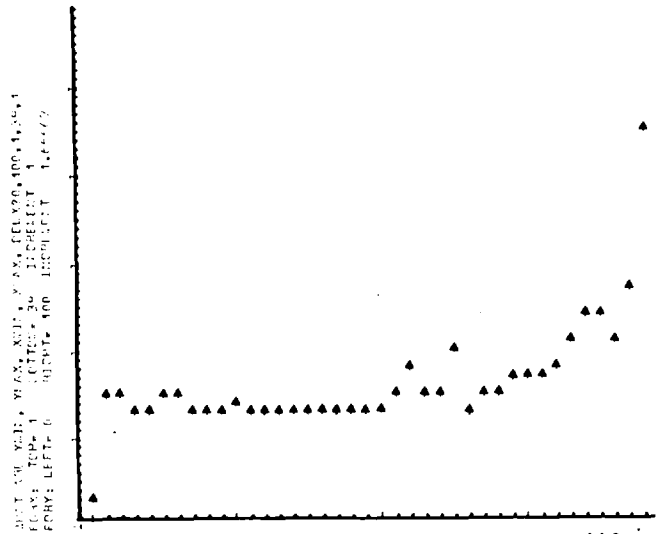
FIG. 112 *D. cephalotes* Uvarov

FIG. 113 *D. anatolicus* (Krauss)

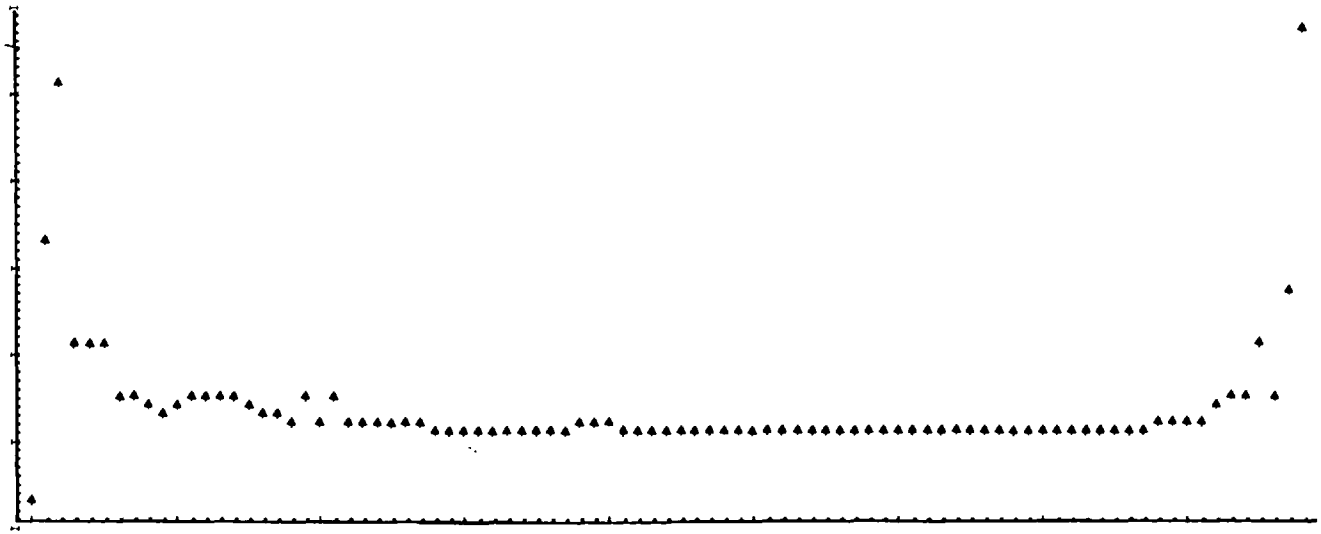
FIG. 114 *D. albicornis* (Eversmann)


WHAT ARE.YMIN, YMAX, XMIN, XMAX, DELXTN,100,1,59,1
FORX; TOP= 1 BOTTOM= 59 INCREMENT 1
FORY; LEFT= 0 HIGHT= 100 INCREMENT 1.66667

113



112



114

14. Dociostaurus (Notostaurus) anatolicus (Krauss, 1896)

Type: ? Stauronotus anatolicus Krauss, 1896. Zool. Jahob., Abt. Supt., 9: 560, pl. 8, fig. 1. Turkey, Angora, _____ (_____). Transferred to genus Dociostaurus by Kirby, 1910. A Synonymic Catalogue of Orthoptera III - Orthoptera Saltatoria part II Locustidae vel Acrididae: 153, no. 7. Holotype untraced. Possibly syntype series lost.

DIAGNOSIS. Male:

1. Phallic complex in lateral view (Fig. 118) with apical penis valves erect, short, sharp and only very slightly curved (Ap). Ventro-posterior margins with small angular projection about one third of way from tip. As seen from above apical valves like those of D. cephalotes in shape but larger. Cingular valves (Cv) thinner, with apex extending beyond tips of apical valves. Less sclerotised than apical penis valves. Arch of cingulum small, (in profile) serrated on its upper surface, sometimes divided into two lobes. Apical valves making a very acute angle at flexure (Fx). Flexure very slender, sclerotised, undulating and joining outer ends of basal penis valves (Bp) after only a short distance. Upper median flange of basal valves irregular in profile, running smoothly down to join main body of basal valves some distance short of the flexure. Upper margin of spermatophore sac (Sps) thickly sclerotised. Basal valves of penis (Bp) large. Gonopore process (Gpr) thick and strongly sclerotised. Spermatophore sac thin walled (similar to D. cephalotes).

Epiphallus large (Fig. 119) with obliquely sloping lateral plates (Lp). Anterior processes (Apr) and posterior processes (Ppr) thick, moderately sclerotised. Bridge (B) robust, thick, sclerotised along its middle. Ancorae (A) short, thickened posteriorly and with apices directed

obliquely upwards and inwards.

2. General colouration brownish grey with pale reddish and dark brown pattern. Sometimes straw-yellow with distinct velvet castaneous patterns starting between hind margin of temporal foveolae and antennal socket but passing backwards, through compound eyes, lateral part of occiput behind eyes, lateral lobes of pronotum and onto basal part of tegmina over cubital and anal areas (cubital area usually ivory white); var. castaneopicta.

3. Fastigium verticis (Fig. 117) strongly concave, usually as wide as long, usually heart-shaped with apex of 'heart' directed forwards. In some specimens fastigium longer than wide. Orientation horizontal. Margins distinct and thickened with rounded angles. Fastigium thus very variable in shape and size. Temporal foveolae distinct, slightly pitted, longer than deep, usually narrowed slightly towards frontal ridge.

4. Frontal ridge flat, surface usually punctate, slightly depressed at median ocellus. Lateral margins distinct right up to edge of fastigium verticis and often visible onto surface of clypeus.

5. Head somewhat elevated above level of pronotum as seen in side view. Vertex convex between compound eyes, sloping down sharply to middle of fastigium. Occiput and vertex rugose with distinct to indistinct median dorsal carinula which runs a short way onto depression of fastigium verticis.

6. Compound eyes rather elongate, longest axis in f. castaneopicta 2.5-3.0 times length of subocular groove, in rest of material 2-2.50

times length of subocular groove.

7. Antennae filiform, whitish (especially in live material). Usually 1.5 times longer than head and pronotum together as seen from above with large scape and short pedicel.

8. Pronotum (Fig. 117) elongate, its length on mid-line as seen from above about 1.5 times as long as length of head. Median carina and adjacent disc strongly elevated. Transverse sulci strongly developed, first sulcus being visible from above. Lateral carinae well developed in metazona and anterior to sulcus 2 in prozona. Fourth transverse sulcus arched forwards where it crosses median carinula. Prozona slightly longer than metazona. Light median band of colour down centre of head and pronotum. Each light marking of pronotal disc flanked by darker pigment. Hind margin of disc obtuse angled. Lateral lobes of pronotum with two short decumbent carinulae between lateral extensions of transverse sulci 2-4. Space between these carinulae light or ivory white (like D. (N.) cephalotes).

Pterothorax (seen in lateral view) with black spots. Epimeron 3 (segment before tympanal organ) black. Black pigment sometimes extends around tympanal area, e.g. in var. castaneopicta.

9. Apices of folded tegmina barely level with tips of folded posterior femora and sometimes much shorter (Yugoslavia apices of tegmina only level with tip of abdomen). Dark spots of pigment in cubital area. Anal area usually dark in colour, as also is first tergite (around tympanal organ). Hind wings rose basally.

10. Posterior femora narrowed towards knee. Three dorsal spots faint

in many cases, but dull indistinct pattern extends from them onto both inner and outer areas. Knee always blackish.

11. Hind tibiae variable in colour (pale yellow, pale blue, reddish) but always black at proximal end.

12. Supra-anal plate (Sa) elongate, smoothly triangular without apical appendage. Separate distinct lobes developed on posterior margin of last abdominal tergite, their outer apical corners acute. Distance between lobes variable. Cerci rather slender, gently curved, their apices falling short of tip of supra-anal plate (Fig. 120).

13. Despite large size of posterior femora number of pegs in file is small, 42-62 (Figs. 113, 116). Mean interval about 17.5 and showing rather small fluctuation and standard deviation between peg 5 and 50.

Female:

1. General colouration similar to that of male. Sometimes straw-yellow with light brown patterns.

2. Temporal foveolae short, slightly longer than deep with very thick marginal carinulae. Fastigium verticis usually wider than long and concave with rounded marginal angles, its front angle about 90°. Occiput like that of male.

3. Frontal ridge wide and flat. Margin below median ocellus usually distinct, rounded. Ridge widened between base of antennae and passing broadly up to front of temporal foveolae.

4. Compound eyes much smaller proportionately than those of male.

Longest axis of eyes 1.25-1.5 times length of subocular groove.

5. Antennae light in colour, slightly longer than head and pronotum together as seen from above. Scape and pedicel short.

6. Pronotum as that in male.

7. Tips of folded tegmina level with knee of folded posterior femora or only reaching to tip of abdomen.

8. Upper genicular lobes of posterior femora black, but lower lobes light with black spots.

9. Hind tibia with indistinct dark ring at proximal end (near knee), though this is sometimes absent.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	9.5-18.3	13-26
Length of hind femur (mm)	11-15	14.5-22.5
Body length (mm)	18.4-24.5	23.5-37.5

MATERIAL EXAMINED.

USSR: 5♂, 7♀ Transcaucasia, 29.VII.25 (M. Siazov).

Iran: 1♂, 3♀ Damavend, 11.VIII.48 (P. Aellen); 2♂, 2♀ Tehran-Mahmudieh, 1250 m, 21.VIII.48 (P. Aellen); 3♂, 2♀ 40 km W. of Tehran, Karadj, 13.VI.49 (Salavatian); 4♂, 6♀ southern Iran, Lar, 4.V.50 (G. Popov); 2♂, 2♀ 40 km E. of Tehran, 4.VII.50 (G. Popov);

2♂, 4♀ Ghazvin, VIII.50 (Mirzayan); 2♂, 5♀ Moghan, 9.VI.58 (L.F.H. Merton); 4♂, 5♀ Moghan, 7.VI.59 (A. Soltani); 3♂, 2♀ Varamin-Kara Aghach, 2.VII.59 (E.S. Brown); 1♂, 2♀ Brudjerd-rajan, 2200 m, 13.VIII.68 (Mirzayan); 5♂, 7♀ Kazerun, Jereh, 20.V.73 (A. Soltani).

Turkey: 1♂, 1♀ Adalia, 15.VI.27 (Tockhorn); 5♂, 7♀ Angora,____30 (Sureya Bey); 2♂, 2♀ Corum, 12.VII.30 (Sureya Bey); 2♂ Urfa, VII.31, (Eshref Bey); 4♂, 6♀ Ankara, Kavaklidere, 1000 m, 11.VIII.60 (K. Guichard); 2♂, 3♀ Sivas, Salar pass, 19.VII.69 (W.G. Tremewan).

Yugoslavia: 7♂, 5♀ Macedonia, Stobi, 14.VII.71 (Z. Adamovic).

Greece: 2♂, 3♀ Tigani, 21.VI.32 (_____); 1♂ Samos-Vathi, 23.VI.32 (_____).

Syria: 2♂, 2♀ Jebel Mazar, 25.VII.45 (K.B. Whitehorn).

Jordan: 6♂, 5♀ 23 km W. of Amman, nr. El Salt, 13.VI.51 (A.R. Waterston).

Israel: 4♂, 3♀ 16 km Jericho rd., 20.V.71 (S. Blondheim); 6♂, 6♀ Bab-el-Hawwa, Golan Heights, 30.VII.73 (A. Soltani).

DISCUSSION.

Apart from the correct generic designation of this species to the genus Dociostaurus in 1910 by Kirby (see type data), this species has been reallocated to the new genus Notostaurus by Bei-Bienko in 1933. Here it accompanied D. albicornis, D. albicornis turcmenus and D. cephalotes. Tarbinsky reduced Notostaurus to subgeneric status in 1940. Bei-Bienko and Mistshenko (1950) retained its generic status, while Jago (1971) took Tarbinsky's view that it had only subgeneric status, i.e. that of a species group within the genus Dociostaurus. This last opinion is adopted here.

The most important characters quoted for separating the genus Notostaurus were:

(i) presence of well defined carinulae on vertex and occiput. Unfortunately D. jagoi, D. genei, D. minutus, D. curvicercus, D. diamesus, D. plotnikovi, D. avicennai and D. dantini all possess this character to a greater or lesser degree. In contrast D. (N.) anatolicus from Yugoslavia and Greece do not have distinct elevated carinulae.

(ii) lateral keels of pronotum more or less developed before anterior sulcus (meaning transverse sulcus 2). This is also clearly the case in D. larensis, D. tarbinskyi, D. tartarus and D. brevicollis (♀).

A study of the male phallic complex indicates that in the following respects Notostaurus is typical of the genus Dociostaurus.

(i) Epiphallus with typical shape of lophi i.e. rounded margin, puntate surface and heavy sclerotisation. Also the shape and situation of bridge and posterior projection of lateral plates.

(ii) Apical penis valves which are always slightly shorter than cingular valves and its ventro-posterior margin is not strongly concave like chorthippus or leva.

(iii) Basal valves of penis which is not heavily prominant and projected upwards on their upper margin and also not strongly attenuated in anterior end (like Eremippus and Bocenhei merella) (Figs. 78, 79).

On the other hand, the genus Mizonocara said by Bei-Bienko (1933) to be akin to that of Notostaurus in fact differs from it in the following respects:

(i) Epiphallus which is entirely different with typical one in

Dociostaurus (Fig. 128) i.e. posterior projection short and forming separate lobes from lateral plate of epiphallus.

(ii) Lophi elongate and their lower margin almost level with inner angle of posterior projection while in Dociostaurus is almost rounded, thick, strongly sclerotised and situated almost on the middle of anterior margin of lateral plates.

(iii) Arch of cingulum very thin and consisting of 2 separate plate shaped processes while in Dociostaurus it is tabular in shape and more sclerotised; also cingular valves which are thicker than apical valves of penis in Mizonocara whereas in Dociostaurus they are almost thinner.

D. (N.) anatolicus is extremely variable in size, relative dimensions and colouration. About 60 males have been examined for this study, however, and it is clear that the genitalia are relatively invariable. Differentiation of the species from D. (N.) cephalotes and D. (N.) albicornis cannot be made on this character alone, however, since the genitalia of these three species are remarkably uniform (Figs. 118, 109 and 125). With supplementary external characters, stridulatory file characters and chromosomal characters, it is possible to separate these species with ease. Note that 'var. castaneopicta' is a colour form found also in D. albicornis, D. jagoi, D. larensis, D. tartarus and D. hauensteini. There is no difference so far detectable in the morphology of normal members of each species and var. castaneopicta.

The chromosomal characteristics of D. (N.) anatolicus are tabulated below.

Locality		Autosome pair number										
Bab-el-Hawa (Golan Heights) Israel	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	ti	ti	t	t	t	t
	Chiasmata: Number	3	1-3	2	2	1-3	1-2	1-2	1	1	1	1
	Terminal heterochromatic segments (size)	lge	lge	lge	lge	lge	lge	lge	lge	lge	med	lge
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	s	s	a
	Chromosome length (%)	21.6	18	14	13	9.5	9	7.5	3.3	2	1.1	1.1
Fars (Kazerun) Iran	Chiasmata: Terminal (t) or Interstitial (i)	ti	t	t	t	t	t	t	t	t	t	t
	Chiasmata: Number	2-3	2	2	1-2	1	1	1	1	1	1	1
	Terminal heterochromatic segments (size)	med lge	lge	lge	lge	med lge	lge	med	med	lge	lge	med
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	a	s	s
	Chromosome length (%)	21.9	16.1	14.3	14.3	8.6	7	4.1	4.1	4.1	2.9	2.6

It will be noted (Figs. 121 and 122):

(i) The terminal heterochromatic segments are very large - hence get a high rating in the table.

(ii) Symmetry of homologues is not the same in all the material studied. Thus in material from Israel (Fig. 121) pair 11 are asymmetrical, whereas in Iranian material (Fig. 122) they are symmetrical.

(iii) The chiasma frequency of the Israel material seems to be higher in chromosome pairs 1-7.

D. anatolicus (Krauss)

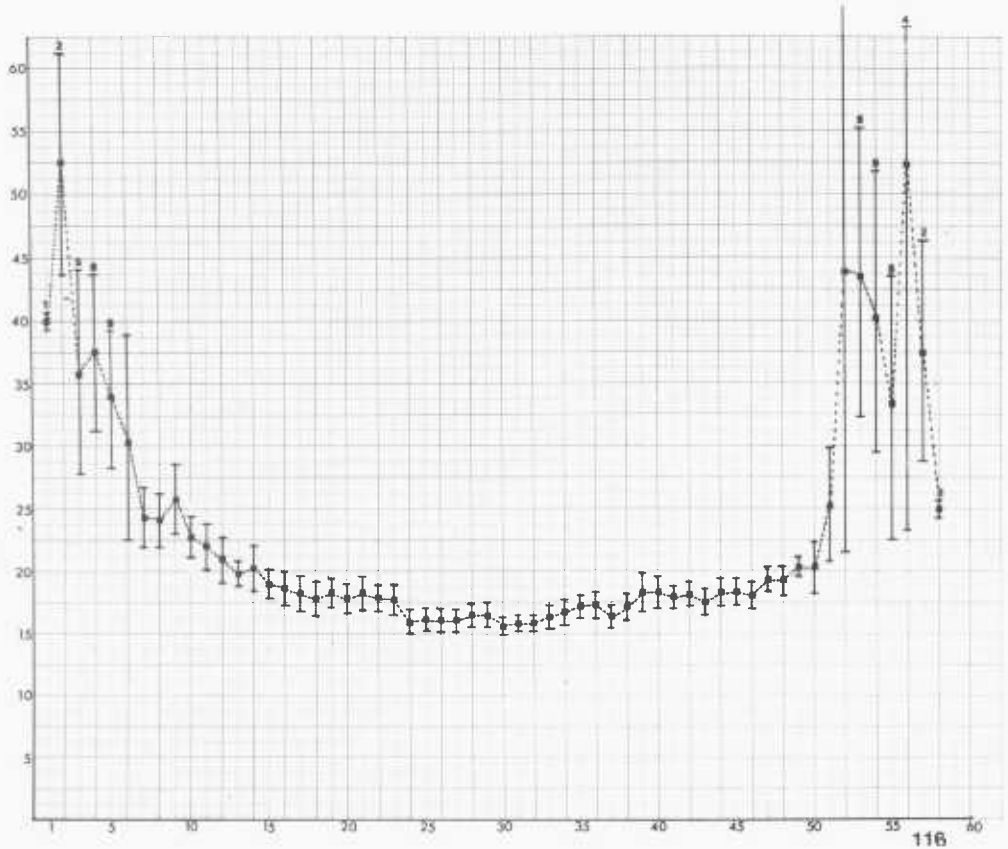
FIG. 116 Stridulatory peg graph showing variation in peg intervals of 10 specimens

FIG. 117 Head and pronotum from above

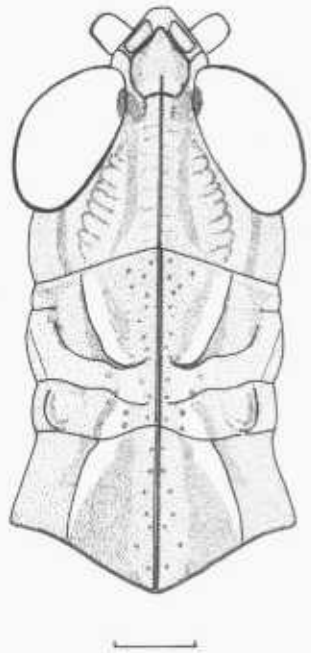
FIG. 118 Phallic complex, lateral view

FIG. 119 Epiphallus, dorsal aspect

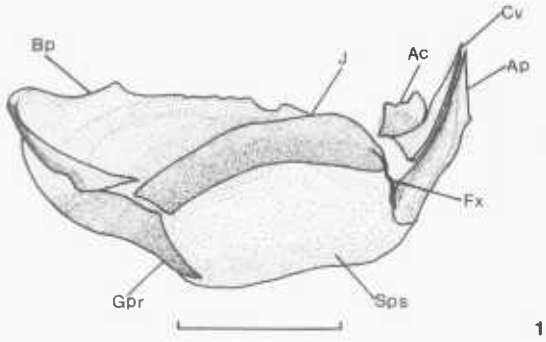
FIG. 120 Supra-anal plate and cerci from above



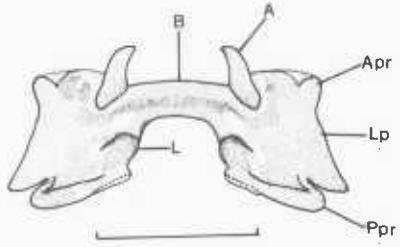
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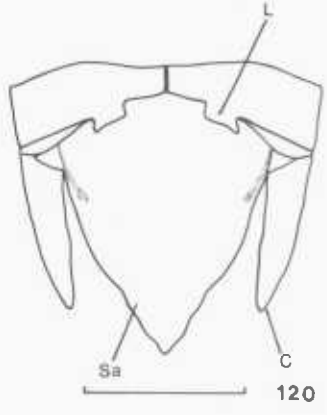
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118



119



120

PLATE 121

Meiosis in the spermatocytes of D. anatolicus (Krauss) collected from Israel (Golan, Bab-el-Hawa)

Mag. x 1500

A Diplotene (normal illumination)

B, C & D Diakinesis (phase contrast)

E Diplotene (normal)

F Early diplotene (phase contrast)

G & H Diakinesis (normal)

J-L Diakinesis (phase contrast)

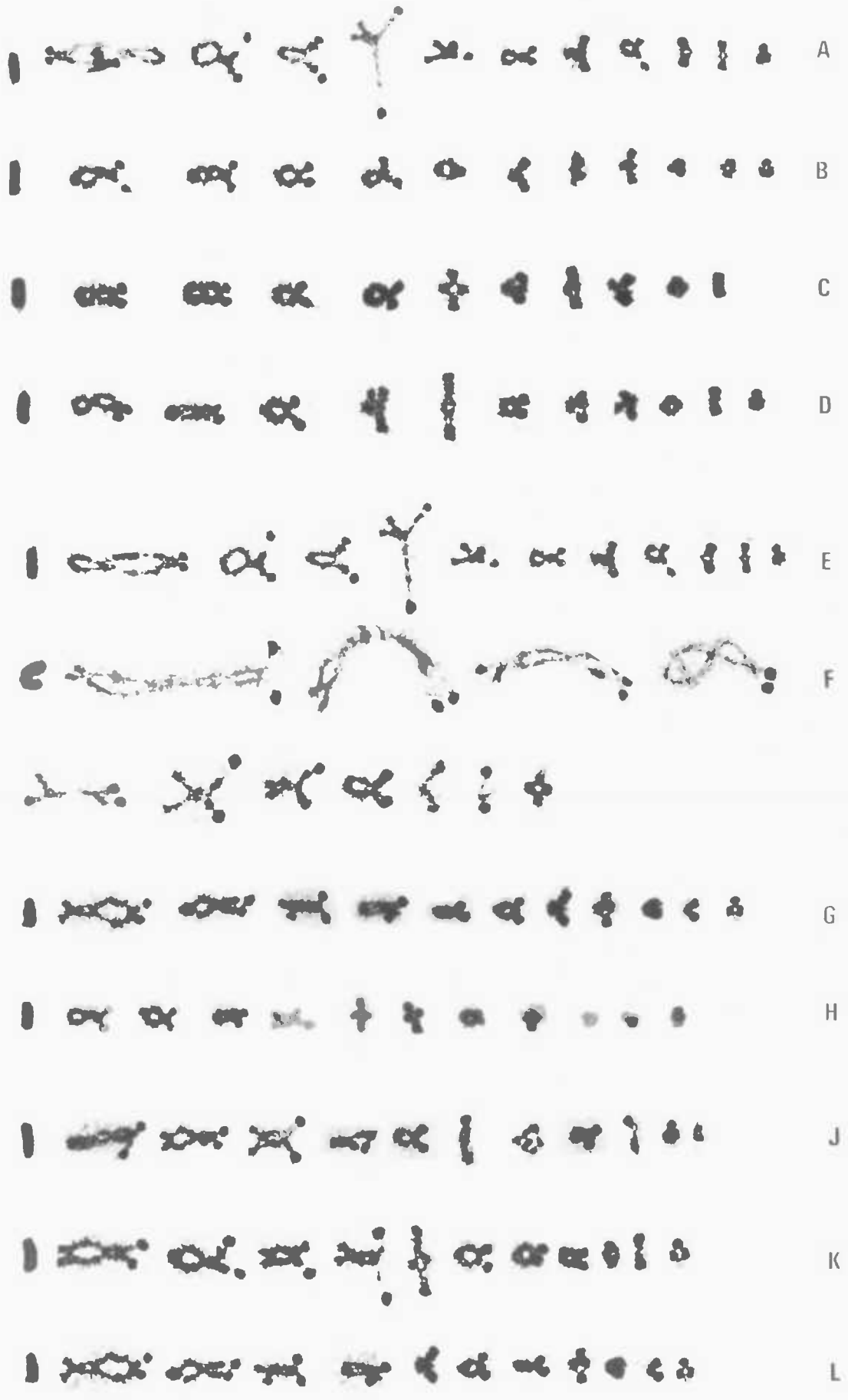

A
B
C
D
E
F
G
H
J
K
L

PLATE 122

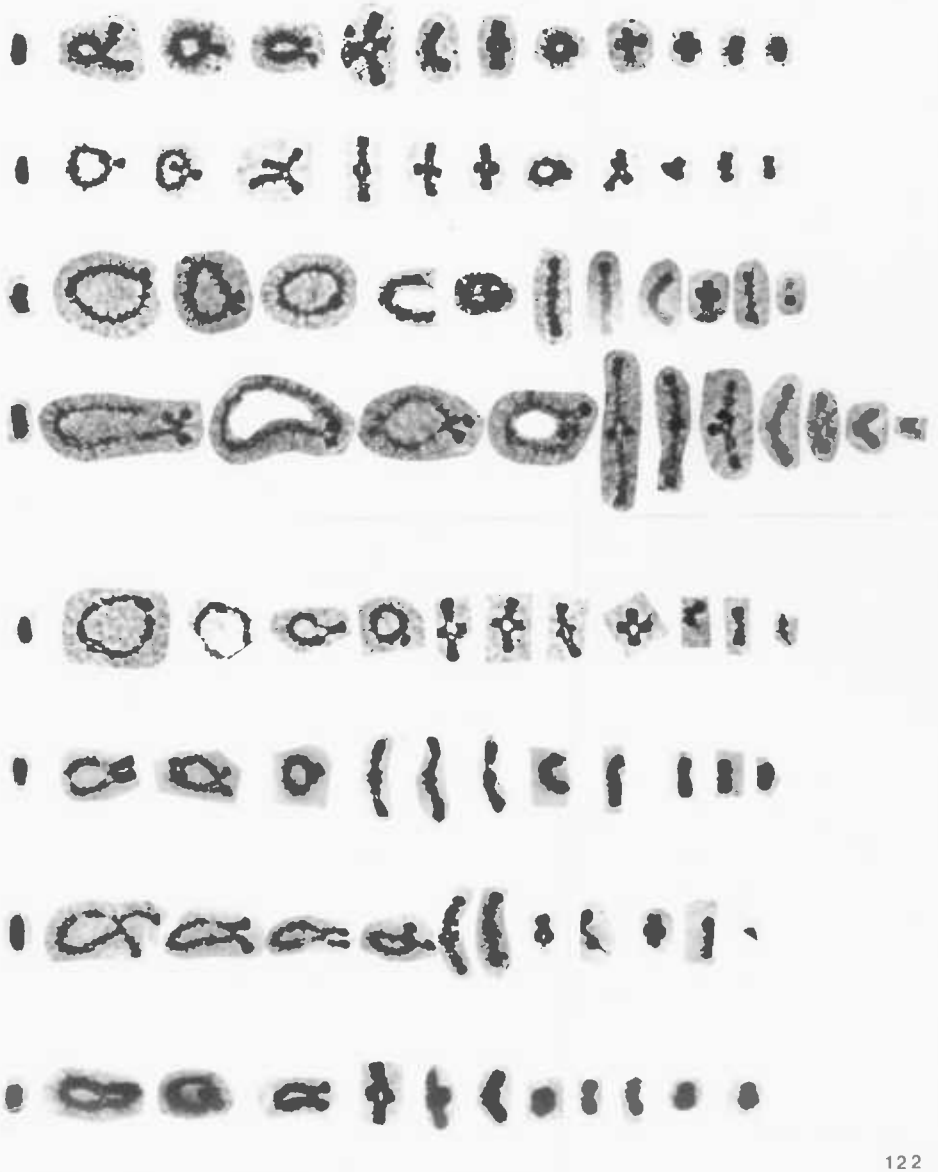
Meiosis in the spermatocytes of D. anatolicus (Krauss) collected from Iran (Fars, Kazerun)

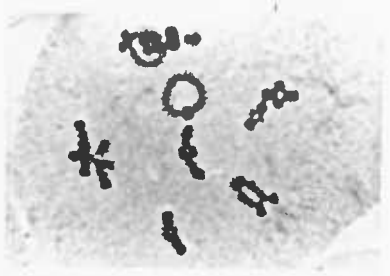
Mag. x 1500 (phase contrast)

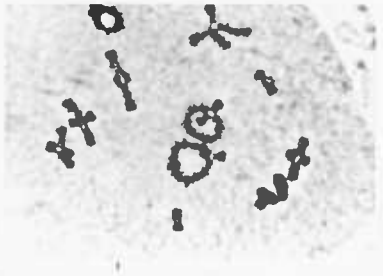
A-D Diakinesis

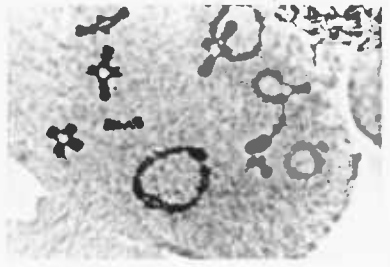
E,F Diplotene

G-M Diakinesis of D. anatolicus from castaneopicta




A


B


G


H

15. Dociostaurus (Notostaurus) albicornis (Eversmann, 1848)

Type:♀ Oedipoda albicornis Eversmann, 1848. Addit. quaedam levia ad Fischer de Waldheim. Orth. Ross., : 10, pl. A, fig. 3. USSR, Acad. Sci., Leningrad. Transferred to Dociostaurus by Kirby, 1910.

DIAGNOSIS. Male:

1. Phallic complex similar to those of D. cephalotes (Fig. 109) and D. anatolicus (Fig. 118). Apical penis valves erect, short, posteriorly thick. Bent inwards towards middle (as seen from above), apices attenuated with a less sclerotised projecting process on ventro-posterior edge. Cingular valves (Cv) thin, less sclerotised than penis valves, but with apex slightly surpassing those of apical valves. Arch of cingulum large, sclerotised and with a marked posterior protruberance in profile. Apodemes (Apd) well developed. Flexure very narrow with apical penis valves set at about 45° to it. Median dorsal confluence of basal valves (Bp) meeting upper end of flexure (Fx) at about 70°, not sloping down smoothly into it as in D. cephalotes and D. anatolicus. Basal penis valves large, widened anteriorly and strongly excurved as seen from above with a projecting process on their outer sides. Gonopore process (Gpr) relatively long, thick, sclerotised and concave in middle of its ventral margin. Spermatophore sac (Sps) small, connected to strongly sclerotised lower edge of basal penis valves (Bp).

Epiphallus very similar to that of D. cephalotes (see Figs. 110 and 126). Small lateral plates (Lp) which are not heavily sclerotised. Lophi (L) large with well defined margins; upwardly directed obliquely toward mid-line. Bridge (B) weakly sclerotised and its lower margin gently curved. Ancorae (A) slender and inclined inwards towards each other.

2. Smaller than D. anatolicus; general colouration dull greyish brown.

15. Dociostaurus (Notostaurus) albicornis (Eversmann, 1848)

Type: ♀ Oedipoda albicornis Eversmann, 1848. Addit. quaedam levia ad Fischer de Waldheim. Orth. Ross., : 10, pl. A, fig. 3. USSR, Acad. Sci., Leningrad. Transferred to Dociostaurus by Kirby, 1910.

DIAGNOSIS. Male:

1. Phallic complex similar to those of D. cephalotes (Fig. 109) and D. anatolicus (Fig. 118). Apical penis valves erect, short, posteriorly thick. Bent inwards towards middle (as seen from above), apices attenuated with a less sclerotised projecting process on ventro-posterior edge. Cingular valves (Cv) thin, less sclerotised than penis valves, but with apex slightly surpassing those of apical valves. Arch of cingulum large, sclerotised and with a marked posterior protruberance in profile. Apodemes (Apd) well developed. Flexure very narrow with apical penis valves set at about 45° to it. Median dorsal confluence of basal valves (Bp) meeting upper end of flexure (Fx) at about 70°, not sloping down smoothly into it as in D. cephalotes and D. anatolicus. Basal penis valves large, widened anteriorly and strongly excurved as seen from above with a projecting process on their outer sides. Gonopore process (Gpr) relatively long, thick, sclerotised and concave in middle of its ventral margin. Spermatophore sac (Sps) small, connected to strongly sclerotised lower edge of basal penis valves (Bp).

Epiphallus very similar to that of D. cephalotes (see Figs. 110 and 126). Small lateral plates (Lp) which are not heavily sclerotised. Lophi (L) large with well defined margins; upwardly directed obliquely toward mid-line. Bridge (B)
Ancorae (A) slender and inclined inwards towards each other.

2. Smaller than D. anatolicus; general colouration dull greyish brown.

3. Fastigium verticis (Fig. 123) broad, concave, as long as wide or sometimes wider than long. Lateral carinulae clear, parallel. General form pentagonal with rounded angles, its foremost angle almost touching line joining front edges of temporal foveolae as seen from above. Temporal foveolae longer and narrower than those of D. anatolicus, 1.5-1.75 times longer than deep and distinctly narrowed forward.

4. Frontal ridge flat, similar to that in D. anatolicus.

5. Head short, slightly projecting above line of pronotal profile. Vertex sloping sharply downwards into fastigium. Dorsal longitudinal carinula not as thick as in D. anatolicus and faint at rear of occiput.

6. Compound eyes elongate, longest axis about 2.5 times length of subocular groove but slightly wider and more inflated than those of D. anatolicus. Situated midway between front and back of head as seen from above. Ratio of longest to shortest axis about 1.2.

7. Antennae light (darker than those of D. anatolicus) and about 1.4 times length of head and pronotum together with relatively large scape.

8. Pronotum broader and weakly constricted in middle. Median dorsal carina less elevated than that in D. anatolicus. Metazona slightly longer than prozona. Lateral carinae weakly but clearly visible between sulcus 3 and front edge of pronotum; clear and strong on metazona. If developed, dull yellow lateral bands of 'X' shaped marking wider in metazona than in prozona and situated on lateral carinae. Darker brown longitudinal band usually present on outer side of each lateral carina on prozona and inner side of each lateral carina in metazona (Figs. 123,

130). Posterior margin of metazona rounded obtusangulate.

9. Apices of folded tegmina barely reaching knees of folded posterior femora. Precostal area always dark brown. Light raised line in costal area.

10. Posterior femora more robust than those in D. anatolicus. Dark dorsal bands or markings indistinct, usually extending onto inner and outer areas as dull brownish marks. Dorsal genicular lobes of inner and outer sides dark, with lower inner and outer lobes light (outer lower one sometimes dark).

11. Hind tibiae variable in colour - pale bluish, pale stramineus or pale reddish (latter in D. (N.) albicornis rubripes Mistshenko) and light at proximal end near knee.

12. Supra-anal plate (Fig. 127) (Sa) triangular with blunt apex and usually a transverse carinula at middle. Two lobes of last abdominal tergite (P) not widely separated and with rounded outer apical margins. Cerci (C) thin, slightly incurved and with apices level with tip of supra-anal plate (Sa).

13. For stridulatory pegs see under subspecies.

14. For chromosomes see general discussion.

Female:

1. General size much greater than that of male. Usually dark greyish brown, though sometimes lighter in colour, e.g. in D. albicornis turcmenus.

Blackish patterns along body. Tendency to melanic forms.

2. Temporal foveolae longer than deep, narrowing towards frontal ridge and with distinct margin. Margins very thick in D. a. turcmenus making foveolar pits quite small and narrow. Fastigium verticis strongly concave, usually wider than long; its anterior angle about 90°. Lateral margins of fastigium distinct and sharp.

3. Frontal ridge widened between antennal sockets, hardly depressed at level of median ocellus but strongly narrowed just below temporal foveolae.

4. Compound eyes rather small, longest axis of eye 1.75 times as long as length of subocular groove (compare with males).

5. Antennae slightly shorter than head and pronotum together, with relatively small scape and pedicel.

6. Disc of pronotum and lateral lobes rugose, punctate and somewhat wrinkled between transverse sulci. Metazona, nearly as long as prozona, with rounded posterior margin.

7. Tegminal apices not (D. a. albicornis) or only just reaching (D. a. turcmenus) tips of folded posterior femora. Very distinct separate spots in cubital and medial fields extending in a widely separated series between first radial vein (R_1) and first cubital vein (Cu_1) to distal half of tegmen. Light linear raised line in costal field.

8. Posterior femora and tibiae the same as in male.

MEASUREMENTS. See under subspecies.

DISTRIBUTION. Southern USSR, western Pakistan, northern and north-western Afghanistan. North-eastern and north-western Iran.

MATERIAL EXAMINED. See under subspecies.

DISCUSSION. The two described subspecies of D. albicornis both have identical male genitalia. The species differs from D. anatolicus in having a much higher number of stridulatory pegs (Figs. 124, 129) than in the latter (Fig. 113). Thus D. anatolicus has 42-62 pegs, while D. albicornis has up to 90.

KEY TO SUBSPECIES OF *D. albicornis*

Males.

General colouration darker. Body size smaller: length of tegmen (mm) 7.7-12, length of posterior femur (mm) 8.5-12.5, body length 13.5-20. Apices of folded tegmina barely reaching knees of folded posterior femora. Hind wings often colourless.

albicornis albicornis (Eversmann)

- General colouration lighter. General body form more elongate: length of tegmen (mm) 11.3-17.8, length of posterior femur (mm) 11.2-14.7, body length 18.5-24.5. Apices of folded tegmina reaching knees of folded hind femora. Hind wings usually rose at base.

albicornis turcmenus Uvarov

15a. Dociostaurus (Notostaurus) albicornis albicornis (Eversmann, 1848)

Type: as for species.

DIAGNOSIS. Smaller in size than subsp. turcmenus (see measurements) and with darker colouration. Folded tegmina with apices extending beyond knees of folded posterior femora. Stridulatory file with slightly more even peg spacing (Fig. 124) but samples measured very small.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	7.7-12.0	13.2-20.0
Length of posterior femur (mm)	8.5-12.5	12.0-18.0
Body length (mm)	13.5-20.0	22.0-28.5

MATERIAL EXAMINED.

USSR: 5♂, 4♀ Turkistan, 12.VII.12 (_____); 4♂, 6♀ Eastern Transcaucasus, 5.VII.24 (M. Siazov); 6♂, 6♀ Krym Karadagh, 25.VI.25 (Kistjakovsky); 3♂, 4♀ Alakol Lake region, 14.VIII.25 (N.V. Antonov).

W. Pakistan: 1♂ Baluchistan, Urak valley, 16 mls. from Quetta, 7000 ft., 8.VI.30 (_____); 1♀ Guam pass, Ziarat road, 7000 ft., 2.VII.30 (W.H. Evans); 5♂, 4♀ L. Hanna near Quetta, 6.VI.63 (G. Popov).

Afghanistan: 4♂, 6♀ Badakhshan, Kokschatal, Senna, 1800 m, 16.VII.53 (J. Klapperich); 5♂, 5♀ N. Herat, 1500 m, 20.V.73 (G. Popov).

Iran: 1♂ Shahrud, 18.V.14 (Kirirshenko); 2♂, 2♀ Moghan, 9.VI.58 (L.F.H. Merton); 6♂, 8♀ Moghan, Agh Dagh, 2.VII.58 (A.A. Soltani); 5♂, 5♀ Moghan, 17.VI.59 (H. Mirzayan); 7♂, 5♀ Moghan, 7.VI.73 (A.A. Soltani).

DISCUSSION. The subspecies were separated from each other by Uvarov, 1926 on the basis of size. There are few differences detectable between the chromosome complements of the two races, though the terminal heterochromatic segments of subsp. turcmenus on chromosome pairs 2, 3 and 5 seem to be larger. The chromosome characteristics (see Fig. 131, A-H) are tabulated below.

Locality		Autosome pair number										
Moghan steppe Iran	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	t	t	ti	t	t	t
	Chiasmata: Number	2-3	2	2	1-2	1-2	1	1-2	1-2	1	1	1
	Terminal heterochromatic segments (size)	med	sm	sm	sm	sm	med	med	med	med	sm	sm
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	a	s	s
	Chromosome length (%)	19.5	19.5	14.9	11.6	10.2	5.6	5.6	5.6	2.8	2.8	1.9

The terminal heterochromatic segments (t.h.s.) small to medium in size. Autosome pair 9 asymmetrical bivalents. Pair 6 are stable with one terminal chiasma. Pair 1-8 shown to have more than one chiasma.

D. albicornis albicornis lives in the north-western part of Iran whereas D. albicornis turcmenus lives in the north-eastern region of Khorasan. Two other subspecies are recognised in the literature D. (N.) albicornis rubripes and D. (N.) albicornis robustus. These were described in 1951 by Mistshenko. The first has reddish hind tibiae while the latter has a wider mesosternal interspace. I have examined the type material in Leningrad and am convinced that they are not sub-specifically distinct. Reddening of the posterior tibiae occurs in other species also (e.g. D. (N.) anatolicus) while the posterior tibiae of

D. maroccanus and D. brevicollis can be pale yellow. The mesosternal interspace characteristic is too variable in this species to be a dependable differentiating character. None of the Afghanistan material in the British Museum, though geographically the subspecies D. (N.) albicornis robustus has the required mesosternal interspace character said to be an essential character.

15b. Dociostaurus (Notostaurus) albicornis turcmenus Uvarov, 1926

Type: ♂ Dociostaurus albicornis turcmenus Uvarov, 1926h. Eos, Madrid, 2: 342. USSR, Tedzhen, _____ (_____). Acad. Sci., Leningrad.

DIAGNOSIS. Larger in size and generally lighter in colour, being pale straw yellow. Tegminal apices falling short of tips of folded posterior femora in females. Stridulatory file with wider range of variation in peg spacing (Fig. 129). File shows very even increase in peg intervals toward proximal and distal ends of file - overall more even in nominate subspecies.

MEASUREMENTS.

	Male	Female
Length of tegmen (mm)	11.3-17.8	13.8-17.2
Length of posterior femur (mm)	11.2-14.7	15.3-18.5
Body length (mm)	18.5-24.5	25.5-31.0

MATERIAL EXAMINED.

USSR: 2♂, 3♀ Golodnaja steppe, 14.V.15 (K. Kostrovsky); 1♂ Tedzhen, 20.VI.24 (_____) paratype; 1♀ Bairam-Ali, 15.V.23 (_____) paratype.

Iran: 1♂, 1♀ Khorasan-Kalat, 16.VII.26 (Shestoperow); 6♂, 8♀ Varamin, 7.VI.47 (H. Mirzayan); 5♂, 5♀ Sarakhs, 18.VII.58 (A.A. Soltani); 4♂, 5♀ Gorgan-Gonbad, 25.VI.59 (A.A. Soltani); 4♂, 3♀ Torbat-e-Heydarieh, 1600 m, 3.VII.64 (M. Descamps); 5♂, 3♀ Sarakhs, 27.VI.73 (A.A. Soltani); 6♂, 5♀ Darehgaz, 30.VI.73 (A.A. Soltani); 4♂, 6♀ Mashad-Aghonge, 2.VII.73 (A.A. Soltani).

DISCUSSION. Chromosomal characteristics are tabulated below (Figs. 132, A-Q; 131, J-P).

Locality		Autosome pair number										
Sarakhs & Aghonge Khorasan prov. Iran	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	t	t	t	t	t	t
	Chiasmata: Number	1-2	2	1-2	1-2	1-2	1	1-2	1	1	1	1
	Terminal heterochromatic segments (size)	sm	med	med	sm	med	sm	med	med	-	sm	-
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	a	s	s
	Chromosome length (%)	26.9	17.2	13.5	10.7	6.5	6.9	5.4	5.3	3.3	3.2	2.1

The terminal heterochromatic segments (t.h.s.) small to medium in size. Chromosome pair 9 asymmetric bivalent. Subspecies not much different from each other though t.h.s. of pair 2, 3, 5 are larger in D. albicornis turcmenus, pair 6 are stable in both subspecies with one terminal chiasma and also both subspecies can show more than one chiasma in pair 1-8.

The characters separating this subspecies from the nominate race are very weak and synonymy of the two may be necessary after more material has been studied. It is clear that more knowledge of the field biology of the two races would be helpful in coming to a final conclusion.

D. albicornis (Eversmann)

FIG. 123 Head and pronotum from above

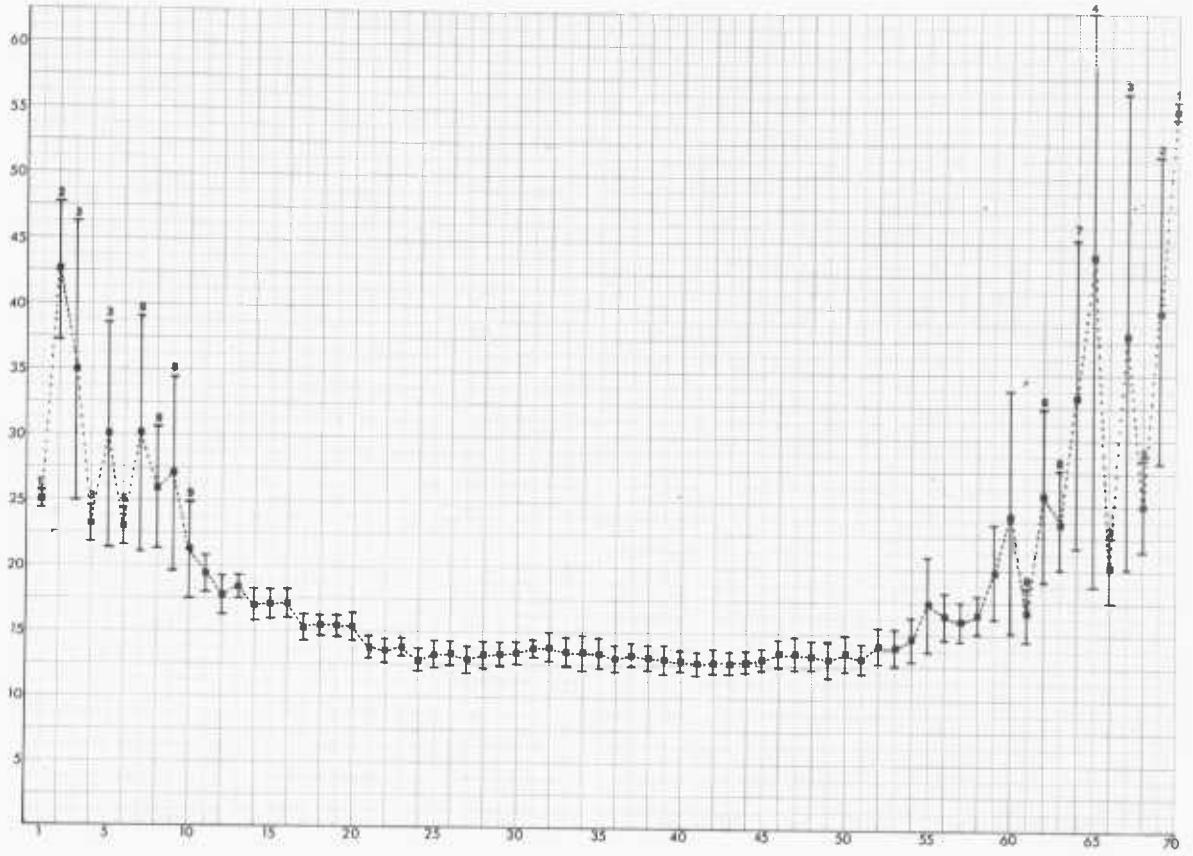
FIG. 124 Stridulatory peg graph showing variations in peg intervals of 10 specimens (collected from Iran)

FIG. 125 Phallic complex, side view

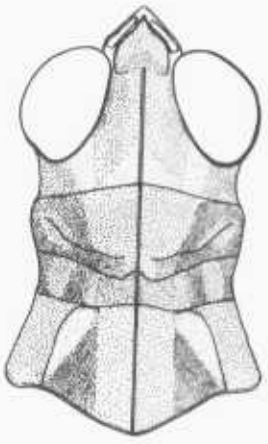
FIG. 126 Epiphallus, dorsal view

FIG. 127 Supra-anal plate and cerci from above

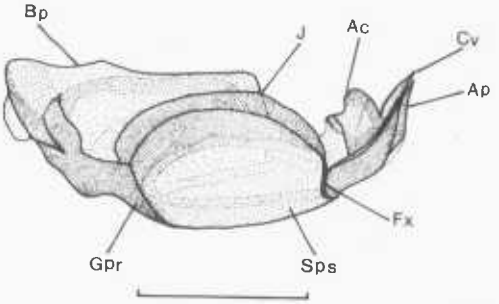
FIG. 128 Epiphallus of Mizonocara robusta Mistshenko, dorsal view (paratype)



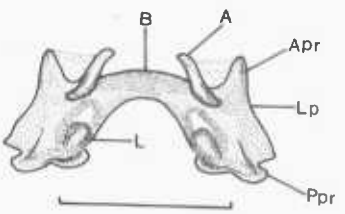
124



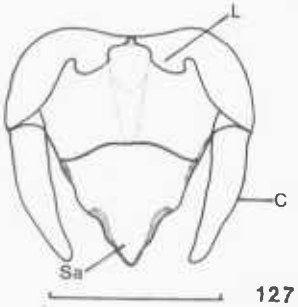
123



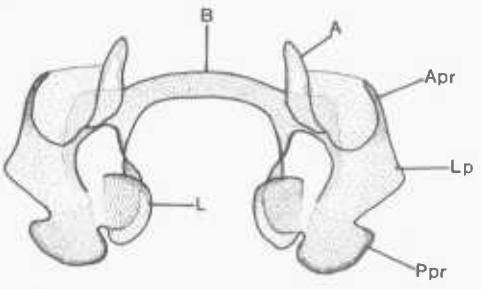
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126



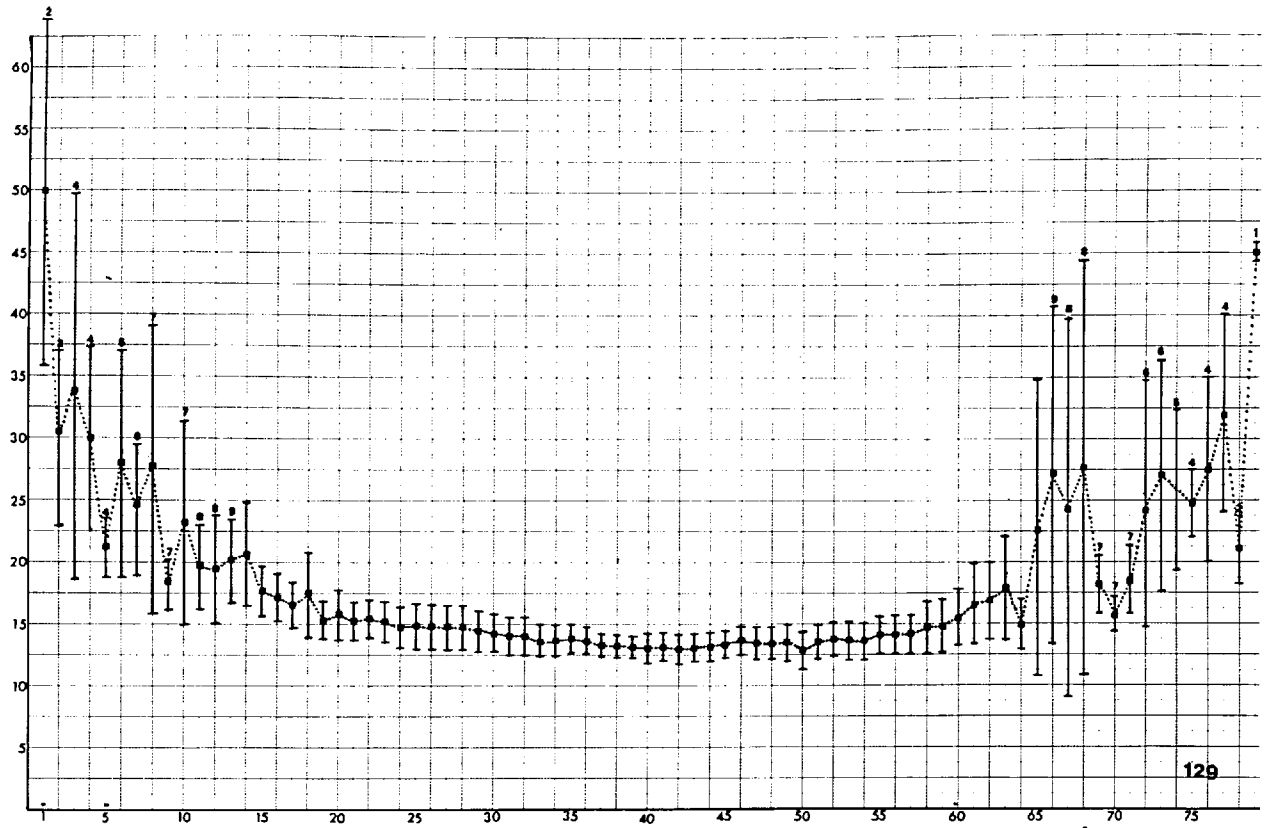
127



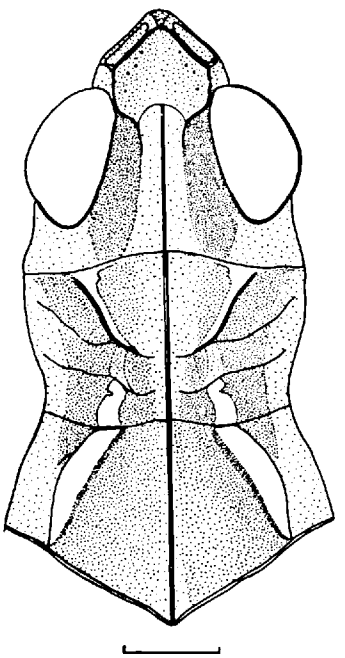
128

FIG. 129 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. albicornis turcmenus Uvarov.

FIG. 130 D. albicornis turcmenus Uvarov (paratype). Head and pronotum from above.


60
55
50
45
40
35
30
25
20
15
10
5
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75

129



130

PLATE 131

Meiosis in the spermatocytes of D. albicornis (Eversmann) collected from Iran

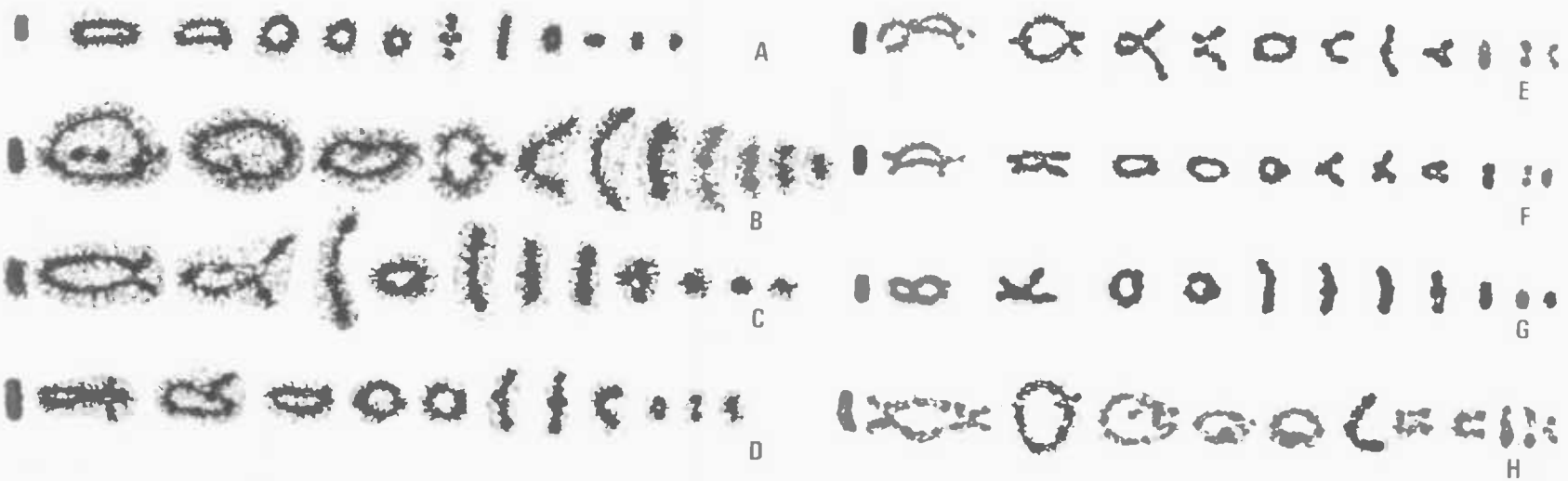
Mag. x 1500 (phase contrast)

A–H Diakinesis of D. albicornis albicornis (Eversmann) (Azarbaijan, Moghan)

J–L Diakinesis of D. albicornis turcmenus Uvarov (Mashad, Aghonge)

M Diplotene of D. albicornis turcmenus Uvarov (Mashad, Aghonge)

N–P Diakinesis of D. albicornis turcmenus Uvarov (Sarakhs)


A
B
C
D
E
F
G
H


J
K
L
M
N
O
P

PLATE 132

Meiosis in the spermatocytes of D. albicornis turcmenus Uvarov,

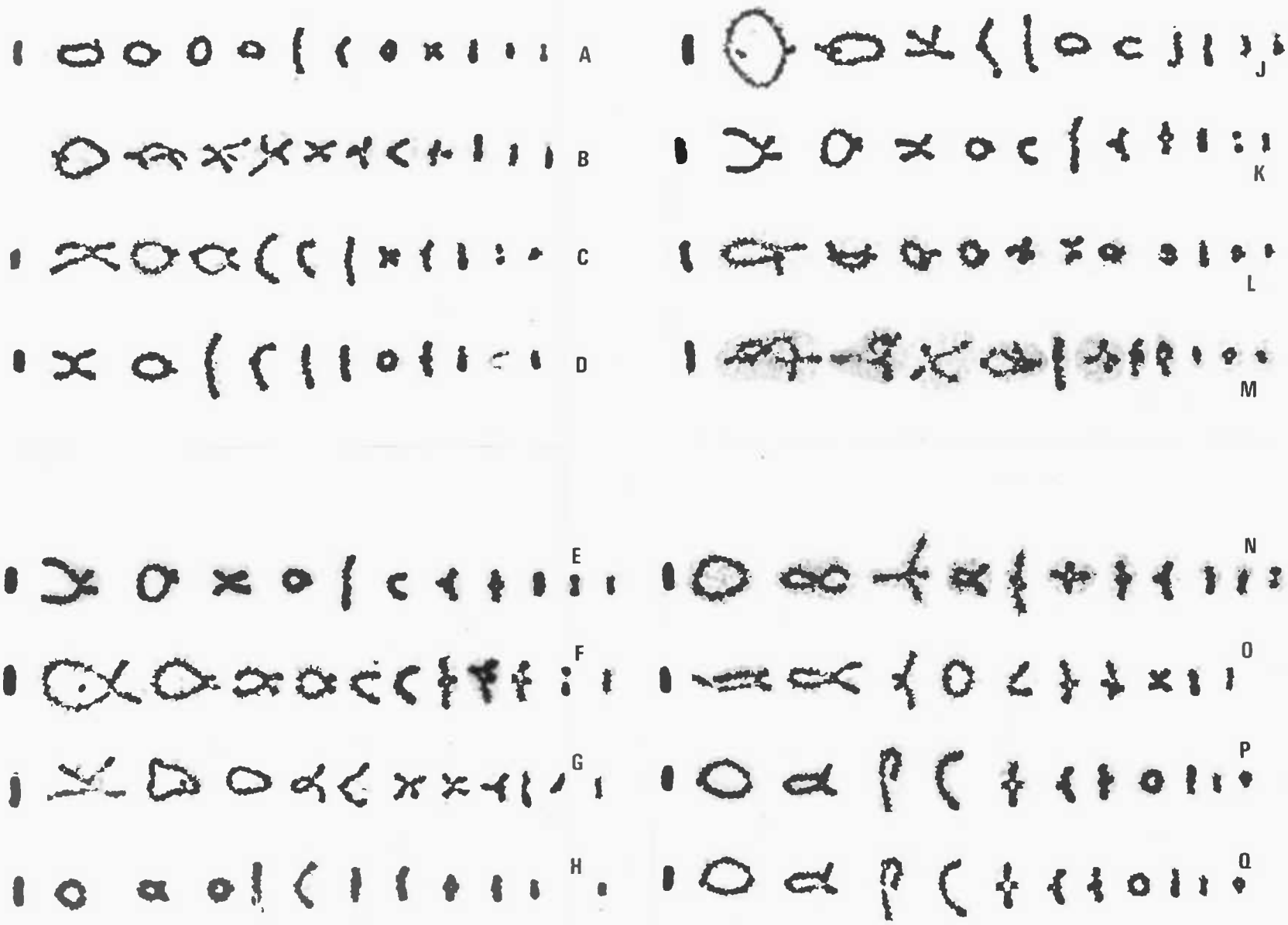
Iran, Sarakhs

Late diplotene Mag. x 1500

A-O Phase contrast

P Normal illumination

Q Phase contrast


A
B
C
D
E
F
G
H
J
K
L
M
N
O
P
Q

16. Dociostaurus (Notostaurus) popovi (Miram, 1935)

Type: ♂ Notostaurus popovi Miram, 1935. Trudy tazhik. Fil. Akad. Nauk. SSSR, 5: 230, fig. 9-11. S. Tadzhikistan, Kuljab, Tibaljej mt., 18.VII.33 (Popov). Academy of Sciences of USSR, Leningrad.

SYNONYMY. See under subspecies.

DIAGNOSIS. Male:

Phallic complex (in lateral view) (Figs. 136, 138) relatively robust. Shape of apical penis valves (Ap) similar to that of D. (N.) cephalotes and of typical form for subgenus Notostaurus. Seen from above, apical valves with outer margins widened at mid-point, apically convergent and coming to a triangular depressed point at apex. Apical valves narrowed from mid-point towards flexure (Fx). Cingular valve (Cv) slightly longer than apical penis valves, with apex narrowly higher than dorsal level of cingular arch (Ac) as seen in side view. Arch of cingulum small (see Fig. 138 for D. (N.) popovi comtulus, where shape of cingular arch is undistorted by dissection as is that in D. (N.) popovi popovi which was removed from a young insect). Basal valves (Bp) large. Flexure (Fx) thin and narrow.

Epiphallus typical of those in subgenus Notostaurus (Figs. 135, 137).

The external characters of this species have been well described by Miram (1935). It resembles D. cephalotes in male genital structure, in size and general appearance, e.g. it has short wings and a relatively low number of stridulatory pegs (48). It differs from D. cephalotes in the following respects:

(i) Head more robust and the shape of head different (Figs. 107 and 133) especially in region of vertex. Fastigium verticis slightly wider than long. Frontal ridge flat. Temporal foveolae flat. Compound

eyes not as large as in D. cephalotes.

(ii) Pronotum with metazona shorter than prozona but not as short proportionately (Fig. 107 and 133) as in D. cephalotes and median dorsal carina more elevated. Lateral carina in prozonal disc not very distinct and not curved.

(iii) Supra-anal plate more elongate (Figs. 108 and 134, Sa) with blunt posterior tip. Apex with long hans in popovi.

(iv) Two median lobes (P) on posterior margin of hindmost abdominal tergite close together, their tips rounded and inner margins oblique to long axis of body.

(v) Cerci long and narrow, their apices level with or slightly surpassing tip of supra-anal plate (Sa).

MEASUREMENTS, MATERIAL EXAMINED AND DISTRIBUTION. See under subspecies.

KEY TO SUBSPECIES OF D. popovi

Males.

Phallic complex larger (Fig. 136); apical valves of penis (Ap) thicker and basal valves of penis (Bp) longer and narrower towards posterior part. Gonopore process (Gpr) longer and thinner. Flexure oblique (Fx). Epiphallus with wider lateral plates (Lp). Bridge (B) relatively narrow. Ancorae (A) thick and short. Lophi (L) large. Posterior projections (Ppr) thicker. Wings and tegmina longer (see measurements); posterior tibiae yellow.

D. (Notostaurus) popovi popovi (Miram)

- Phallic complex smaller (Fig. 138); apical valves of penis (Ap) thinner and basal valves of penis (Bp) shorter and deeper towards posterior part. Gonopore process (Gpr) short and thick. Flexure vertical (Fx). Epiphallus with narrow lateral plates (Fig. 137, Lp). Bridge attenuated and wide (B). Ancorae (A) very long and erect. Posterior projections (Ppr) thinner. Lophi (L) smaller and rounded in profile. Tegmina and wings shorter (see measurements); posterior tibiae reddish.

D. (Notostaurus) popovi comtulus Mistshenko

16a. Dociostaurus (Notostaurus) popovi popovi (Miram, 1935)

Type as for species.

DIAGNOSIS. See key, p. 203.

MEASUREMENTS. (After Miram)

	Male	Female
Length of tegmen (mm)	9.5	5.2
Length of posterior femur (mm)	14	16
Body length (mm)	20.5	24

DISTRIBUTION. USSR, southern Tadzhikistan nr. Kulyab.

MATERIAL EXAMINED in addition to material studied in Leningrad Museum. USSR: 1♂ Tadzhikistan, Hessar, 5.VII.35 (L. Mistshenko); 1♀ Tadzhikistan, W. Darvas, Dashti-Chinor, 26.6.56 (K. Lopatin).

DISCUSSION. Material available for study was miniature and this does make a difference to the morphology of the male genitalia as prepared for this research. Mistshenko differentiated the subspecies on tibial colouration only. This by itself is usually an insufficient basis on which to found subspecies in this genus and more material is required before a final decision can be taken on the validity of the subspecies described here. The male genitalia do seem to show conspicuous differences but how much variation is involved here is not known.

16b. Dociostaurus (Notostaurus) popovi comtulus Mistshenko, 1951

Type: ♂ Notostaurus popovi comtulus Mistshenko, 1951. Opred. Faune SSSR, Moscow, 40: 447. USSR probably southern Tadzhikistan, near

Stalinabad, _____ (_____).

MEASUREMENTS. (After Mistshenko)

	Male	Female
Length of tegmen (mm)	6.7	8.7-8.9
Body length	15.4	23.6-25.1

DISTRIBUTION. USSR, southern Tadzhikistan, near Stalinabad.

D. popovi (Miram)

FIG. 133 Head and pronotum from above

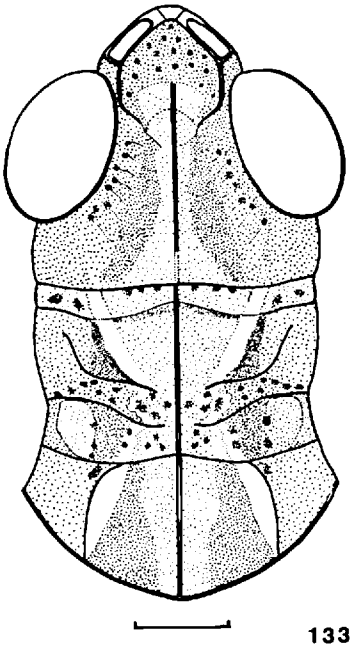
FIG. 134 Supra-anal plate and cerci from above

FIG. 135 Epiphallus from dorsal view (holotype)

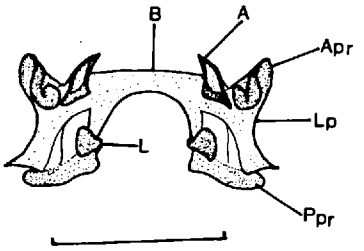
FIG. 136 Phallic complex, lateral view (holotype)

FIG. 137 Epiphallus of D. popovi comtulus (holotype)

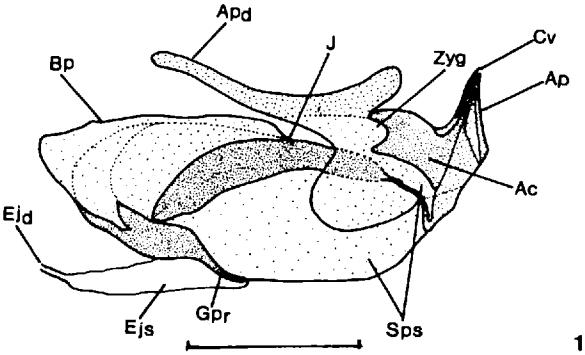
FIG. 138 Phallic complex of D. popovi comtulus (holotype)



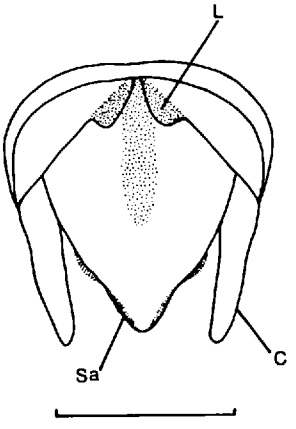
133



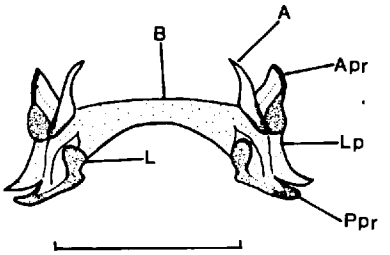
135



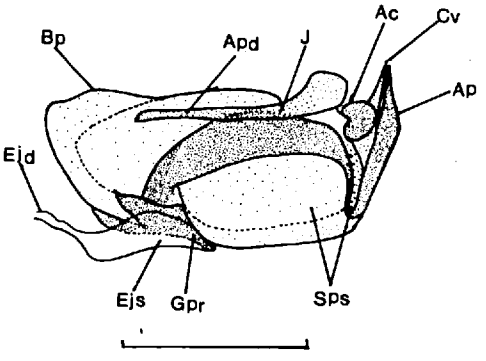
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137



138

17. Dociostaurus (Stauronotulus) hauensteini (I. Bolivar, 1893)

Type:♂ Stauronotus hauensteini Bolivar, 1893a. Rev. Biol. Nord France, 5: 481. Ouadys, Dead Sea coast. Probably in Madrid Museum.

SYNONYMY. Stauronotus crassiusculus, var. cappadocicus Azam, 1913, Bull. Soc. Ent. France, No. 8, 219. Cotype ♂, Turkey, Cappadocia. Syn.n.

Dociostaurus kurdus Uvarov, 1921, Bull. ent. Res., 11(4): 401, 406. (Type ? Iraq, Kurdistan, Museek and Vezne, VI.1914 (P. Nesterov), probably Acad. Sci., USSR, Leningrad). Syn.n.

DIAGNOSIS. Male:

1. Apical penis valves (Ap) (Figs. 140, 141, 149, 153) with apices level with or falling slightly short of cingular valves (Cv). Phallic complex as a whole relatively short and deep. Apical valves narrowed near flexure (Fx) with a projection on ventro-posterior margin. Latter covered with pocket shaped membrane or sheath making upper part of apical penis valves wider and thicker than lower part (Fig. 140), and apically blunt. Cingular valves (Cv) with regularly upcurved upper profile shaped like a Gaussian distribution curve, these lobes touching dorsally on mid-line and fused. Thus base of cingular valves joined by membrane. Dorsal profile at base very close to back of cingular arch (Ac).

Anterior surface of cingular valves with a few scattered spinose spots. Arch of cingulum comparatively small, thick, sclerotised and heart shaped, as seen from above. Upper side of cingular arch concave in part connected to zygoma. Apodemes (Apd) thick and robust. Rami of cingulum (Rm) large, with a rounded upper margin. Median dorsal flange of basal penis valves meeting upper end of flexure (Fx) at right angles and well elevated above it (compare with that in subgenus Notostaurus, Fig. 118). Flexure (Fx) thin and well sclerotised. Basal valves of penis (Bp) widened with a rounded and thickened anterior margin. Anterior margin round in profile, not produced and pointed. Spermatophore sac (Sps) small with a very thick margin. Ejaculatory sac (Ejs) large. Ejaculatory duct (Ejd) thick and elongate (Fig. 142, 146).

Epiphallus with short, thick, strong bridge (B) (Figs. 144, 145) its upper edge heavily sclerotised. Ancorae (A) rather short, apically blunt and broad at base. Anterior projections (Apr) broad and decurved; rest of lateral plates large (Lp). Posterior projections of lophi (Ppr) very short, thickly sclerotised and closely attached to lophi (L). Lophi (L) relatively large, close to each other, with a distinct margin on outer aspect. Lophi and their posterior projections strongly oriented upwards.

It is clear from figures of male phallic complex (Figs. 140, 141, 149, 153) that penis valves are variable. Unfortunately, with material so far examined, no division into subspecies can be based on morphology of penis valves. Likewise, while epiphallus (Figs. 144, 145, 148, 152) is often of use in defining subspecies in other Dociostaurus species, here its morphology is fairly stable from subspecies to subspecies.

2. General colouration very variable. Light or dark brownish grey or greyish yellow with yellow or darker brown or greyish patterns. Body proportions stocky; most robust and massive in subsp. kurdus, most elongate in subsp. farsistanicus (Fig. 139).

3. Fastigium verticis slightly concave, from slightly longer than wide (subsp. hauensteini) to wider than long (subsp. elbursianus). Horizontal to slightly sloping forwards.

Temporal foveolae pitted (as in subsp. cappadocicus) to smooth (as in subsp. kurdus). Rim clearly marked, usually matte, but smooth and shiny in subsp. elbursianus. Proportions always such that length greater than depth (Figs. 139, 146, 151).

4. Frontal ridge with margins ending just below ocellus (as in subsp.

kurdus) to reaching almost down to level of clypeus (as in nominate subspecies). Usually slightly depressed at ocellus but convex at level of antennal sockets. Sides sub-parallel in subsp. kurdus, but slightly widened between antennal bases in other subspecies. Narrowest and most deeply impressed near ocellus in subsp. iranicus.

5. Head only slightly elevated above level of pronotum. Frons more or less vertical to sloping weakly backwards in profile. Weakly rugose above with a weak median carinula in subsp. cappadocicus.

6. Length to width of compound eyes about 1.3. Longest axis slightly greater to 1.7 times length of subocular groove.

7. Antennae slightly longer than head and pronotum as viewed from above. Lighter in colour than body.

8. Pronotum. Prozona equal in length to metazona or distinctly longer (former state in subsp. hauensteini). Disc rather broad; strongly rugose in subsp. kurdus to less so in other subspecies. Lateral carinae weak but entire between sulci 2 and 3, e.g. subsp. farsistanicus, Fig. 139, to absent in that region. Pronotum only slightly constricted (least so in subsp. cappadocicus). Distance between sulci 2 and 3 at point of traverse by lateral carinae normally equal to that between transverse sulci 3 and 4, though of different proportions (1:2) in subsp. farsistanicus. Light lateral bands or markings of pronotal disc wider in metazona than prozona and narrowest between transverse sulci 2 and 3. Light bands absent or weak in prozona of subsp. elbursianus. Light bands very wide in subsp. cappadocicus, Fig. 151 (compare with Figs. 139, 146). Lateral and median carinae dark, dull and shiny in subsp.

elbursianus. Lateral carinae not elevated in subsp. iranicus. Metasternal interspace in subsp. elbursianus about twice as wide as long, in subsp. iranicus ratio about 1.5:1, while in other subspecies about 1:1 (see Figs. 154, 155, Mti). Posterior dorsal margin of pronotum obtuse angular to rounded.

9. Tegmina variable in length. Tips of folded tegmina never level with knees of folded posterior femora but always covering half of abdomen.

10. Posterior femora thick and powerful with 3 dorsal spots indistinct in subsp. elbursianus, and farsistanicus. If spots distinct then extending to some extent onto inner area. Posterior femora with knee black. Inner area sometimes pink in subsp. hauensteini, inner and lower side being red, coral red or light red in subsp. cappadocicus, elbursianus, kurdus. No pink colour in farsistanicus.

11. Hind tibiae normally red in nominate subspecies but yellow in material from Gilan near Teheran. Red pigment, if present, fainter towards knee with black annulus at proximal tip.

12. Supra-anal plate and rear edge of last tergite of abdomen distinctive in this species (Fig. 150). Tergite lobes very large, half covering supra-anal plate. Cerci short, their apices not surpassing tip of supra-anal plate. Latter as wide as long.

13. Number of stridulatory pegs (Figs. 158 and 159) very variable from 22-32 in subsp. hauensteini to 50-60 in elbursianus.

14. Chromosome set of great interest in showing an intriguing association

of small 10th autosome pair with unpaired X (see Fig. 157).

Female:

1. General colouration as for males.

2. Head short, robust. Fastigium verticis always wider than long and twice width of frontal ridge at level of antennal bases in subsp. cappadocicus. Front angle about 90°. Temporal foveolae small in subsp. kurdus, longer than wide in all cases with margins variably defined.

3. Frontal ridge usually widened between antennal bases, broad and flat to slightly concave at ocellus.

4. Relatively small, longest axis 1.15 (subsp. cappadocicus) to 1.3 times (subsp. hauensteini) longer than sub-ocular groove.

5. Antennae dull in colour, slightly longer than length of head and pronotum together.

6. Pronotum broad with prozona equal to or shorter than metazona. Disc tectiform and rugose in subsp. elbursianus. Lateral carinae between sulci 2 and 4 may be very irregular.

7. Tips of folded tegmina reaching halfway along abdomen or even level with tips of folded posterior femora in Israel material of subsp. hauensteini. Tegminal spotting usually present but absent in subsp. elbursianus.

8. Posterior femora - as for males.

9. Posterior tibiae - as for males.

DISTRIBUTION & MATERIAL EXAMINED. See under subspecies.

DISCUSSION. D. (S.) hauensteini has a wide range of distribution (see ranges under subspecies) and is the most variable species, both in size and dimensions, in the whole genus. The species inhabits localities from 200 m to 2500 m above sea level. Within limits the genital morphology shows the same variation over the whole range. The strong thickly sclerotised epiphallus and membranous pocket covering the penis valves are characteristic of the subgenus Stauronotulus. In brachypterous races e.g. cappadocicus, elbursianus and farsistanicus the form of the gonopore processes (Gpr) seems related to altitude of habitat, being longer at lower altitudes and in moister regions. Tegmina and wings do not vary in length very much up to habitat elevations of 800 m. In these regions the male tegmina and wings just reach the apex of the abdomen, while in the female the tips of the folded tegmina are level with or surpass the abdominal tip. From 1000-2500 m wing length abbreviation becomes marked and the wings are much shorter than the tegmina. In contrast to the position seen in many other species, high altitude forms are longer more powerful insects. These large races are seen in the Elburz and Zagros mountains of Iran.

The number of stridulatory pegs also correlates with habitat altitude. D. (S.) hauensteini hauensteini at low altitudes has low peg numbers (22-32) while D. (S.) h. elbursianus has 50-60 pegs at high altitudes.

Material for this study was lent by museums in Leningrad, Madrid, Berlin and Paris. Paratypes of subsp. elbursianus and kurdus were studied at the British Museum. In addition material was sent to me by Mr H Mirzayan from Iran and collected personally by myself in Iran and Israel.

Subspecies recently added to the Dociostaurus hauensteini complex are D. h. iranicus Ramme, 1951 and D. h. farsistanicus Descamps, 1967 (originally described as a new species). The type locality of subsp. iranicus was recorded as Hashtar in the Persian Elburz mountains. The locality name may be in error and could be:

Hashtjerd - a low altitude locality in the western Elburz between Tehran and Qazvin,

or Hashtpar - in north-western extreme of the Elburz foothills near the Caspian Sea.

It follows that subspecies iranicus lives in the western Elburz and subsp. elbursianus lives in the eastern Elburz up to Bojnurd in Khorassan province. D. h. iranicus is much closer morphologically to D. h. hauensteini than is D. h. elbursianus. It lies between the two, since the latter has a higher number of stridulatory pegs and rather uniform tegminal pigmentation, while the former has a lower number of pegs, slightly smaller average size and variegated patterning on the tegmina. Further collecting and ecological study may lead us to synonymise subspecies hauensteini with subspecies iranicus in the future.

D. h. kurdus was described briefly by Uvarov in 1921. The unique female paratype in the British Museum has a locality label indicating Museck in Kurdistan. This locality is untraceable, but further good series of both sexes from Kordestan, Esfahan and Fars provinces of Iran were lent to me by Mr Mirzayan and it has been possible subsequently to divide D. h. kurdus and D. h. farsistanicus into two groups in the Zagros mountain chain. This mountain range extends from north-western Kordestan to south-western Fars. Specimens of D. h. kurdus from high altitudes in the northern Zagros (Sanandaj-Kermanshah; Asadabad-Hamadan; Khunsar near Oshtoran Kuh) are larger in size (especially in females), darker in colour and have a higher number of stridulatory pegs (39-48). In the

middle of the Zagros chain (Charmahal-Bakhtiari) around Zardkuh, the size of the insect is slightly smaller, general pigmentation a much lighter straw-yellow and number of pegs lower (36-40). Finally in the southern Zagros (Dinar, Kakan, Komehr, Sisakht - north west of Shiraz) size is still smaller and the number of pegs lowest (32-36). It is this last group to which the subspecific name farsistanicus has been applied. Thus the Zagros populations show a good cline extending from subspecies kurdus in the northern Zagros to subspecies farsistanicus in the southern high altitude areas of the range.

KEY TO SUBSPECIES IN D. hauensteini

Males.

1. Light bands on inner sides of lateral carinae absent between transverse sulci 2 and 4 (Fig. 151). Remains of pattern confined, therefore, to front of prozona and to metazona only. Each band two times longer than wide.

D. hauensteini cappadocicus (Azam)

- Light bands on inner sides of lateral carinae usually present between sulci 3 and 4 but may be faint between sulci 2 and 3. Bands in front of transverse sulcus 2 at least 4 times longer than wide; those behind transverse sulcus 4 also at least 4 times longer than wide.....2

2. Pronotal prozona equal in length to, or less than length of metazona. Stridulatory file with 22-32 pegs and showing relatively little variation. Apices of folded tegmina lying between mid-point and apex of hind femur.

D. hauensteini hauensteini (I. Bolivar)

- Pronotal prozona longer than metazona. Stridulatory file with 32-60 pegs. Apices of folded tegmina usually only reaching to mid-point of abdomen, but in D. h. iranicus sometimes surpassing this point though never level with apex of hind femur.....3

3. Fastigium verticis wider than long. Lateral carinal markings (light bands) not clear in metazona. Tegmina unmarked or very faintly so. Number of stridulatory pegs 50-60. Rim of fastigium verticis shiny and clearly marked.

D. hauensteini elbursianus Uvarov

- Fastigium verticis longer than wide or of isometric proportions. Lateral carinal markings (light bands), whether elevated or not, clear in prozona and metazona. Tegmina with clear darker markings. Number of stridulatory pegs 32-53. Rim of fastigium verticis matte

and less clearly marked.....4

4. Interspace between transverse sulci 2 and 3 at point of traverse by lateral carinae, half that between 3 and 4. Hind femora lacking pink pigment.

D. hauensteini farsistanicus Descamps

- Interspace between transverse sulci 2 and 3 at point of traverse by lateral carinae sub-equal to that between sulci 3 and 4. Hind femora often bearing pink pigment.....5

5. Pronotal disc rugose with distinct, elevated light 'X' shaped bands. Total length 22.5-30.0 mm; tegminal elngth 7.7-10.0 mm; hind femora 13.5-17.0 mm.

D. hauensteini kurdus Uvarov

- Pronotal disc smooth with light 'X' shaped marking but these bands not elevated. Total length 19.5-24.5 mm; tegminal length 9-10.4 mm; hind femora 12.3-14.5 mm.

D. hauensteini iranicus Ramme

17a. Dociostaurus (Stauronotulus) hauensteini hauensteini (I. Bolivar, 1893)

Type:♂ For name and data see under species.

SYNONYMY.

Dociostaurus kervillei Bolivar, 1911. Bull. Soc. Sci. nat. Rouen, XLVII: 36 (type♂?, Lebanon, Baalbek _____ (_____) probably Madrid Museum) Syn.n.

DIAGNOSIS. See under key, p. 215.

MEASUREMENTS.

	Male	Female
Length of hind femur (mm)	8.9-13.0	14.0-16.1
Length of tegmina (mm)	6.6-12.3	11.4-18.0
Length of body (mm)	15.5-22.7	23-28.5

DISTRIBUTION. South-western USSR, Iran, north-eastern Iraq, Turkey, Syria, Jordan, Lebanon, Israel.

MATERIAL EXAMINED.

USSR: 1♂, 1♀ Armenia, Tangezur, 14.VI.25 (M. Rialov); 3♂, 4♀ Armenia, near Eriwan, 28.VI.25 (_____); 2♂, 2♀ E. Transcaucasia, VI.25 (M. Siazov).

Iran: 3♂, 2♀ Tajrish - Tehran, 11.VI.27 (M. Siazov); 2♂, 4♀ Bushehr, 12.V.27 (M. Siazov); 1♂, 1♀ Esfahan, 30.V.27 (M. Siazov); 2♂, 3♀ Jabal - Barez, 3.V.48 (P. Aellen); 1♂, 2♀ Tehran, 14.VIII.48 (P. Aellen); 1♂, 1♀ Gilan, 2.VI.50 (Salavatian); 5♂, 6♀ Kuh Genau, 40 km N. of Bandar Abbas, 20.IV.50 (G. Popov); 5♂, 5♀ Lar, 4.V.50 (G. Popov); 2♂, 2♀ nr. Shiraz, 1500 m, 7.V.50 (E.P. Wiltshire); 1♂, 1♀ Kuh - Genau, 12.V.50 (Fasihi); 2♂, 3♀ Khosravi, 15.V.50 (Mirzayan); 3♂, 4♀ Darab, 2.IV.52

(Mirzayan); 4♂, 6♀ Mehran, 25.IV.52 (Salavatian); 6♂, 6♀ Mehran, 16.IV.56 (A. Soltani); 2♂, 2♀ Gargan - Minu Dasht, 10.V.56 (A. Soltani); 5♂, 6♀ Moghan, __VI.57 (A. Soltani); 4♂, 4♀ Azerbaidjan, Moghan, 9.VI.58 (L.F.H. Merton); 2♂, 3♀ Azarbaidjan, Khoy, 7.VI.59 (E.S. Brown); 4♂, 3♀ Tehran, Damavend, 5.VII.60 (E.S. Brown); 2♂, 2♀ Azarbaidjan, Azarshahr, 23.V.54 (M. Descamps); 3♂, 2♀ Behbahan, 26.V.64 (Ayatolahi-Zairi); 4♂, 2♀ Azarbaidjan - Moghan, 28.V.64 (M. Descamps); 2♂, 1♀ Ahar-Tabriz, 5.VI.64 (M. Descamps); 2♂, 2♀ Sarab-Ardabil, 6.VI.64 (M. Descamps); 2♂, 1♀ Tehran - Amol - Plur, 2300 m, 28.VI.64 (M. Descamps); 4♂, 4♀ Jiroft, 11.V.68 (H. Mirzayan and A. Pazuki); 4♂, 3♀ Sarakhs, 20.V.68 (A. Soltani); 2♂, 3♀ Kashan-Barzok, 2.VI.70 (Mirzayan); 5♂, 5♀ Fars - Kazerun, 27.IV.73 (A. Soltani); 4♂, 5♀ Dehloran, 3.V.73 (A. Soltani); 6♂, 3♀ Azarbaidjan, Moghan, 2.VI.73 (A. Soltani).

Iraq: 1♂, 1♀ Kurdistan, Penjwin, 4500 ft, 25.VI.28 (N. Scott); 3♂, 3♀ Kurdistan between Sulymanieh and Penjwin, 1500-3000 ft, 28.V.32 (Uvarov).

Turkey: 4♂, 3♀ Diarbeker, 15.VI.30 (M. Sureya); 2♂, 3♀ Ankara, 16.VI.30 (M. Sureya); 4♂, 4♀ Antitaurus, Maras Kardak, 1900 m, 24.VII.52 (P.H. Davis); 5♂, 4♀ Ankara, 1000 m,(20-30).VI.59 (K.M. Guichard); 3♂, 2♀ Kassan Oglan, 30 km Ankara, 1000 m, 8.VII.59 (K.M. Guichard); 4♂, 2♀ Ankara, 39 km E. of Kirikdale, Yenihan, 1.VII.60 (K.M. Guichard & D.H. Harvey); 3♂, 3♀ Ispir, 1200 m, 31.V.62 (Guichard & Harvey); 2♂, 12♀ Siaras, Salar pass, 19.VII.69 (W.G. Tremewan); 6♂, 6♀ Konya, 17.VII.72 (G. Popov).

Syria: 3♂, 4♀ Beralbok, 16.V.35 (Werner); 2♂, 2♀ Damascus, __V.45 (G.H.Q.; M.E.F.); 5♂, 3♀ Tekieh, 14.VI.45 (Middle East Biological Studies Scheme, G.H.Q.; M.E.F.); 3♂, 3♀ Aleppo, 28.V.46 (E.S. Brown).

Lebanon: 3♂, 2♀ Talia Nbekaa, 3.V.51 (A.R. Waterston); 5♂, 3♀ Rasal

Baalbek, 3.V.51 (A.R. Waterston); 2♂, 3♀ Dahr el Beidar, 10.VII.52 (A.R. Waterston).

Israel: 1♂, 1♀ Wadi Kelt, 18.IV.23 (P.A. Buxton); 2♂, 3♀ E. Nebron to Ein Jedi, __V.34 (O. Theodor); 2♂, 2♀ Jerusalem, 29.IV.36 (ex. coll. H.B. Johnston); 1♂, 1♀ Jerusalem, 23.V.63 (Blondheim); 1♂, 2♀ Arad, 27.V.65 (_____); 2♂, 1♀ Beil Techem, 4.IV.68 (Blondheim); 1♂, 1♀ Manzura, 27.V.68 (Blondheim); 1♂, 1♀ Man Elias, 14.VI.68 (Blondheim); 3♂, 1♀ Maala Ha Adumin, 22.IV.69 (Blondheim); 1♂, 1♀ Jerusalem, 25.IV.69 (_____); 1♂, 1♀ 16 km Jericho road, 20.V.71 (Blondheim); 1♂, 1♀ 25 km E. of Azania, 29.IV.72 (Blondheim).

Jordan: 4♂, 4♀ Chor Damiya, Ain Khanaizir, 11.IV.51 (A.R. Waterston); 3♂, 3♀ Marha and Reseifa, 13 km from Amman, 13.IV.51 (A.R. Waterston); 3♂, 2♀ Safat, Ain Basha, 14.IV.51 (A.R. Waterston).

DISCUSSION. The most notable features of the chromosome complement in this subspecies are listed in the table below:

Locality			Autosome pair numbers										
Moghan (Azarbaidjan)	Chromosome characteristic		1	2	3	4	5	6	7	8	9	10	11
	Chiasmata	Terminal (t) or Interstitial (i)	ti	ti	ti	ti	t	t	ti	t	t	t	t
		Number	2-3	2-3	1-2	1-2	1-2	(1)-2	1-2	1-2	1	1	1
	Terminal heterochromatic segments (size)		v. small	v. small	v. small	v. small	v. small	v. small	v. small	v. small	v. small	L	-
	Autosome pair symmetry symmetrical (s) asymmetrical (a)		s	s	s	s	s	s	s	s	s	s with X	s
	Chromosome length (%)		23.6	17.7	13.4	11.8	11.4	6.5	6.3	3.5	2.3	1.8	1.5
Kazerun (Fars)	Chiasmata	Terminal (t) or Interstitial (i)	ti	ti	ti	ti	t	t	ti	t	t	t	t
		Number	1-3	1-3	1-2	1-2	1-2	1	1	1-(2)	1	1	1
	Terminal heterochromatic segments (size)		-	-	v. small	v. small	med	med	-	v. small	-	-	-
	Autosome pair symmetry symmetrical (s) asymmetrical (a)		s	s	s	s	s	s	s	s	s with X	s	s
	Chromosome length (%)		21.9	12.6	12.6	11.4	9.9	8.4	6.3	6.8	5.9	2.1	2.1

Noteworthy is the association of pair 10 of the autosomes with the male sex chromosome, X (Figs. 156 A-G; 157 A-P). In common with other members of the subgenus Stauronotulus the chromosomes are large, but it should be noted that the large species D. maroccanus is an exception having small chromosomes.

17b. Dociostaurus (Stauronotulus) hauensteini cappadocicus (Azam, 1913) stat. & comb.n.

Type: ♀ Stauronotus crassiusculus var. cappadocicus Azam, 1913. Bull. Soc. ent. Fr., 8: 219. Turkey, Cappadoce, _____, (_____).

DIAGNOSIS. See key, p. 215.

MEASUREMENTS.

	Male	Female
Length of hind femur (mm)	11.4-12.1	13.8-15.7
Length of tegmina (mm)	6.6-8.3	7.7-9.0
Length of body (mm)	18.4-21.5	23-27.5

DISTRIBUTION. South western Turkey.

MATERIAL EXAMINED.

Turkey: 1♂, 1♀ Ulukisla, 1400-1600 m, (17-22).VII.37 (Ramme); 1♀ Calbali Dag, 1300-1800 m, 13.VII.49 (P.H. Davis); 1♀ Antalya, Sivra Dag, 400-1200 m, 14.VII.49 (P.H. Davis); 2♂, 2♀ Mersui-Silifke, 16.VIII.52 (T. Karabag); 1♀ Konya, 20.VII.69 (W.G. Tremewan).

DISCUSSION. The race cappadocicus started taxonomic life as a variety of the species crassiusculus Pantel. It seems clear that D. crassiusculus Uvarov, 1921c and D. crassiusculus Morales-Agacino, 1941 are referrable to this subspecies of hauensteini. The subspecies cappadocicus was raised to species rank by Ramme in 1951. It is, however, quite clear that it is an integral part of the species hauensteini and as such should have subspecies rank within it.

17c. Dociostaurus (Stauronotulus) hauensteini elbursianus Uvarov, 1932

Type: ♂ Dociostaurus hauensteini elbursianus Uvarov, 1932. Tmdy. Zool. Inst. AN. SSSR, 1: 194, 195 (Iran, N.E. of Elburz mountains, village Shahkuh, VII.1914 (Kirigenko). Leningrad (Academy of Sciences)).

SYNONYMY.

Dociostaurus elbursianus caspicus Ramme, 1951. Mitt. zool. Mus. Berl., 27: 395, fig. ec, 396, table 30, fig. 7♂,♀. (Type ♂?, Iran nr. Caspian Sea, Suledeh, 16.VII.27 (G. Heinrich), Berlin Museum). Syn.n.

DIAGNOSIS. See key, p. 222.

MEASUREMENTS.

	Male	Female
Length of hind femur (mm)	12.6-16	15.5-20.5
Length of tegmina (mm)	8.3-10.3	9-12.0
Length of body (mm)	22.15-27.0	26.6-35.5

DISTRIBUTION. Northern and north eastern Iran, Elburz Mts.

MATERIAL EXAMINED.

Iran: 3♂, 2♀ Shahkuh, N.E. Elburz mt., (26.VI)-(3.VII).14 (Kirgenko) (paratype of D. h. elbursianus Uvarov); 1♂, 1♀ Shahkuh, _____, (_____) (paratypes of D. h. elbursianus det. by Uvarov in Leningrad); 1♂, 1♀ Suledeh, nr. Amol, N.E. of Tehran, 16.VII.27 (G. Heinrich) (paratypes of D. h. caspicus Ramme, Berlin Museum); 2♀ Khorassan, Boynourd, 900 m, 30.VI.64 (M. Descamps).

DISCUSSION. I have examined paratypes of D. elbursianus caspicus Ramme and found them to be inseparable from this subspecies.

17d. Dociostaurus (Stauronotus) hauensteini farsistanicus Descamps, 1967

Type:♂ Dociostaurus hauensteini farsistanicus Descamps, 1967.

Iran, Fars-Kakan, 2300 m, 20.VII.64 (M. Descamps). Paris Museum.

DIAGNOSIS. See key, p. 216.

MEASUREMENTS.

	Male	Female
Length of hind femur (mm)	13.9	15.1
Length of tegmina (mm)	8.15	9.0
Length of body (mm)	23.7	26.7

DISTRIBUTION. South western Iran; north-east of Shiraz - Ardekan, Kakan and Komehr in the Zagros mts.

MATERIAL EXAMINED.

Iran: 2♂, 2♀ Fars-Kakan, 23.VII.49 (H. Mirzayan); 1♂, 1♀ Fars-Komehr, 4.VIII.49 (H. Mirzayan); 1♀ Fars, between Ardekan-Kakan, 19.VII.64 (M. Descamps) (paratype); 1♂, 1♀ Fars-Kakan, 2300 m, 20.VII.64 (M. Descamps) (holotype♂, paratype ♀, det. by M. Descamps); 1♂, 2♀ Fars-Kakan, 16.VI.67 (A. Kashkuli).

DISCUSSION. See under the species.

17e. Dociostaurus (Stauronotulus) hauensteini kurdus Uvarov, 1921 comb. et stat. nov.

Type: ♂? Probably lost. Dociostaurus kurdus Uvarov, 1921. Bull. ent. Res., 11(4): 401, 406. Iraq, Kurdistan, Museck and Vezne, VII.1914 (B. Nesterov). Depository? Neotype ♂ designated: Iran, Kordestan, Sanandaje, Ariz, 2200 m, 5.VII.72 (H. Mirzayan & M. Abaii). British Museum (Natural History) London. Plesiotypes in Plant Pests & Diseases Research Institute, Tehran.

DIAGNOSIS. See key, p. 216.

MEASUREMENTS.

	Male	Female
Length of hind femur (mm)	13.5-17.0	17.0-22.0
Length of tegmina (mm)	7.7-10.0	11.0-13.0
Length of body (mm)	22.5-30.0	31.5-40.5

DISTRIBUTION. Iran, north western region in the Zagros mountains of Kordestan. Iraq, north eastern region (Kurdistan).

MATERIAL EXAMINED.

Iraq: 1♀ Kurdistan, Museck, 28.VI.14 (P. Nesterov) (paratype).

Iran: 3♂, 3♀ Hamadan, __VII.50 (Alexandrov); 4♂, 5♀ Charmahal, Bakhtyari, 23.VII.50 (Sadughi); 1♂, 2♀ Kurdistan, Marivan, 2000 m, 3.VIII.67 (Dez Julian); 5♂, 5♀ Asadabad-Hamadan, 11.VIII.68 (Mirzayan & Morales Agacino); 4♂, 5♀ Kordestan-Sanandaj, 4.VII.71, (Terureh); 2♂, 2♀ Shahabat-Kermanshah, 1800 m, 30.VI.72 (Mirzayan - Abaii); 5♂, 6♀ Kordestan-Sanandaj, Ariz, 2200 m, 5.VII.72 (Mirzayan - Abaii).

DISCUSSION. The holotype of this subspecies is probably lost. I could find only three female specimens in Leningrad Museum and one ♀ paratype in the British Museum (Natural History), so I decided to designate a ♂ neotype from the good series of specimens of this subspecies which I had received from Iran.

17f. Dociostaurus (Stauronotulus) hauensteini iranicus Ramme, 1951 stat.n.

Type: ♂ Dociostaurus iranicus Ramme, 1951. Mitt.zool. mus. Berl., 27: 395, 396, figs. i, pl. 30, fig. 6. Iran, Elburz, Haschtar, 7.IX.35 (K. Fusek). Berlin Museum.

DIAGNOSIS. See key, p. 216.

MEASUREMENTS.

	Male	Female
Length of hind femora (mm)	12.3-14.5	14.5-17.5
Length of tegmina (mm)	9.0-10.4	12.1-17.2
Length of body (mm)	19.5-24.5	29.0-32.0

DISTRIBUTION. Iran, northern Tehran (Demavend area).

MATERIAL EXAMINED.

Iran: 1♀ (allotype) same data as holotype; 7♂, 5♀ Tehran, Demavend, 6.VII.60 (E.S. Brown).

D. hauensteini farsistanicus Descamps

FIG. 139 Head and pronotum from above (holotype)

FIG. 140 Valves of penis, lateral view

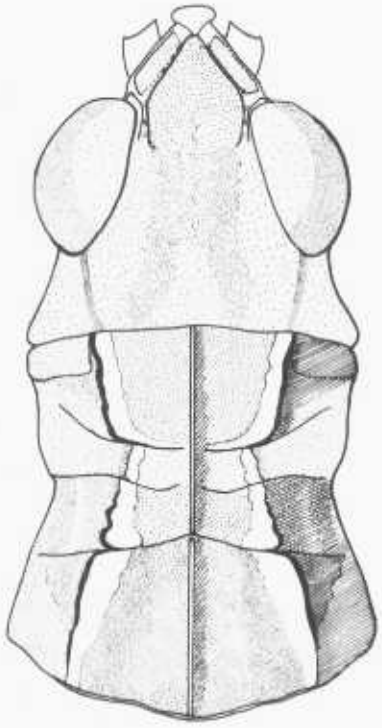
FIG. 141 Phallic complex, side view

FIG. 142 Phallic complex with rami and apodemes from lateral view

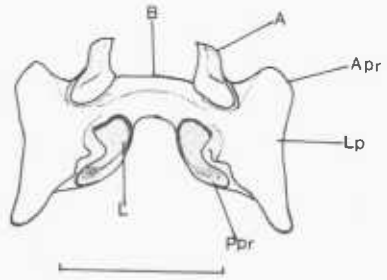
FIG. 143 Phallic complex with rami and apodemes from dorsal view

FIG. 144 Epiphallus, dorsal aspect

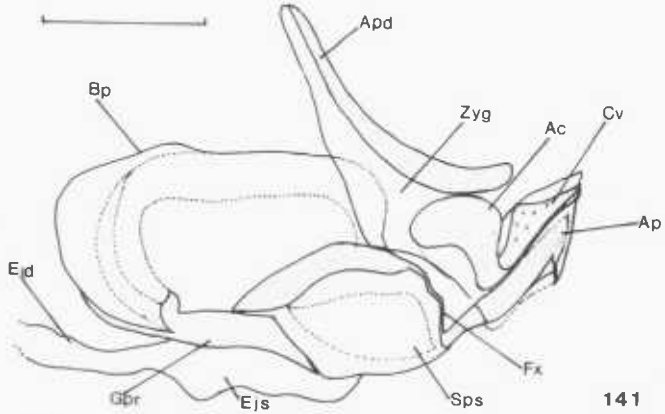
FIG. 145 Epiphallus of D. h. elbursianus, dorsal view



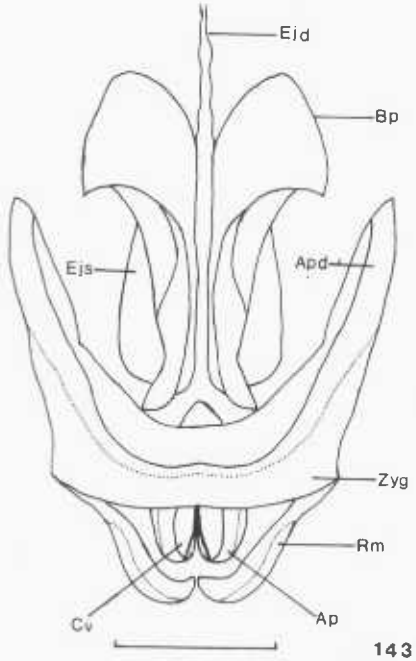
139



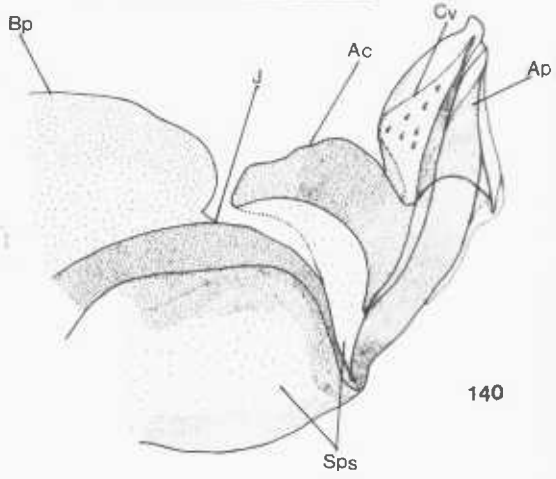
144



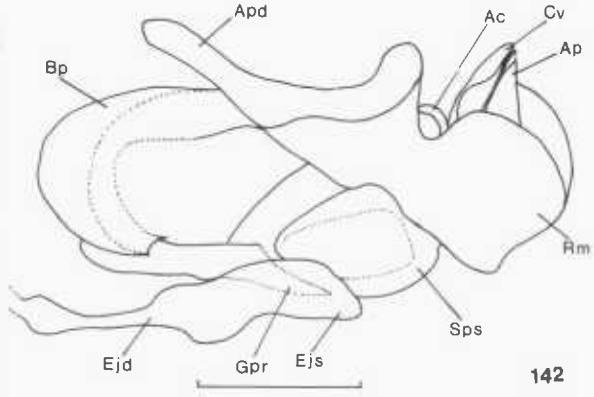
141



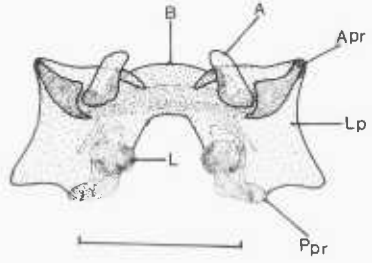
143



140



142



145

FIG. 146 D. h. iranicus (Ramme), head and pronotum from above (holotype)

FIG. 147 Phallic complex, dorsal view

FIG. 148 Epiphallus, dorsal view

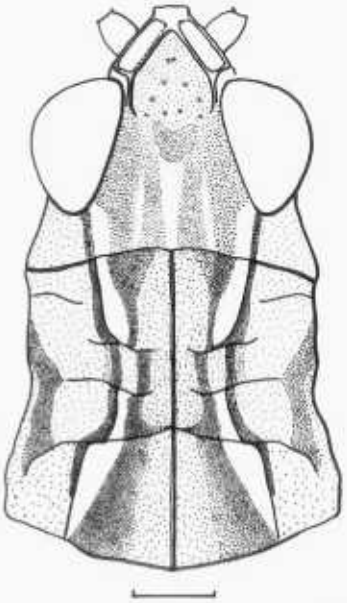
FIG. 149 Phallic complex, side view

FIG. 150 Supra-anal plate and cerci of D. hauensteini Bolivar

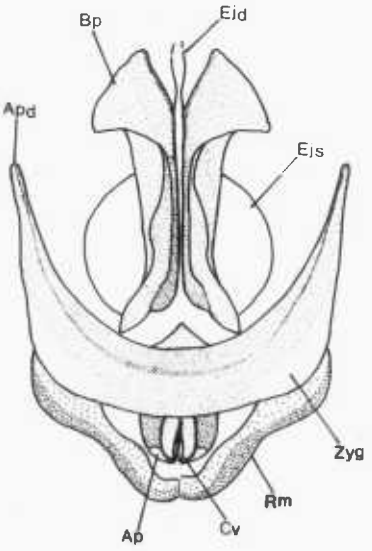
FIG. 151 D. h. cappadocicus (Azam), head and pronotum from above

FIG. 152 Epiphallus from dorsal view

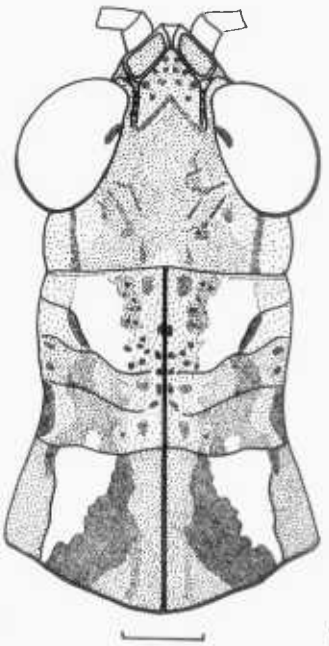
FIG. 153 Phallic complex, lateral view



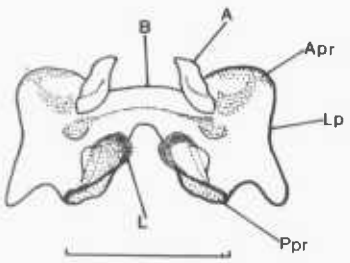
146



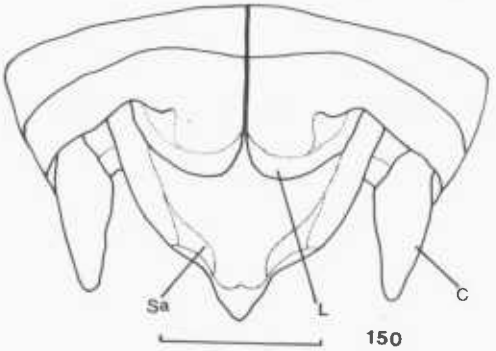
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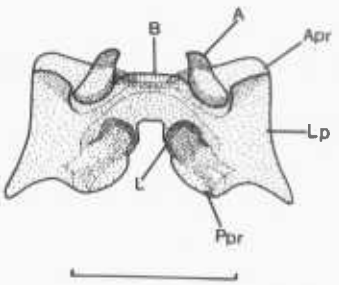
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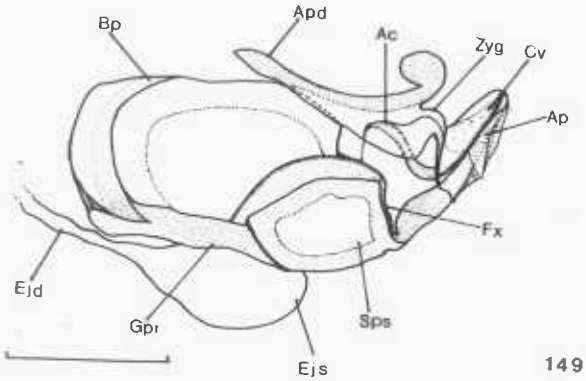
148



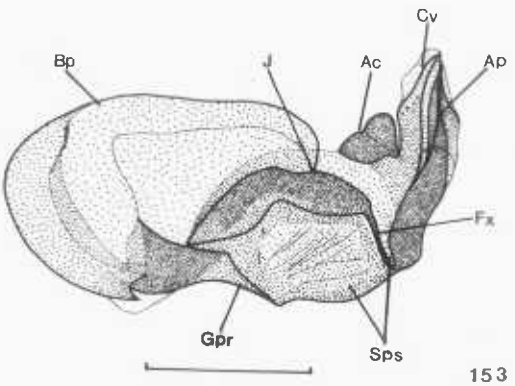
150



152



149



153

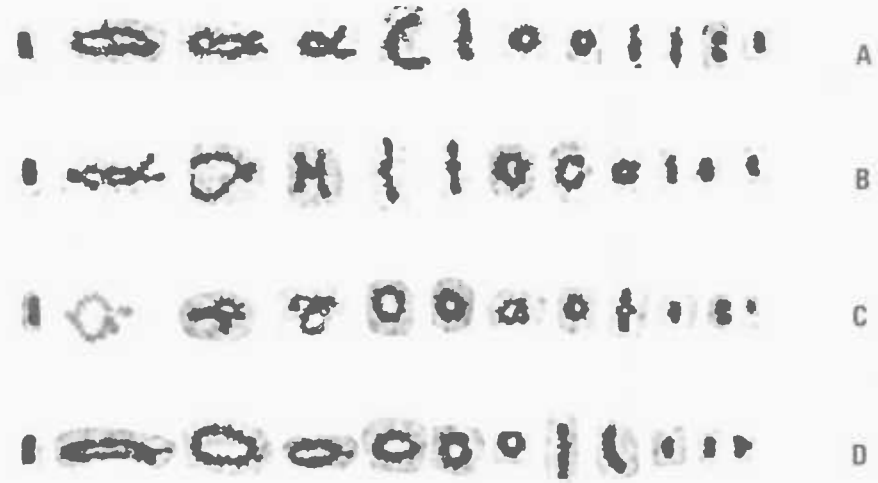
FIG. 154 ♀ Meso- and metasternum of D. h. hauensteini (paratype)

FIG. 155 ♀ Meso- and metasternum of D. h. cappadocicus

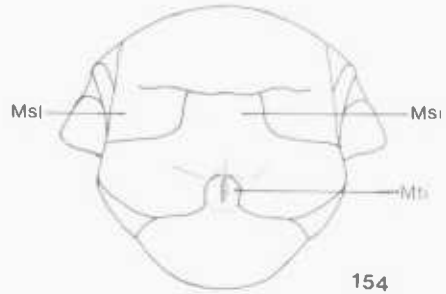
FIG. 156 Meiosis of spermatocytes of D. h. hauensteini (I. Bolivar) collected from Iran, Moghan. Mag. x 1500 (phase contrast)

A-D Late diplotene

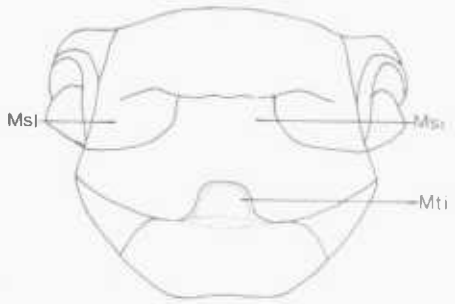
E-H Early diplotene



156



154



155

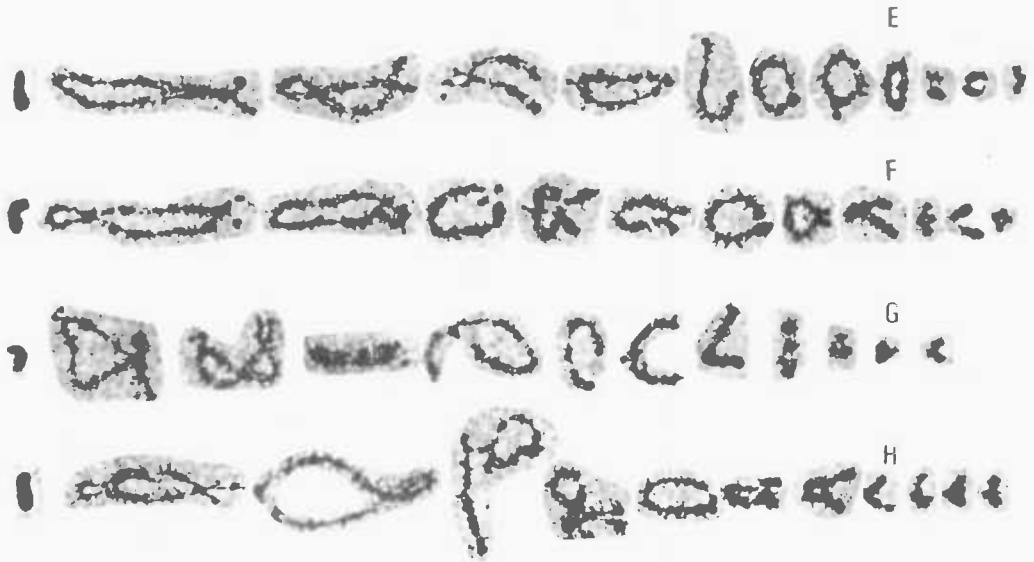


PLATE 157

Meiosis of spermatocytes of D. h. hauensteini (I. Bolivar) collected from Iran (Fars, Kazerun)

Mag. x 1500 (phase contrast)

A, B, C, E Diakinesis

D Diplotene

F, H, J Diakinesis

K Diakinesis (objective x 40)

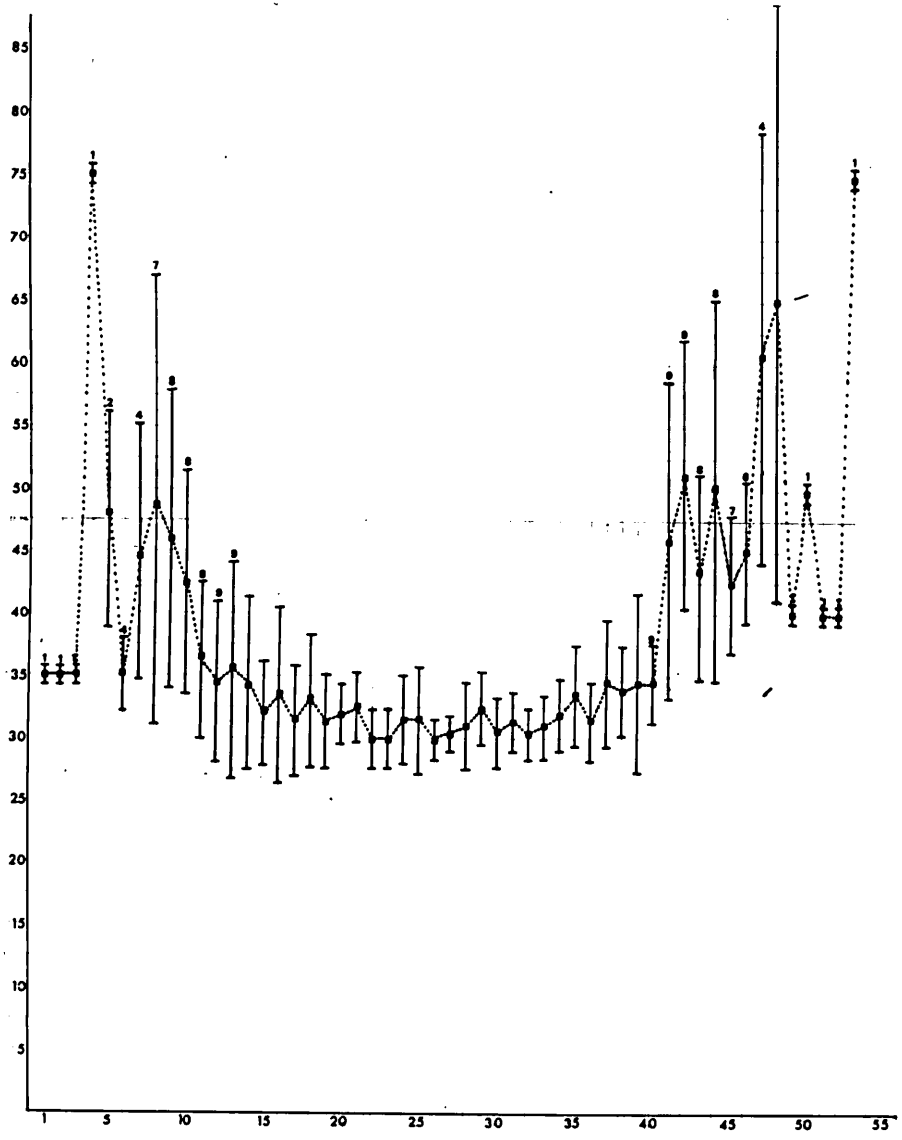
G, L, M, N, O & P Late diplotene


A
B
D
D
E
F
G
H
J
K
L
M
N
P
O

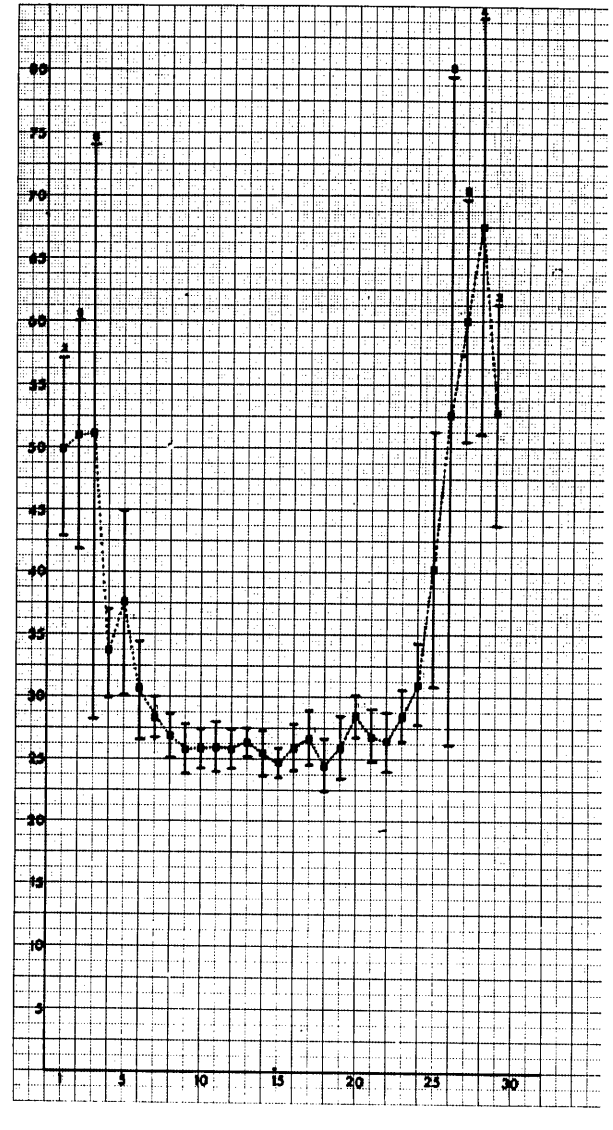
Stridulatory peg graph showing variation in peg intervals of 10 specimens from Iran

FIG. 158 D. h. kurdus (Uvarov), Sanandaj

FIG. 159 D. h. hauensteini (I. Bolivar), Kazerun


85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
1
5
10
15
20
25
30
35
40
45
50
55

158


1
5
10
15
20
25
30

159

18. Dociostaurus (Stauronotulus) crassiusculus (Pantel, 1886)

Type: ♂ Stauronotus crassiusculus Pantel, 1886. An. Soc. Esp. Hist. nat., 15: 237, pl. 2, fig. 1, A, B, C. Spain, S.E. of Madrid, Ucles, _____, (_____). Paris Museum.

SYNONYMY. See under subspecies, p.

DIAGNOSIS. Male:

1. Phallic complex very similar to that of D. hauensteini. Size smaller, however, especially in epiphallus which is less solid and bulky (cf. similarity in penis apex Figs. 161 and 140, 163 and 141).

Epiphallus of crassiusculus (Figs. 162, 164, 166) with larger more horizontal and laterally produced posterior lobe (Ppr) of lophus (cf. hauensteini, Figs. 144, 148, 152, where this lobe smaller and oblique). Moreover, posterior outer lobe of lateral plate (Lp) is postero-laterally produced in D. hauensteini whereas in D. crassiusculus it is pointed and laterally produced.

2. General colouration brown or dull red-brown with darker brown or black markings.

3. Fastigium verticis (Figs. 160, 170) concave, pentagonal with acute front angle. Oblique marginal anterior ridge rather low and longer than lateral longitudinal one. Temporal foveolae trapezoidal and pitted.

4. Frontal ridge narrow, moderately sulcate longitudinally and slightly depressed at median ocellus. Lateral margins distinct above median ocellus but fading below it.

5. Head relatively small in proportion to body. Frons not sloping backwards sharply. Vertex broad, truncate, its width between compound eyes about 2.5 times width of frontal ridge at level of antennal bases. Longitudinal line of raised pigment on mid-dorsal line of vertex and occiput.

6. Compound eyes small longest axis being 1.5-1.8 times length of sub-ocular groove (see under subspecies) and somewhat bulging (length to width about 1.2).

7. Antennae brownish, 1.5 times longer than head and pronotum as seen from above.

8. Pronotal disc usually dark. Shiny black pattern on lateral pronotal lobes covering interspace laterally between transverse sulci 2 and 4. Lateral carinae distinct in metazona, slightly divergent caudad and sometimes weakly developed on prozonal disc as well between transverse sulci 2 and front edge of pronotum. Lateral light bands, when present, situated on inner edges of lateral carinae. Lateral bands of light pigment clear in metazona, wide and triangular (Fig. 160, 170). Lateral light bands much more feeble in prozona and sharply uncurved. Posterior margin of metazona obtusangular to rounded.

9. Apices of folded tegmina just reaching to just surpassing tips of folded posterior femora. Decorated with indistinct brownish patterns.

10. Posterior femora with 3 dorsal dark spots, sometimes not very clear, but covering upper carina and carinula, though usually not extending onto inner or outer areas. Series of black spots present on lower carinula of external side of hind femora.

11. Hind tibiae red in D. crassiusculus crassiusculus, orange in D. crassiusculus kraussi and pale yellow in D. crassiusculus nigrogeniculatus (with black base in latter subspecies).

12. Supra-anal plate (Fig. 171) about as wide as long. Slight median apical constriction sets off tip from rest of plate. Apex rectangular. Cerci short, swollen, robust, slightly incurved and blunt. In contrast to D. hauensteini, paired lobes of last abdominal tergite are short, subrectangular, much wider than long (P) and distinctly separated on midline (compare Fig. 150).

13. Stridulatory pegs. Number of stridulatory pegs 30-54 (see under the key to subspecies and graph 169).

Female:

1. General colouration brownish with dark brown patterns.

2. Temporal foveolae short, weakly pitted and slightly longer than deep with upper margin moderately curved towards the tip of frontal ridge. Fastigium verticis weakly concave or flat and wider than long.

3. Frontal ridge widened at level of antennal sockets, its marginal carinulae fading immediately below level of ocellus.

4. Compound eyes smaller than those in male, the ratio of longest axis of compound eye to length of subocular groove 1.17-1.5 (see under key to subspecies).

5. Antennae equal in length to or slightly longer than head and pronotum together as seen from above.

6. Pronotum lacking black lateral markings or with these much abbreviated.

7. Tips of folded tegmina shorter than or hardly reaching hind knee of folded posterior femora.

8. Lower genicular lobe on outer aspect of posterior femur light and usually with dark spots.

9. Posterior tibiae reddish fading to pale yellow near knee.

DISTRIBUTION. Western China, USSR, western Afghanistan, south-western Pakistan, northern and south-eastern Iran and central Spain. This species shows a very interesting disjunct and presumably relict distribution. Unlike D. (S.) hauensteini probably does not occur at altitudes above 1500 m.

MATERIAL EXAMINED. See under subspecies.

DISCUSSION. Stauronotus kraussi was described from south-western Siberia in 1897 by Ingenitsky. The male holotype and a female cotype have been examined by me. There is no difference in the genitalia or stridulatory organ of this species and those of D. crassiusculus Pantel. Thus I have placed kraussi as a synonym of D. crassiusculus. In external characters Spanish D. crassiusculus differs from D. kraussi from the USSR in its slightly more robust appearance and less constricted pronotum, an exact evolutionary parallel being seen in D. brevicollis brevicollis and D. brevicollis hispanicus. Ingenitsky stated that kraussi differed from hauensteini and crassiusculus in having slightly

longer tegmina and wings but otherwise was similar to them. Wing length is, of course, a very variable character in the subgenus Stauronotulus.

In this paper the species crassiusculus is divided into 3 valid subspecies only:

(i) D. (S.) crassiusculus crassiusculus (Pantel) from Spain

(ii) D. (S.) crassiusculus kraussi (Ingenitsky) from USSR

and (iii) D. (S.) crassiusculus nigrogeniculatus (Tarbinsky) from Iran, Afghanistan and Pakistan.

Three further subspecies were listed in 1951 under D. kraussi in Bei-Bienko and Mistschenko:

(i) D. (S.) kraussi claripes Mistshenko, 1951

(ii) D. (S.) kraussi aurantipes Bei-Bienko, 1933 (later described as a subspecies of nigrogeniculatus by Mistshenko, 1949)

(iii) D. (S.) kraussi ornatus Mistshenko, 1951.

These would seem to be based mainly on colour characters and wing length which on their own are not considered to be subspecifically significant. There are, for example, no differences in the stridulatory files or male genitalia of these races and those of the equivalent races thought to be their valid counterparts in this paper.

KEY TO SUBSPECIES OF D. (S.) crassiusculus

Males.

1. Number of stridulatory pegs 40-54 (see Fig. 169). Eyes large, longest axis of compound eye 1.8 times length of subocular groove. Pronotum more elongate and constricted (Figs. 170 and 160). Fastigium verticis longer than wide and acutangulate in front (Fig. 170). Temporal foveolae narrowing forwards sharply. Length of prozona equal to or slightly longer than length of metazona. Lateral carinae only sometimes visible in prozona. Light 'X' shaped marking usually distinct, in metazona narrower than in subsp. kraussi or crassiusculus and with wavy inner margin. Knees of posterior femora totally black. Hind tibiae pale yellow, black at base.

D. (S.) crassiusculus nigrogeniculatus Tarbinsky, 1928, comb.n.

- Number of stridulatory pegs 30-40. Eyes smaller. Pronotum more stocky (Fig. 160). Fastigium verticis as wide as long, front angle subrectangular. Temporal foveolae shorter, not narrowing sharply forwards. Lateral pronotal carinae weakly present in prozona. Prozonal length equal to that of metazona. Light 'X' shaped marking indistinct on prozona or absent. Light markings in metazona wider than in subsp. nigrogeniculatus and with inner margin straight. Knees of posterior femora lighter, at least in part. Hind tibiae orange or red with a black band at base (inner aspect) 2

2. Hind tibiae orange. Longest axis of compound eyes over 1.6 times length of subocular groove. Pronotum less robust. Genicular lobes on both sides light posteriorly.

D. (S.) crassiusculus kraussi (Ingenitsky, 1897) comb.n.

- Hind tibiae reddish. Longest axis of compound eyes 1.5 times

length of subocular groove. Pronotum more robust. Genicular lobes light posteriorly on lower outer side only.

D. (S.) crassiusculus crassiusculus (Pantel, 1886) stat.n.

KEY TO SUBSPECIES OF D. (S.) crassiusculus

Females.

1. General colouration light brown with faint decoration. Head short and thick. Antennae light, slightly shorter than head and pronotum together. Compound eyes very small, longest axis of eye about 1.18 length of subocular groove. Vertex not prominant and wide between compound eyes. Temporal foveolae short with rounded marginal angles. Disc of prozona somewhat prominant, robust and not constricted. Metazonal disc relatively slender, lateral carina on metazona almost parallel to slightly divergent posteriorly. Light bands on inner side of metazonal lateral carina regular triangular and strongly widened anteriorly. Mesosternum and metasternum interspace wide. Apices of folded tegmina not reaching knee of folded hind femora with faint dark pattern. Hind tibiae red and light near the base.

D. (S.) crassiusculus crassiusculus (Pantel, 1886)

- General colouration darker with distinct dark patterns. Head more slender as seen from above. Antenna dark and slightly longer than head and pronotum together. Compound eyes larger. Vertex convex and narrower between compound eyes. Temporal foveolae longer than deep with distinct marginal carinula and gradually narrowed anteriorly. Pronotal disc comparatively slender, not prominant on prozona. Lateral carina on metazonal disc divergent posteriorly, light bands on metazonal lateral carina longer and narrower. Meso- and metasternum interspace narrower. Apices of folded tegmina just reaching or just surpassing knees of folded posterior femora, dark pattern present on medial and posterior medial field. Hind tibia pale red on the second posterior half and pale towards base 2

2. Longest axis of compound eyes 1.35 times length of subocular groove.

Prozonal disc more constricted. Disc of metazona broad.

D. (S.) crassiusculus nigrogeniculatus Tarbinsky, 1928

- Longest axis of compound eyes 1.5 times length of subocular groove. Pronotum less constricted. Metazonal disc narrower.

D. (S.) crassiusculus kraussi (Ingenitsky, 1897)

18a. Dociostaurus (Stauronotulus) crassiusculus crassiusculus (Pantel, 1886) stat.n.

Type: See under species.

SYNONYMY. While no synonymy has been attempted here, it is clear that this subspecies differs from subsp. kraussi on only very minor characters and with more data, despite their extreme geographical separation, they may have to be synonymised in future.

DIAGNOSIS. See key, p. 238.

MEASUREMENTS.

	Male (holotype)	Female (cotype)
Length of posterior femora (mm)	11.4	15.0
Length of tegmina (mm)	10.0	13.0
Length of body (mm)	20.3	25.0

DISTRIBUTION. Central Spain.

MATERIAL EXAMINED.

Spain: 2♀ (cotype) from type locality; 2♀ _____, _____1900 (Bolivar); 1♂, 1♀ Montarco, _____1921 (Bolivar).

18b. Dociostaurus (Stauronotulus) crassiusculus kraussi (Ingenitsky, 1897) comb.n.

Type:♂ Stauronotus kraussi Ingenitsky, 1897. Horae Soc. ent. Ross, 31: 63, pl. 7, figs. 1-5. USSR, Semipalatinsk, 2.VIII.1895(Zubovski). Leningrad Museum.

SYNONYMY.

Dociostaurus svenhedini Ramme, 1951b. Artc. zool. (2) 3(2): 20, fig. ♂, ♀ (p. 22). Holotype ♂, CHINA, Urumchi Wulumuch'i, Tihua, Sinkiang distr., ____1928 (Hummel). Stockholm Museum.

Dociostaurus (Stauronotulus) kraussi orantus Mistshenko, 1951. Opred. Faune SSSR Moscow, 40: 444. Holotype ♂, USSR, Kzyl. tam. Acad. Sci. Leningrad. Syn.n.

Dociostaurus (Stauronotulus) kraussi claripes Mistshenko, 1951. Opred. Faune SSSR Moscow, 40: 443. Holotype ♂, USSR, Koilibai. Acad. Sci. Leningrad. Syn.n.

DIAGNOSIS. See key, p. 237.

MEASUREMENTS.

	Male	Female
Length of posterior femora (mm)	10.5-11.5	13.8
Length of tegmina (mm)	11.5-15.0	13.4
Length of body (mm)	17.0-20.0	23.8

DISTRIBUTION. USSR (Cis-Caucasia, Lower Volga, Kazahstan, S.E. part of W. Siberia); N. China.

MATERIAL EXAMINED.

USSR: 1♀ Semipalatinsk, W. Siberia, 2.VIII.1895 (Zubovski) cotype of D. kraussi Ingenisky; 1♂ S. Siberia, Zaysan distr., 21.V.16 (Zaitzev) topotype of D. svenhedini; 1♂, 1♀ Astrakhan, Sasykalsk, 19.V.23 (Entom. stat. n.); 1♂, 1♀ E. Locot, Altaysk, S.W. Siberia, 15.VI.23 (Katykov); 2 ♀ Turkestan, 12.IV.26 (Entom. stat. n.).

China: ♀ paratype of D. svenhedini - see above.

DISCUSSION. After examination of ♀ paratype and ♂ topotypical material I have no hesitation in synonymising D. svendhedini with subsp. kraussi.

18c. Dociostaurus (Stauronotulus) crassiusculus nigrogeniculatus Tarbinsky, 1928 comb.n.

Type: ♂ Dociostuarus kraussi nigrogeniculatus Tarbinsky, 1928. Isv. Kurs. Prikl. Zool. Fitopatol., Leningrad, 4: 58. USSR, Kizyltshi district, Gusar, Bukhara, 12.V.26 (A. Gerasimore) Leningrad Museum.

SYNONYMY.

Dociostaurus nigrogeniculatus aurantipes B. Bienko, 1933. Bol. Soc. Esp. Hist. Nat., 33: 336-337.

Type ♂ USSR S.E. of Tadzhikistan, Kuljab, 19.VI.33 (G. Bei-Bienko).

DIAGNOSIS. See key, p. 237.

MEASUREMENTS.

	Males	Females
Length of posterior femora (mm)	9.0-12.0	11.3-15.0
Length of tegmen (mm)	10.0-15.0	11.4-19.4
Length of body (mm)	15.2-21.5	21.2-26.5

DISTRIBUTION. South-western USSR, Kazahkstan; north, north-eastern and south-eastern Iran; western Afghanistan and south-western Pakistan.

MATERIAL EXAMINED.

USSR: 1♂, 1♀ Ashkhabad, 18.IV.12 (coll. of Uvarov).

Afghanistan: 6♂, 5♀ Farah-Herat, 16.V.73 (G. popov).

Pakistan: 1♀ Baluchistan, Wam Kotal, 23.V.31 (D. Harrison).

Iran: 5♂, 6♀ Khorasan, Shahrud, 15.V.14 (Kiritshenko); 2♂ Gorgan, Korand, 28.IV.49 (H. Mirzayan); 2♂, 1♀ Baluchistan, Khash, Kusheh, __V.50 (M. Salavatian); 5♂, 5♀ Baluchistan, nr. Khash, __IV.51 (G. Popov); 1♂, 2♀ N. of Gonbad-e-Ghabus, 1.V.58 (L.F.H. Merton); 2♂ Fars, Bushkan, 10.IV.59 (L.F.H. Merton); 4♂, 5♀ Gorgan, 10.V.59 (A.A. Soltani); 5♂, 5♀ Sarakhs, 28.V.59 (A.A. Soltani); 6♂, 4♀ Moghan, 8.V.61 (A.A. Soltani); 3♂, 3♀ Sarakhs, 20.V.68 (A.A. Soltani); 5♂, 3♀ Gorgan, Maraveh-Tappeh, 24.V.73 (A.A. Soltani).

FIG. 160 D. crassiusculus kraussi (Ingenitsky), head and pronotum from above

FIG. 161 Valves of penis of D. c. crassiusculus (Pantel), side view (holotype)

FIG. 162 Epiphallus of D. c. crassiusculus (Pantel), dorsal view (holotype)

FIG. 163 Phallic complex of D. c. crassiusculus (Pantel), lateral aspect (holotype)

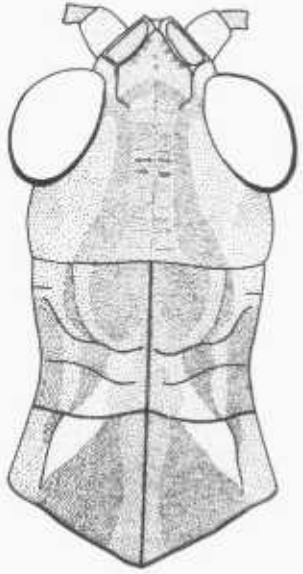
FIG. 164 Epiphallus of D. c. ornatus (Mistshenko), dorsal view (holotype)

FIG. 165 Phallic complex of D. c. ornatus (Mistshenko), lateral view (holotype)

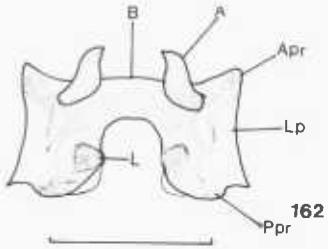
FIG. 166 Epiphallus of D. c. aurantipes (Bei-Bienko), dorsal view (holotype)

FIG. 167 Phallic complex of D. c. crassiusculus, dorsal view (holotype)

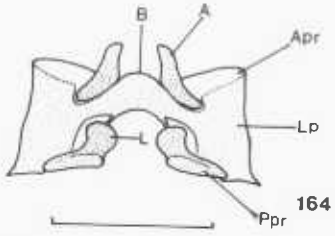
FIG. 168 Phallic complex of D. c. aurantipes, side view (holotype)



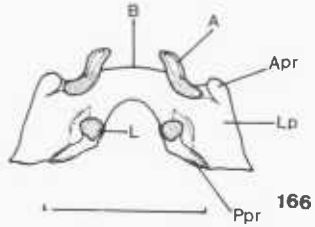
160



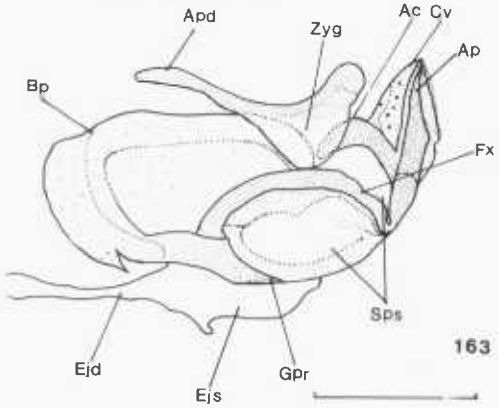
162



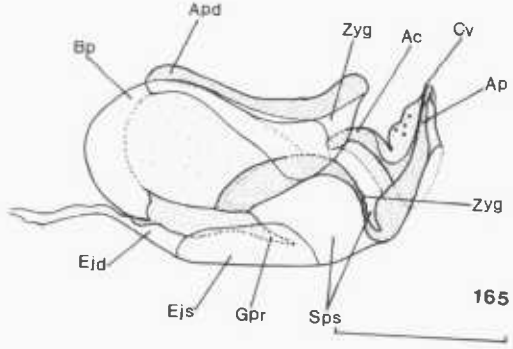
164



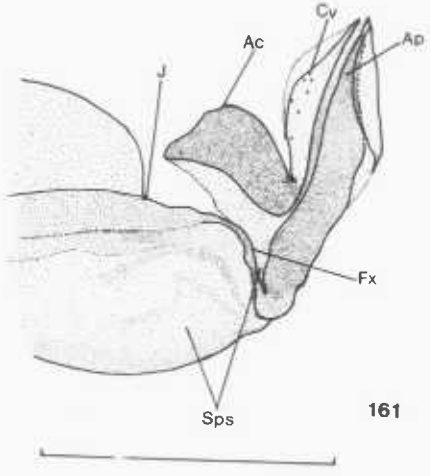
166



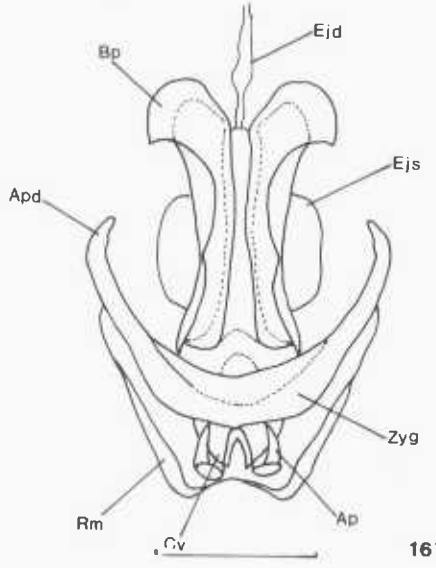
163



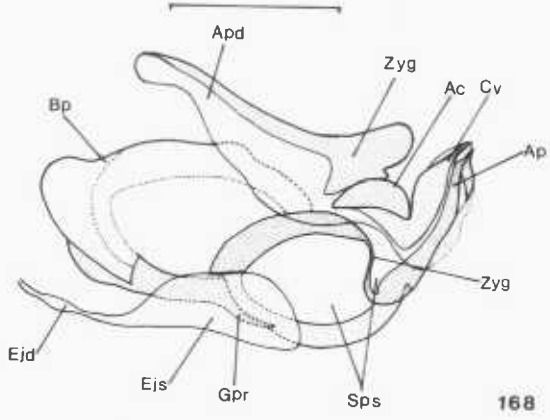
165



161



167

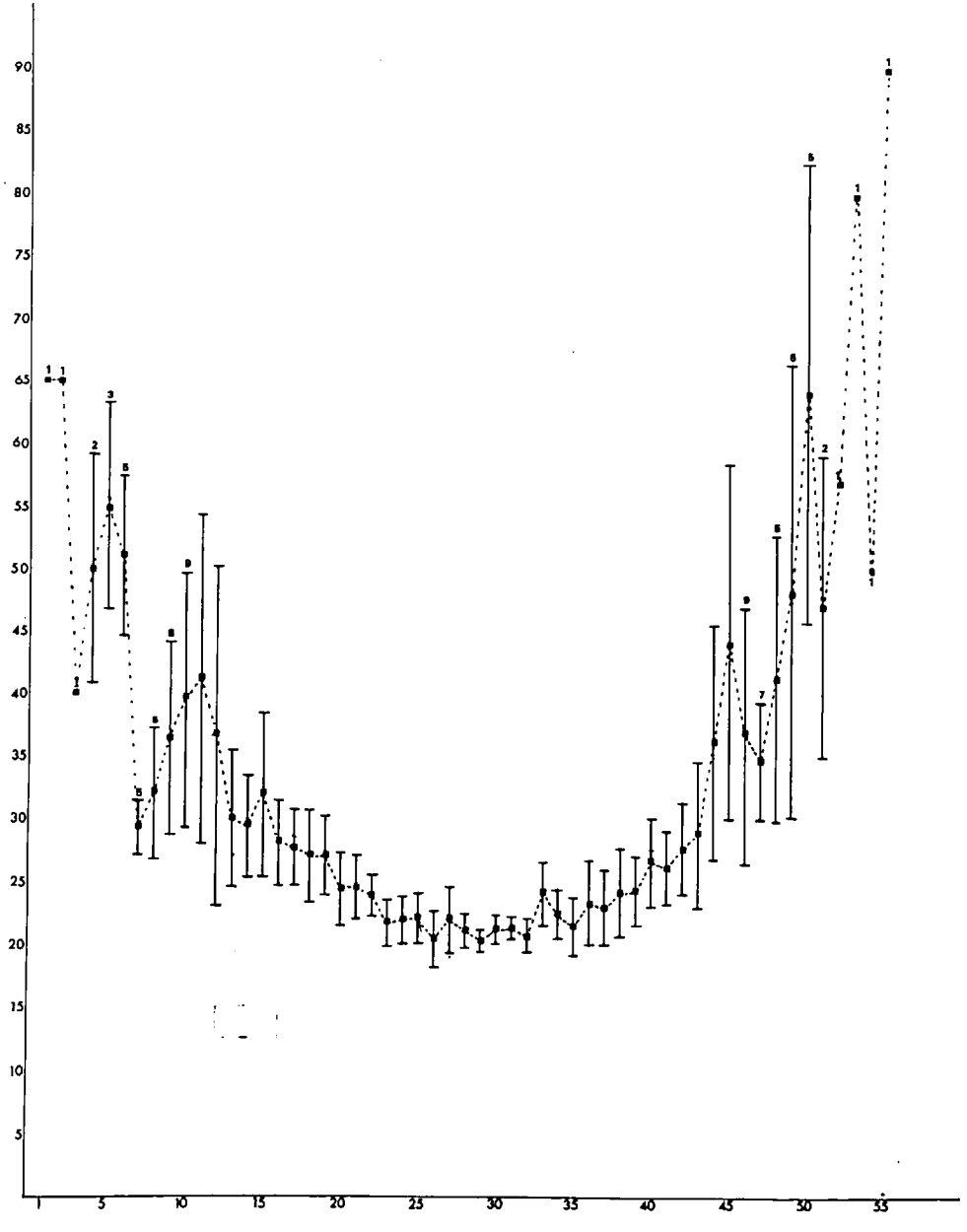


168

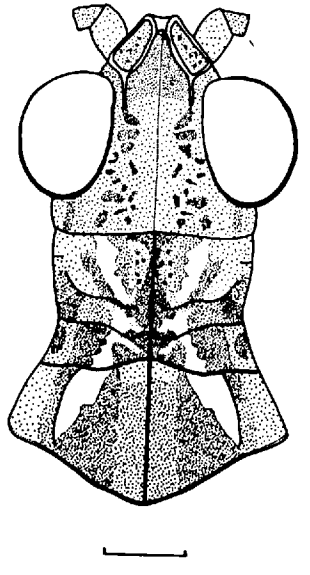
FIG. 169 Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. c. nigrogeniculatus (Uvarov) (collected from Iran)

FIG. 170 D. c. nigrogeniculatus (Uvarov), head and pronotum from above

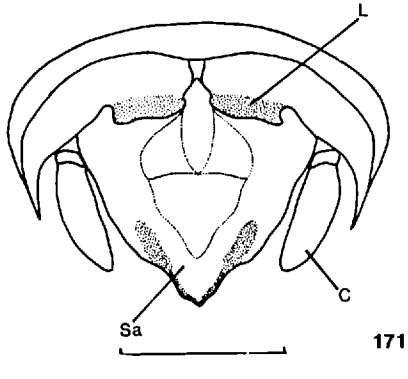
FIG. 171 Supra-anal plate and cerci of D. c. crassiusculus (Pantel)


90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
1
5
10
15
20
25
30
35
40
45
50
55

169



170


L
C
Sa

171

19. Dociostaurus (Stauronotulus) maroccanus (Thunberg, 1815)

Type: ? Gryllus maroccanus Thunberg, 1815. Mem. Acad. Imp. Sci. St. Petersb., 5: 244. Morocco, Barbary Coast.

Type lost. Neotype ♂ here designated. Morocco, Middle Atlas Mts. Aguelman Sidi Ali Ou Mohammed, 6500 ft, IX.1935 (K.H. Chapman). British Museum (Natural History) London.

SYNONYMY.

Gryllus cruciatus Charpentier, 1825. Hore. Ent. 137. Type ? 'Lusitania'. Berlin Mus.

Oedipoda vastator Fischer de Waldheim, 1846. Orth. Imp. Ross., Type ♀, 312, no. 30, tab. 14, fig. 1. Moscow or Acad. Sci. (Leningrad).

Epacromia oceanica Walker, 1870: 779, 780. Type ♀. Sandwich Islands, _____ (presented by Cap. Beechey). Brit. Mus. Nat. Hist., London.

Dociostaurus maroccanus degeneratus Baranov, 1925. Pol'opr. ogl. i. Kontr. st. Topehider, Fit. ent. Odsek., 3: 14, 21, fig. 8.

Dociostaurus maroccanus f. xanthocnema Tarbinsky, 1932.

Dociostaurus maroccanus ph. solitaria and ph. gregaria Tarbinsky, 1932.

DIAGNOSIS. Male:

1. Phallic complex in side view (Fig. 174) with very long apical valves (Ap), quite unlike any other species in genus. Apical valves weakly sclerotised, slightly longer than basal valves (Bp) as measured from base of flexure (Fx). Apical third of apical valves free but rest closely attached to cingular valves (Cv). Apical valves widened just beyond posterior edge of cingular rami (Rm) as seen in side view, then gradually narrowed towards flexure (Fx). Cingular valves narrower (Cv) than apical penis valves and of same basic pattern as those in D. hauensteini

and crassiusculus, i.e. typical for subg. Stauronotulus. Cingular valves widened at base and curving towards each other distally, basally joined by a thin transparent membrane. Cingular rami (Rm) rather small with regular rounded margin and forming a ring covering basal part of penis valves like a collar. Arch of cingulum (Ac) very small, bilobate in profile with posterior part (connected to zygoma) sclerotised with a concave upper margin. Distance between flexure (Fx) and arch of cingulum wide. Apodemes (Apd) short and thick with blunt, rounded apices. Flexure relatively long, well sclerotised and roughly at 90° to base of apical penis valves. Gonopore process (Gpr) short, sclerotised and widened in middle, with a sharp angular projection on its ventro-anterior margin (Figs. 172 and 174). Ejaculatory sac (Ejs) large (Figs. 172, 175).

Epiphallus (Fig. 173) typical of subgenus Stauronotulus. Bridge (B) short, thick. Ancorae (A) long, elevated and sclerotised standing vertically on bridge. Lateral plates (Lp) relatively narrow, not elongated downwards. Posterior projection of lophus (Ppr) very small and curling upwards. Lophi (L) small and well sclerotised.

2. General colouration light brown or greyish red-brown with indistinct dark patterns (gregarious form) or greyish brown or dark brown with sharply defined patterns and markings (in solitarious form). Series of small brown spots above spiracle rows of abdomen.

3. Fastigium verticis pentagonal concave, nearly equilateral. Parallel sided posteriorly with distinct marginal carinulae and rounded angles (Fig. 177). Temporal foveolae rectangular, short, pitted, their length to maximum width ratio about 1.25 and slightly narrowed anteriorly. Space between antennal socket and temporal foveolae usually black.

4. Frontal ridge punctate, depressed at ocellus and below it, its marginal carinulae parallel up to upper level of antennal sockets or slightly widened at that level. Greatly narrowed between anterior margins of temporal foveolae.

5. Head subconical, relatively small in proportion to size of body, 0.5-0.6 times as long as pronotum as seen from above. Top of head produced above level of pronotum.

6. Compound eyes vertically oriented, not bulging, longest axis being about 1.6 times length of sub-ocular groove.

7. Antennal slightly longer than length of head and pronotum.

8. Pronotum elongate with distinct transverse sulci. Median carina somewhat elevated. Lateral carinae of metazona distinct. Prozonal disc narrow, constricted in area of transverse sulci 2 and 3. Prozona much shorter than metazona, ratio of lengths about 0.7. Lateral carinae weakly developed anterior to transverse sulcus 2 and bordered internally by light pigment. Metazonal disc bordered (Fig. 177) by two distinct lateral light bands which extend onto area between transverse sulci 3 and 4 and are distinctly convergent forwards. Posterior margins of metazona strongly oblique, posterior angle being rounded obtusangular. Lateral pronotal lobes rather deep, constricted and bearing a prominent whitish patch of pigment about $\frac{2}{3}$ of way down lobe from its upper edge.

9. Tegmina and wings long, tips of folded tegmina extending far beyond tips of folded posterior femora to just level with them. Dark patterns always present on tegmina, especially in median field (between its close parallel cross-veins).

10. Posterior femora not particularly thick and powerful. Fore femora inflated in male. Dorsal spots of dorsal side of hind femora (3 in number) distinct and covering upper inner and upper outer areas in solitarious forms but indistinct in gregarious forms. If present these spots usually extend a short way onto inner and outer areas of femora. Upper genicular lobes of hind femora always dark brown or black but lower lobes vary in colouration (black or light on inner or outer aspect).

11. Hind tibiae red, pink or pale yellow (f. xanthocnema Tarbinsky) or even whitish.

12. Supra-anal plate (Fig. 176) (Sa) large, usually as long as wide, with triangular apex. Subgenital plate (Sg) broad, bluntly truncate and highly characteristic of this species. Cerci conspicuously elongate, their tips surpassing tip of supra-anal plate. Median lobes of last abdominal tergite decumbent, not produced at all.

13. Number and spacing of stridulatory pegs significantly different in solitarious (number about 85) and gregarious forms (number about 120). In gregarious forms (Fig. 178) spacing much more uniform than in solitarious forms (Fig. 179).

14. Chromosome characteristics are tabulated below (see Figs. 183, 184).

Locality		Autosome pair number										
Darehgaz 500-750 m	Chromosome characteristic	1	2	3	4	5	6	7	8	9	10	11
	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	ti	t	ti	t	t	t
	Chiasmata: Number	2-3	2-3	1-2	1-2	1-2	1	1-2	1	1	1	1
	Terminal heterochromatic segments (size)	med	sm	sm	sm	sm	sm	sm	sm	sm	sm	sm
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)	19.2	16	11.2	9.8	8.7	8	7.2	6.8	5.6	4.5	3
Aghonge (Mashad) 1500-2000 m	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	t	t	t	ti	t	t	t
	Chiasmata: Number	2-3	2-3	1-2	1-2	1	1	1-2	1-2	1	1	1
	Terminal heterochromatic segments (size)	med	sm	sm	sm	sm	sm	sm	sm	sm	sm	sm
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)	18.5	16.5	12.5	11.1	9.7	7.4	6.7	6	4.7	3.9	3
Moghan 250-400 m	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	ti	ti	ti	ti	t	ti	t	t	t
	Chiasmata: Number	2-3	2-3	1-2	2	1-2	1-2	1-2	1-2	1	1	1
	Terminal heterochromatic segments (size)	med	med	sm	sm	sm	sm	sm	sm	sm	sm	sm
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)	19.2	16.8	12.2	11	8.6	7.2	6.5	6.1	5.1	3.9	3.4
Kazerun (Fars) 400-600 m	Chiasmata: Terminal (t) or Interstitial (i)	ti	ti	usually t	usually t	ti	t	t	ti	t	t	t
	Chiasmata: Number	1-3	1-3	1-2	1-2	1-2	1-2	1-2	1-2	1	1	1
	Terminal heterochromatic segments (size)	med	med	med	sm	sm	sm	sm	sm	sm	sm	sm
	Autosome pair symmetry symmetrical (s) asymmetrical (a)	s	s	s	s	s	s	s	s	s	s	s
	Chromosome length (%)	18.3	16.4	12.3	10.7	10	8	7.3	6.3	4.2	3.5	3

Note that:

1) chromosomes are on the whole small in size and size range from large to small less abrupt than in other species;
2) a great many chromosomes in the set form 'ring' bivalents;
3) bivalents are symmetrical.

There is some suggestion that the total length of chromosomes from high altitude localities is less than that from low altitude ones (e.g. compare Aghonge village, 1500-2000 m, near Mashad with other material).

MEASUREMENTS.

	Male	Female
E/F ratio (France) solitarious form	1.25	1.30
E/F ratio gregarious form	1.75 (Cyprus)	1.85 (Syria)
Length of posterior femora (mm)	12.3-17.0	12.7-19.2
Length of tegmina (mm)	13.5-27.0	20.4-35.0
Length of body (mm)	17.5-36.0	26.0-45.0

DISTRIBUTION. USSR, Afghanistan, Iran, Iraq, Turkey, Syria, Lebanon, Israel, Jordan, Arabia (?).

Cyprus, Greece, Bulgaria, Yugoslavia, Hungary, France, Italy, Spain, Corsica, Sardinia, Sicily, Portugal.

Libya, Morocco, Tunisia, Algeria, Madeira, Canary Islands.

N.E. Africa; Somali republic. This last is a new record for the species of great zoogeographical interest.

MATERIAL EXAMINED.

USSR: 7♂, 5♀ E. Transcaucasia, 2.V.24 (Siazov).

Afghanistan: 4♂, 4♀ Wazir Abad, 4 mls. N. of Kabul (20-25).VI.38

(S.A. Akhtar).

Iran: 2♂, 1♀ Bushehr to Kazerun, 21.V.27 (Siazov); 3♂, 3♀ Khusestan-Masjed Suleiman, _____32 (F. Marsh); 4♂, 2♀ Masjaid Solaiman, _____33 (V. Pill); 5♂, 5♀ Mehran, 350 m, __V.46 (Gh. Farahbakhsh); 5♂, 6♀ Mehran, 2.VI.55 (A.A. Soltani); 7♂, 5♀ Sarakhs, 250-300 m, 7.VI.56 (A.A. Soltani); 4♂, 3♀ Moghan, 300-400 m, 2.VI.59 (H. Mirzayan); 5♂, 5♀ Moghan, 9.VI.58 (L.F.H. Merton); 3♂, 3♀ Gorgan, 250-400 m, 15.VII.60 (A.A. Soltani); 2♂, 2♀ Behshehr, nr. Caspian Sea, 30 m, 2.VIII.60 (A.A. Soltani); 3♂, 2♀ Fars-Kazerun, 600 m, 8.VIII.61 (H. Mirzayan); 4♂, 5♀ Shahrud-Abr, 2200-2500 m, 15.VIII.62 (A.A. Soltani); 3♂, 2♀ Khorramabad, Lorestan, 2.VII.63 (H. Mirzayan); 5♂, 3♀ Fars, Gereh, 700 m, 4.V.73 (A.A. Soltani); 6♂, 3♀ Mehran, 15.V.73 (A.A. Soltani); 5♂, 3♀ Gorgan, Maraveh tappe, 750 m, 23.V.73 (A.A. Soltani); 5♂, 2♀ Sarakhs, 1.VI.73 (A.A. Soltani); 4♂, 3♀ Dareh gaz, 600-700 m, 18.VI.73 (A.A. Soltani); 6♂, 3♀ Moghan, 2.VII.73 (A.A. Soltani).

Turkey: 6♂, 4♀ Smyrna prov., Menemen, _____30 (Sureya Bay); 4♂, 2♀ Habiblar, S. Tireh, 21.VII.31 (B.P. Uvarov); 2♂, 2♀ Urfa, VII.31 (Eshnef Bey).

Iraq: 3♂, 3♀ Khanagrin, 26.V.32 (B.P. Uvarov); 3♂, 2♀ Kurdistan, btwn. Kirkuk and Sulaymaniah, 28.V.32 (B.P. Uvarov).

Syria: 4♂, 3♀ Hama, N. Syria, 1.VII.45 (Middle East Biological Studies Scheme); 5♂, 4♀ Hassetche, 17.V.46 (E.S. Brown).

Jordan: 4♂, 2♀ Jordan valley, Khor Fasayil, 10.IV.51 (A.R. Waterston).

Israel: 5♂, 3♀ Jericho, 17.V.31 (F. Bodenheimer); 3♂, 3♀ E. of Azaniya, 28.IV.72 (S. Blondheim).

Greece: 2♂, 2♀ Kerkeni, Struma valley, 25.VI.35 (P. Buxton); 5♂, 4♀

Mt. Hortiat nr. Salonika, 600 m, 8.VIII.38 (O. Grebenchikoff); 3♂, 2♀ Drosia, 17.VII.57 (G.A. Mavromoustakis).

Cyprus: 4♂, 4♀ Mesayitonia, 25.IV.35 (G.A. Mavromoustakis); 2♂, 3♀ Larnaca airport, 19.V.50 (A.R. Waterston).

Yugoslavia: 1♂, 1♀ Macedonia, Lambet, __VI.16 (M. Burr); 2♂, 2♀ Herzegovina, Domanovic, 24.VII.30 (O. Holic); 4♂, 4♀ Montenegro, Titograd, 15.VI.47 (M. Gradojevic); 3♂, 3♀ S. Serbia, Kozuh Mts., Dvonsija Mt., nr. Gevgeli, 1500-1900 m, (13-17).VII.37 (O. Grebenchikoff).

Bulgaria: 3♂, 4♀ Kostenetz, nr. Sofia, 700-1500 m, __VIII.26 (E.M. Edwards).

Italy: 1♂, 2♀ Rome, __VI.25 (D. Vitozanon).

Corsica: 3♂, 3♀ Calvi, 12.VII.31 (M.E. Mosely); 4♂, 3♀ N.S. Corsica, Belgodere, 500 m, 26.VII.63 (D.H. & D.J. Harvey).

Sardinia: 2♂, 3♀ Macomer, 9.VI.31 (O. Grey).

France: 3♂, 3♀ Bouches-du-Rhone, 22 kms. S.E. of Arles, nr. Mas Thiberte, (1-17).VII.60 (D.J. Philpot); 2♂, 3♀ Languedoc-Ronsillon prov. Nimes dep., Les Baux de Provence, VIII.73 (N.D. Jago) in citadel plateau, bare rocks.

Spain: 3♂, 3♀ Sierra de Guadarrama, __VIII.26 (B.P. Uvarov).

Portugal: 2♂, 1♀ Guarda arca, __VIII.66 (R.M. Dobson).

Canary I.: 4♂, 3♀ Teneriffe, Tocoronte, 10.IV.27 (E. Appenhagen); 2♂, 3♀ Teneriffe, Montana zaco, 17.IV.52 (M. Morales); 2♂, 2♀ Teneriffe, Puertos de la Cruz, 8.IV.59 (O.W. Richards); 4♂, 3♀ Teneriffe, Buenavista, S.L., 3.VI.64 (K.M. Guichard).

Morocco: 3♂, 4♀ Middle Atlas Mts., Aguelman Sidi Ali ou Mohammed,

6500 ft., __IX.35 (K.H. Chapman).

Algeria: 3♂, 3♀ Saida, _____23 (A. Cros); 1♂, 1♀ Oran, Frenda, __VI.27 (Balachovsky); 4♂, 3♀ El Gehra station, S. of Constantine, 2.VII.39 (M.N. Korsakoff).

Libya: 1♂, 1♀ Cyrenaica, El Abiar, 2.IV.58 (K.M. Guichard).

Somali Rep.: 6♂, 4♀ Cajdn, 2.VII.49 (E. Burtt).

DISCUSSION. Dociostaurus maroccanus is the most serious pest of agriculture in the genus, e.g. in such countries as Iran.

According to Uvarov the species is exclusively palaearctic, but during my study I discovered several small, highly melanic forms of the species in the Somali Republic section of the accessions collections at the British Museum (misidentified as an Oedaleus species). This record has subsequently become the basis for a revised Commonwealth Institute map of the distribution of this pest. The specimens are of small individuals, but the genitalia and stridulatory files are typical for D. maroccanus. Similar small dark forms are also found on the northern fringe of distribution e.g. in Greece, Bulgaria, Yugoslavia, France and Canary Is.

The enormously elongated apical penis valves of this species though highly characteristic to the species are of a basic plan common to D. hauensteini and D. crassiusculus also. In particular the form of the cingular valves is the same in all three species indicating quite clearly that D. maroccanus should be put in the same species group. Despite great variation in size, colour and 'phase' the shape and structure of the genitalia are remarkably constant in this species (on basis of 150 examined male specimens).

Study of the male stridulatory file showed, however, that regularity of peg distribution offered a good phase character. Twenty-five of each extreme phase polymorph were examined and their peg intervals plotted (see graphs Figs. 178, 179). Most of the specimens were collected during plague and recession periods in Iran by myself.

Baranov (1925) described a dwarf race of the Moroccan Locust from Montenegro in Yugoslavia. Its diagnostic features were its smaller size, acute vertex, sharp frontal ridge and differences in form of the male genitalia (only epiphallus). He gave this small form the name 'degeneratus' and of racial rank. Uvarov (1928a) made no final decision on the status of this insect. I have compared these insects with larger members of adjacent populations and with other small insects from other areas of southern Europe. I find no useful difference sufficient to separate them as a geographical race. It is general that the species becomes dwarfed in fringe areas less suitable to it biologically.

Other grasshoppers sympatric in Iran with D. maroccanus are D. hauensteini, D. crassiusculus nigrogeniculatus (Moghan, Gorgan), D. jagoi (Mehran, Somar), D. albicornis turcmenus (Mashad, Darehgaz), D. tartarus (Gorgan), Chorthippus apricarius asiaticus (at high altitudes), Calliptamus italicus, C. barbarus (Mazandaran, Azerbaijan), Oedaleus decorus, O. senegalensis, Sphingonotus rubescens, S. satrapes some several tettigoniid species. Habitats for the species occur in two main belts (divided into 8 zones) (see Pasquier, 1958, L.F.H. Merton, 1961, H. Mirzayan and A. Soltani, unpubl.) which lie in the foothills of the Elburz and Zagros mountain ranges.

A study of phase variation in permanent breeding areas, involving observation of behaviour, general external characters, colouration, statistical measurements, etc., has been of great use in the recent past

in assessing the recession status or upsurge status of populations. Much is now known of the food preferences of this insect, living as it does in grass associations which offer permanent breeding areas at altitudes between 200 to 500 m. Its extreme altitudinal range lies from sea level up to 2200 m (in the north-eastern Elburz).

D. maroccanus (Thunberg)

FIG. 172 Phallic complex from side view

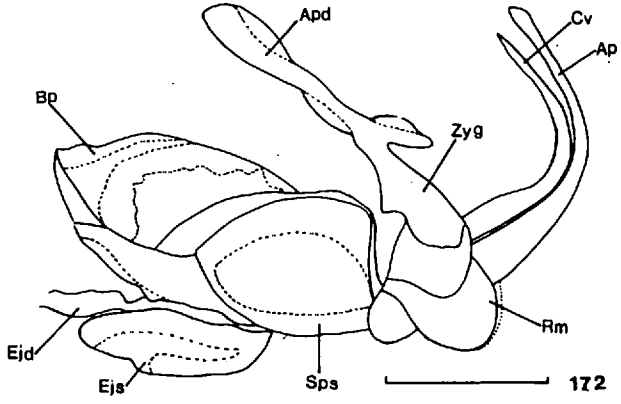
FIG. 173 Epiphallus, dorsal aspect

FIG. 174 Phallic complex (zygoma and apodemes removed), lateral view

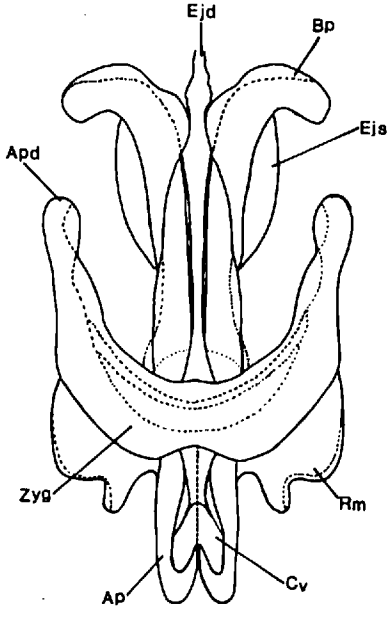
FIG. 175 Phallic complex, dorsal aspect

FIG. 176 Supra-anal plate, subgenital plate and cerci from above

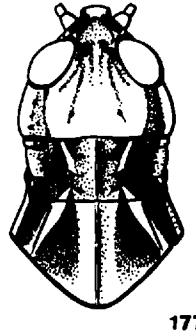
FIG. 177 Head and pronotum from above



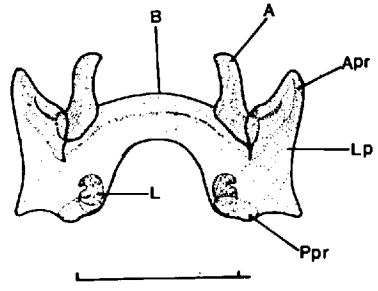
172



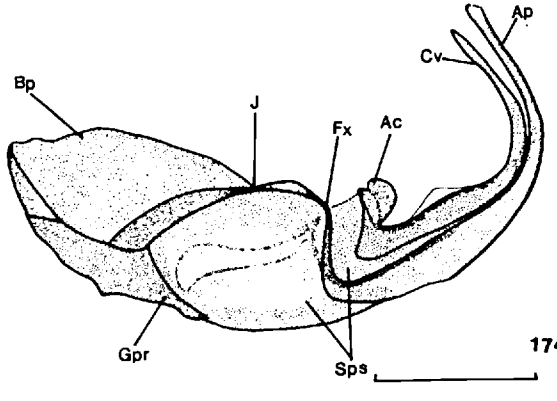
175



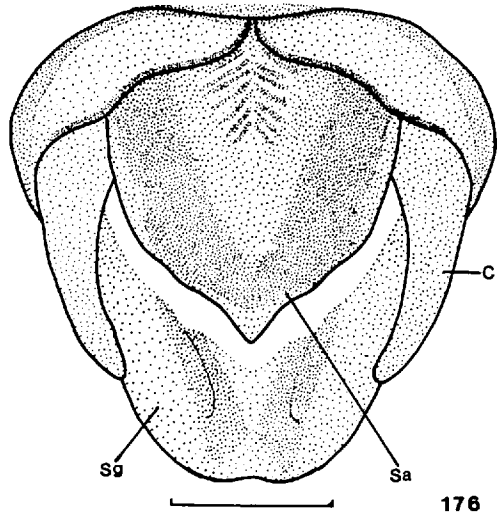
177



173



174

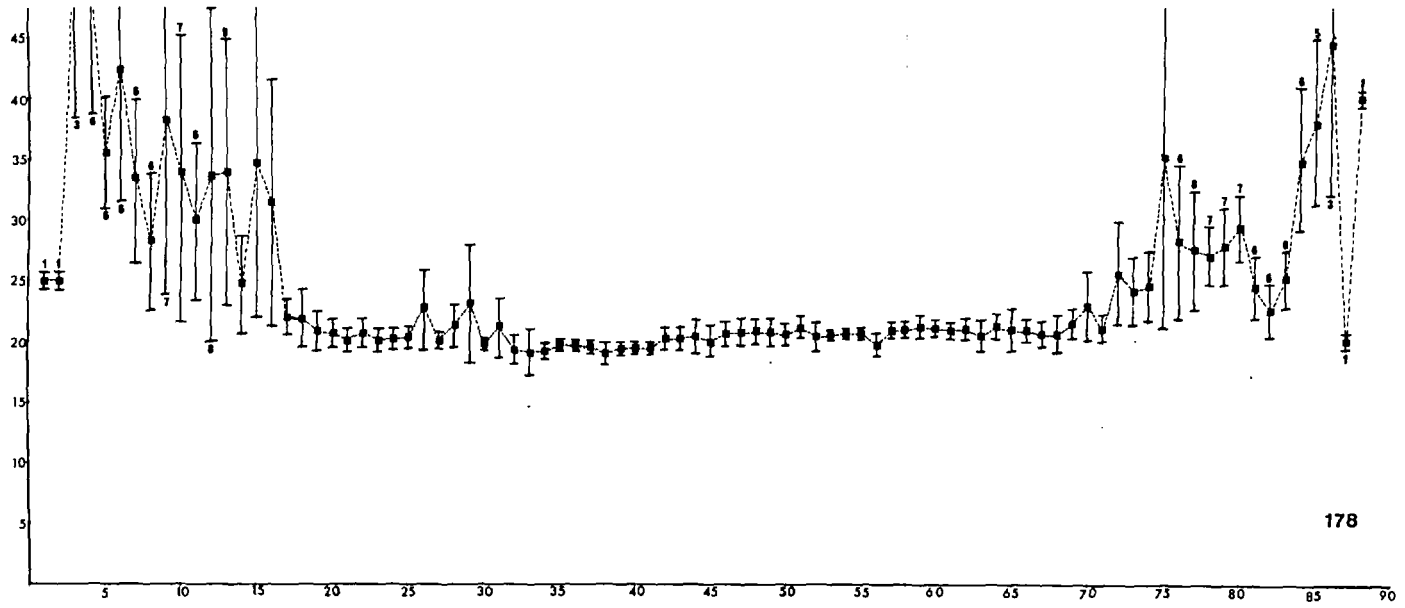


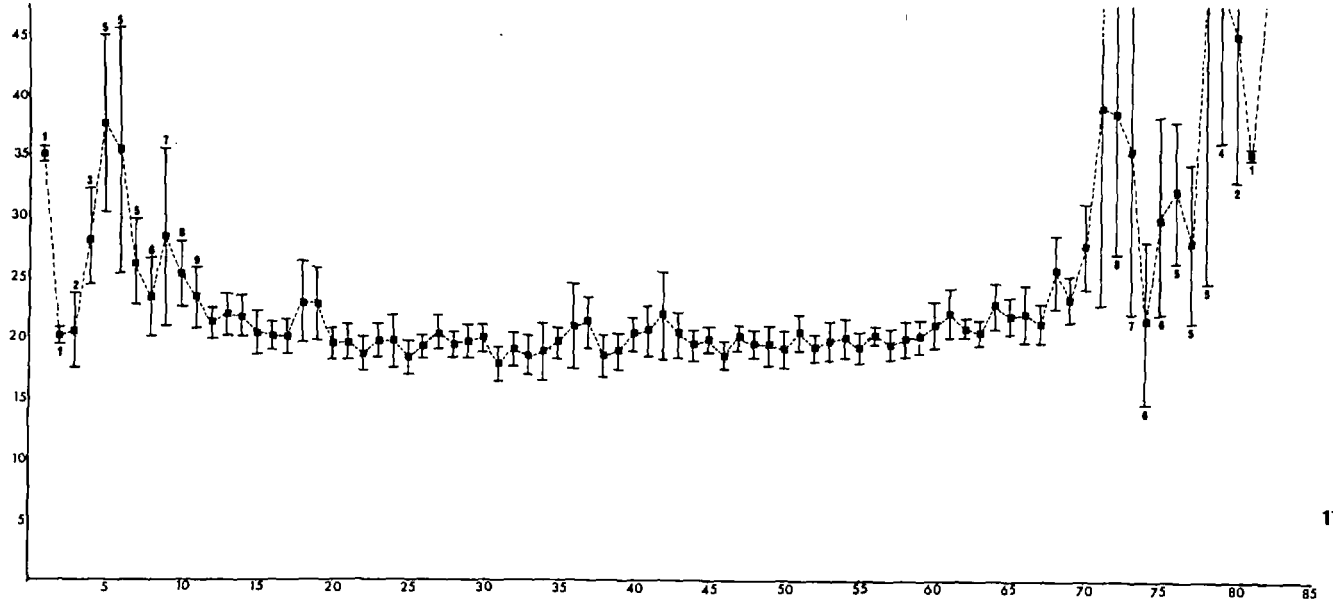
176

Stridulatory peg graph showing variation in peg intervals of 10 specimens of D. Maroccanus (collected from Iran)

FIG. 178 Phase gregaria

FIG. 179 Phase solitaria


178


179

Stridulatory file pattern from one specimen of D. maroccanus (collected from Iran)

FIG. 180 Solitarious phase

FIG. 181 Gregarious phase

FORX: TOP= 1 BOTTOM= 90 INCREMENT 1
FORY: LEFT= 0 RIGHT= 100 INCREMENT 1.66667
180
181

PLATE 182

Meiosis in spermatocytes of D. maroccanus Thunberg (collected from Iran)

Mag. x 1500

A, B, C & E Diakinesis (phase contrast), material from Moghan

D Diakinesis (normal illumination), material from Moghan

F-J Diplotene (normal), Fars prov., Kazerun

K Diakinesis (normal), Khorasan, Daregaz

L-O Diakinesis (phase contrast), Mashad, Aghonge

P Diakinesis (phase contrast), Fars, Kazerun


A
B
C
D
E
F
G
H
J
K
L
M
N
O
P

PLATE 183

Meiosis in spermatocytes of D. maroccanus Thunberg, Iran

Mag. x 1500 (A-M), 600 (N,O)

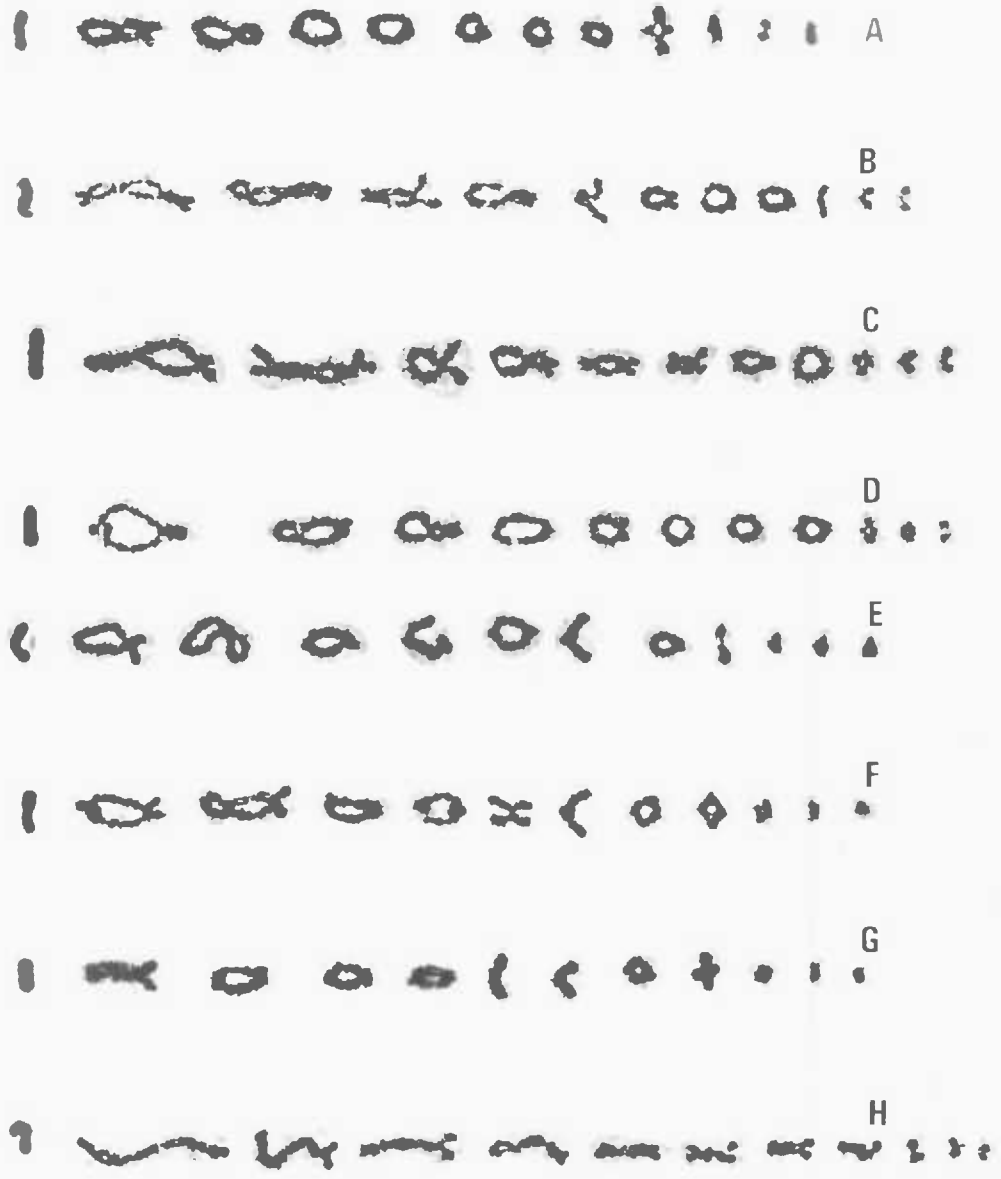
A-D Diplotene (phase contrast), E. Azarba, Moghan

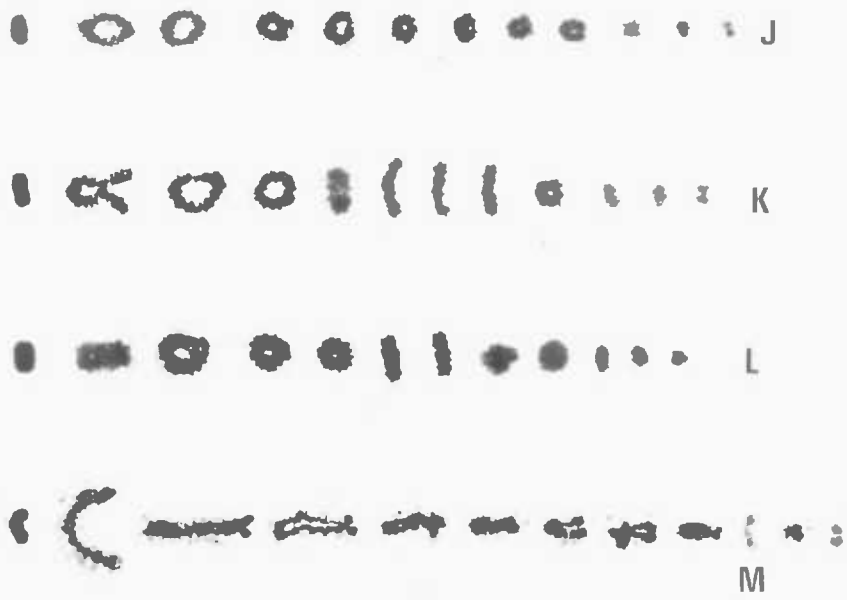
E-H Late diplotene (phase contrast), Fars, Kazerun

J (normal), K,L (phase contrast) Diakinesis, Fars, Kazerun

M Diplotene (normal), Kazerun

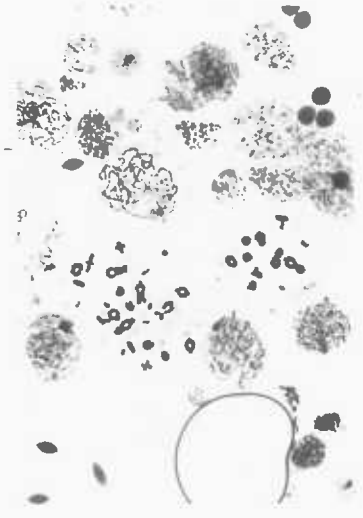
N,O Diakinesis (x 40 normal illumination, several cells), Moghan







N



O

PLATE 184

Different stages of meiosis in chromosomes of some species of the genus Dociostaurus

Mag. ca. x 1875

a-c x 40 normal objective

a D. tartarus (Shchel.) left, late leptotene; middle, diakinesis; lower, preleptotene (Iran, Sarakhs)

b D. maroccanus (Thunberg) middle, diakinesis; right, preleptotene (Iran, Moghan)

c D. larensis sp.n. upper, metaphase I; lower, late leptotene (Iran, Kazerun)

d x 100 normal and e-i x 100 phase contrast

d D. jagoi jagoi subsp.n., Iran, Somar

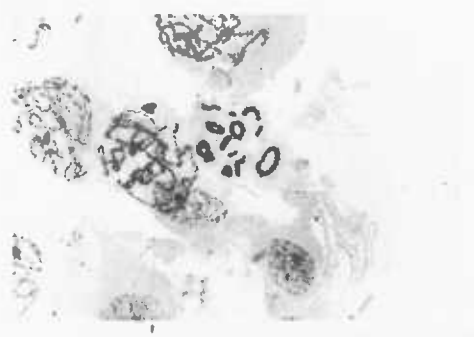
e D. maroccanus (Thunberg), Iran, Kazerun

f D. anatolicus (Krauss), Israel, Golan, Bab-el-Hawa

g D. maroccanus (Thunberg), Iran, Moghan

h D. tartarus (Shchel.), Iran, Sarakhs

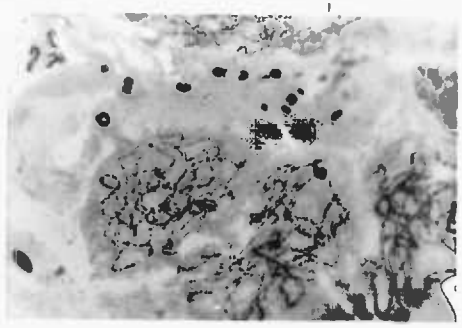
i D. maroccanus (Thunberg), Iran, Moghan



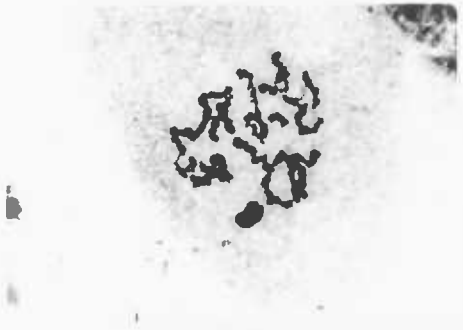
a Late leptotene - Diakinesis - Preleptotene



b Diakinesis - Preleptotene



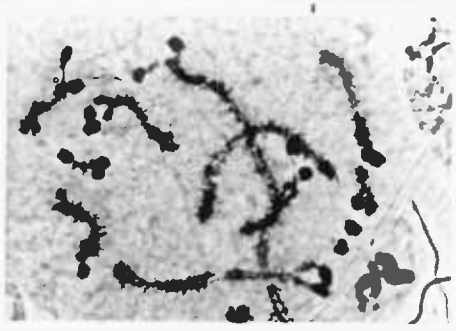
c Metaphase I - Late leptotene



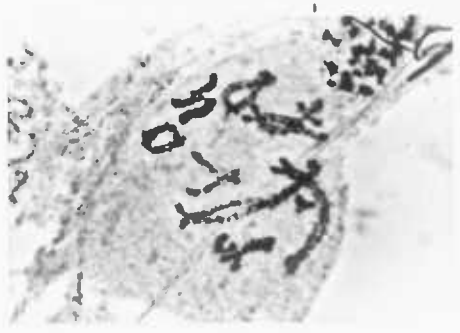
d Late zygotene



e Late pachytene



f Early diplotene



g Diplotene



h Diplotene



i Diakinesis

PLATE 185

Different stages of meiosis in chromosomes of some species of the genus Dociostaurus

Mag. ca. x 1875

J, K, M-P x 100 normal objective and L x 40 normal illumination

J D. larensis sp.n., Iran, Kazerun

K D. cephalotes Uvarov, Israel, Golan, Bab-el-Hawa

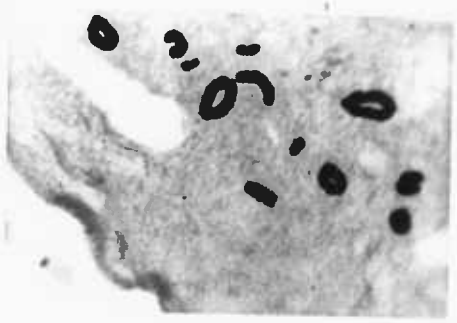
L D. albicornis (Eversmann), Iran, Moghan

M D. cephalotes Uv., Israel

N D. jagoi jagoi subsp.n., Iran, Somar

O D. larensis sp.n., Iran, Kazerun

P D. jagoi jagoi subsp.n., Iran, Somar



j Metaphase I



k Metaphase I



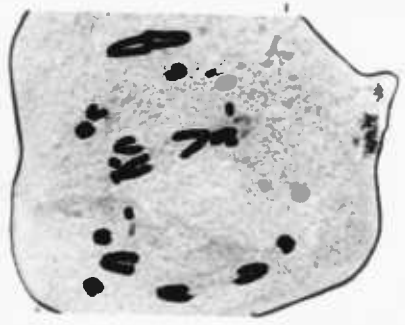
l Late leptotene - Metaphase I - Diakinesis



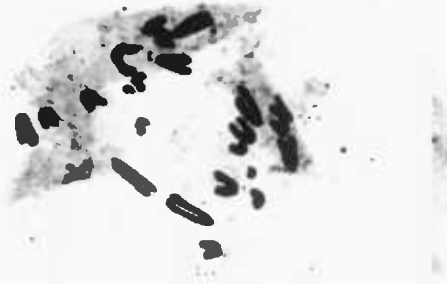
m Two cells at metaphase II



n One cell at metaphase II



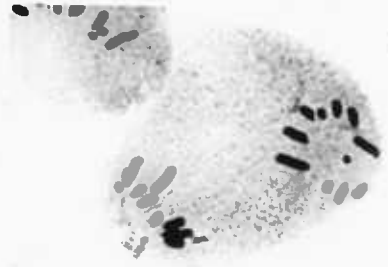
o Anaphase I



p Anaphase I



q One cell at anaphase II

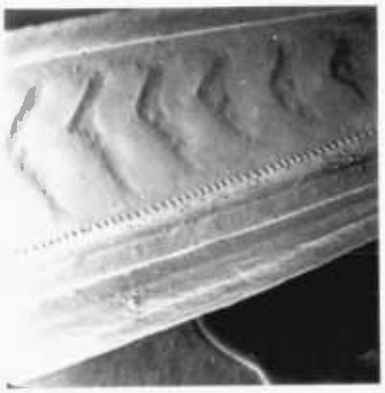


r One cell at anaphase II

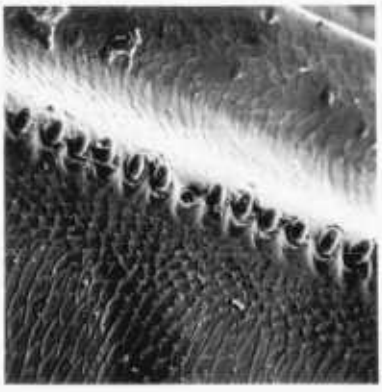
PLATE 186

Scanning electron microscopy of stridulatory pegs in some species of the genus Dociostaurus (Thunberg).

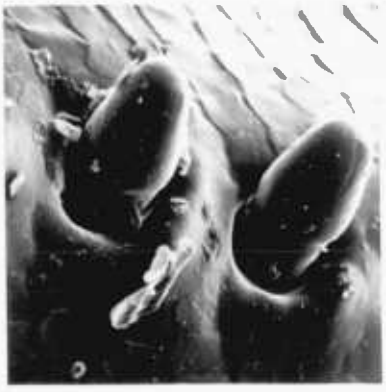
Owing to reduction, actual magnifications of the photographs given have one half of the captioned magnification.



a Dociostaurus maroccanus Ph. gregaria 20x



b Dociostaurus maroccanus Ph. gregaria 200x



c Dociostaurus maroccanus Ph. gregaria 1000x



c Dociostaurus maroccanus Ph. solitaria 500x



d Dociostaurus maroccanus Ph. solitaria 200x



e Dociostaurus maroccanus Ph. solitaria 1000x



f Dociostaurus maroccanus



g Dociostaurus maroccanus



h Dociostaurus maroccanus

PLATE 187

Scanning electron microscopy of stridulatory pegs in some species of the genus Dociostaurus (Thunberg).

Owing to reduction, actual magnification of the photographs given have one half of the captioned magnification.



a Dociostaurus anatolicus 200x



b Dociostaurus anatolicus 500x



c Dociostaurus anatolicus 1000x



e Dociostaurus albicornis 200x



f Dociostaurus albicornis 500x



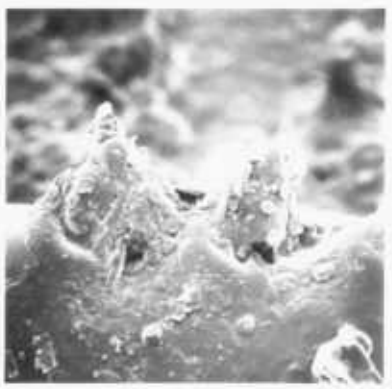
g Dociostaurus albicornis 1000x



h Dociostaurus jagoi occidentalis 200x



j Dociostaurus jagoi occidentalis 500x



k Dociostaurus jagoi occidentalis 1000x

FIG. 188 Graph of percentage chromosome length against autosome pair number of following species:

(measurements taken at similar meiotic stages)

D. larensis sp.n., Iran, Kazerun

D. tartarus (Shchelkanovtesev), Iran, Sarakhs and Daregaz

D. curvicercus Uvarov, Israel:

I material from Jerusalem

II specimens collected from Betgoverin

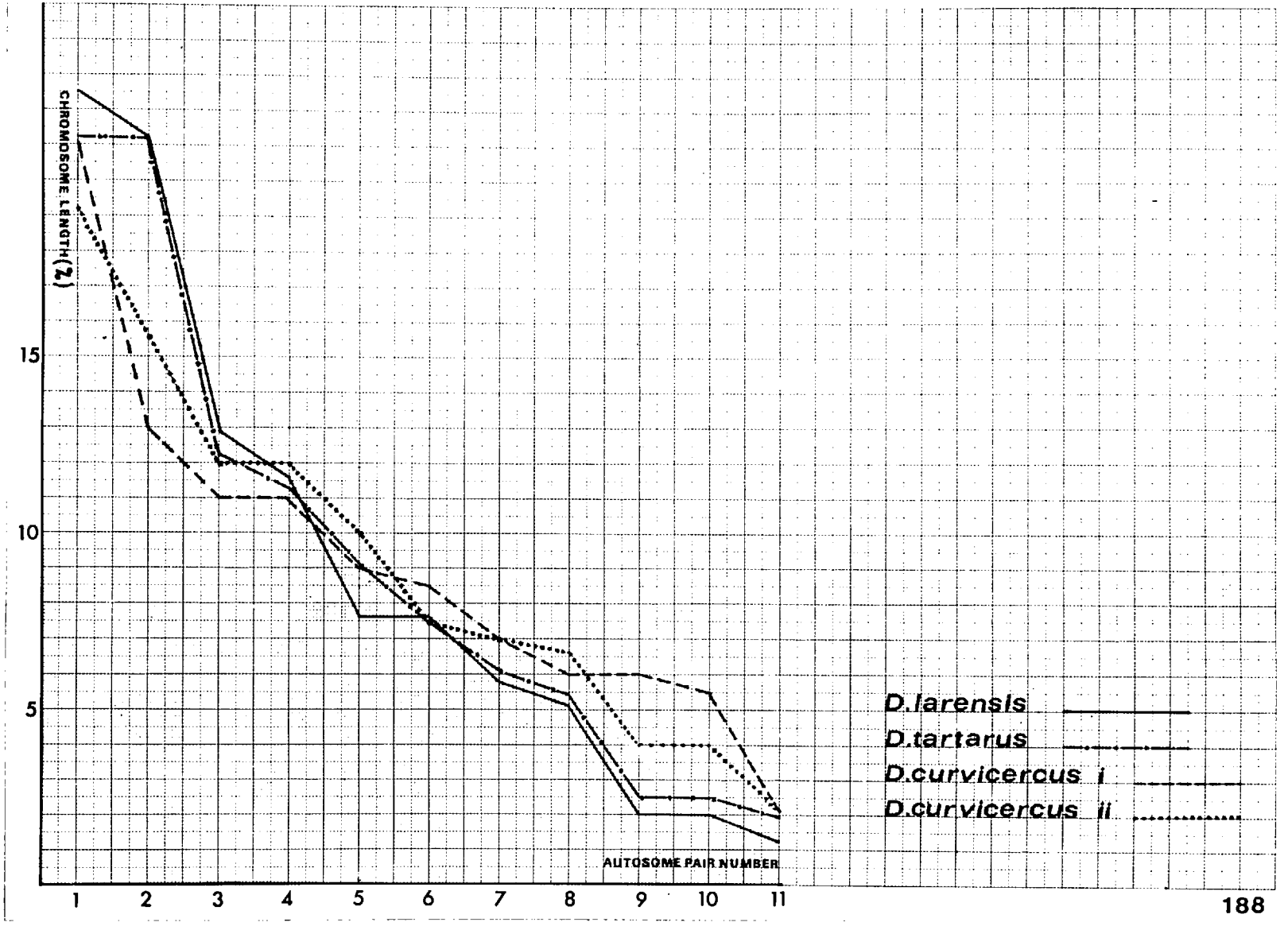

CHROMOSOME LENGTH (%)
15
10
5
1
2
3
4
5
6
7
8
9
10
11
AUTOSOME PAIR NUMBER
D.larensis
D.tartarus
D.curvicercus i
D.curvicercus ii

FIG. 189 Graph of percentage chromosome length against autosome pair number of following species:

D. maroccanus (Thunberg), Iran, Daregaz

D. anatolicus (Krauss), Israel, Golan, Bab-el-Hawa

D. hauensteini (I. Bolivar), Iran, Moghan

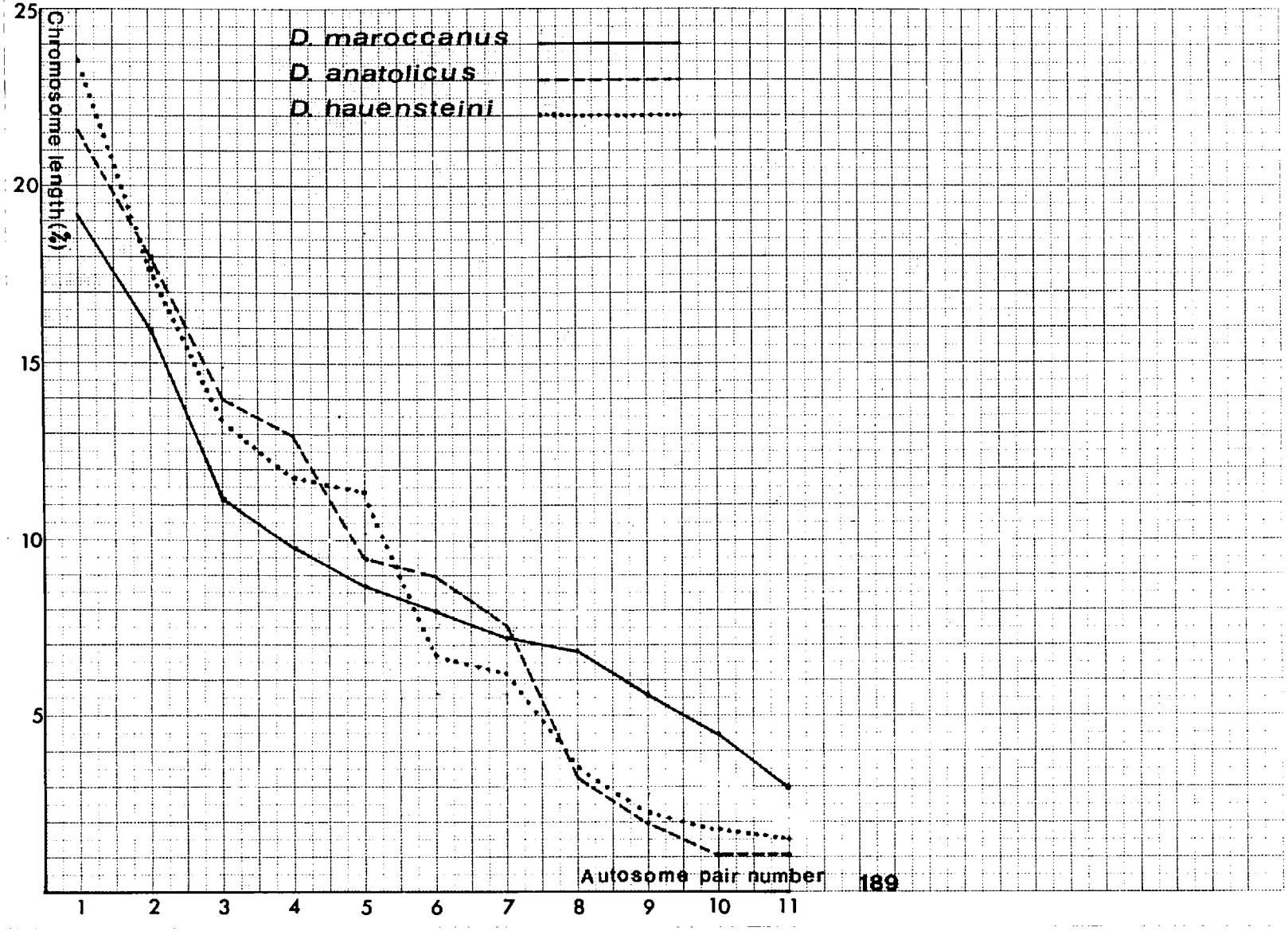

D. maroccanus
D. anatolicus
D. hauensteini
Chromosome length (%)
25
20
15
10
5
1
2
3
4
5
6
7
8
9
10
11
Autosome pair number

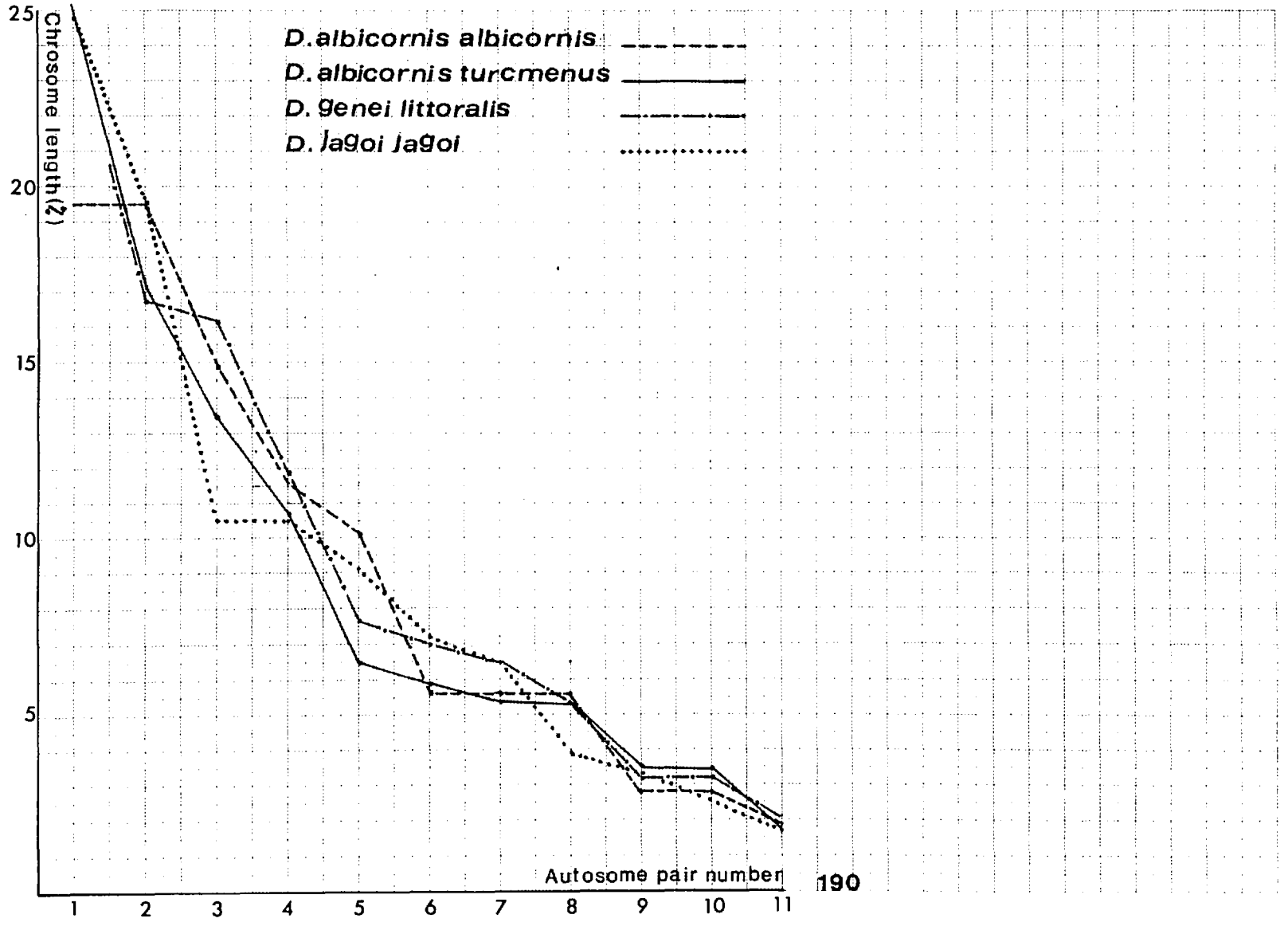
FIG. 190 Graph of percentage chromosome length against autosome pair number of following species:

D. albicornis albicornis (Eversmann), Iran, Moghan

D. albicornis turcmenus Uvarov, Iran, Sarakhs

D. genei littoralis subsp.n., Israel, Ziqim

D. jagoi jagoi subsp.n., Israel, Betgoverin


D.albicornis albicornis
D.albicornis turcmenus
D. genei littoralis
D. jagoi jagoi
Chrosome length(2)
25
20
15
10
5
1
2
3
4
5
6
7
8
9
10
11
Autosome pair number

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Addendum

Analysis of phenetic distance between taxa using size of chromosomes

The programme was provided by Dr N.D. Jago. The results of groupings are shown in Fig. 191.

Two major groupings occur in the dendrogram which can be drawn following this analysis:

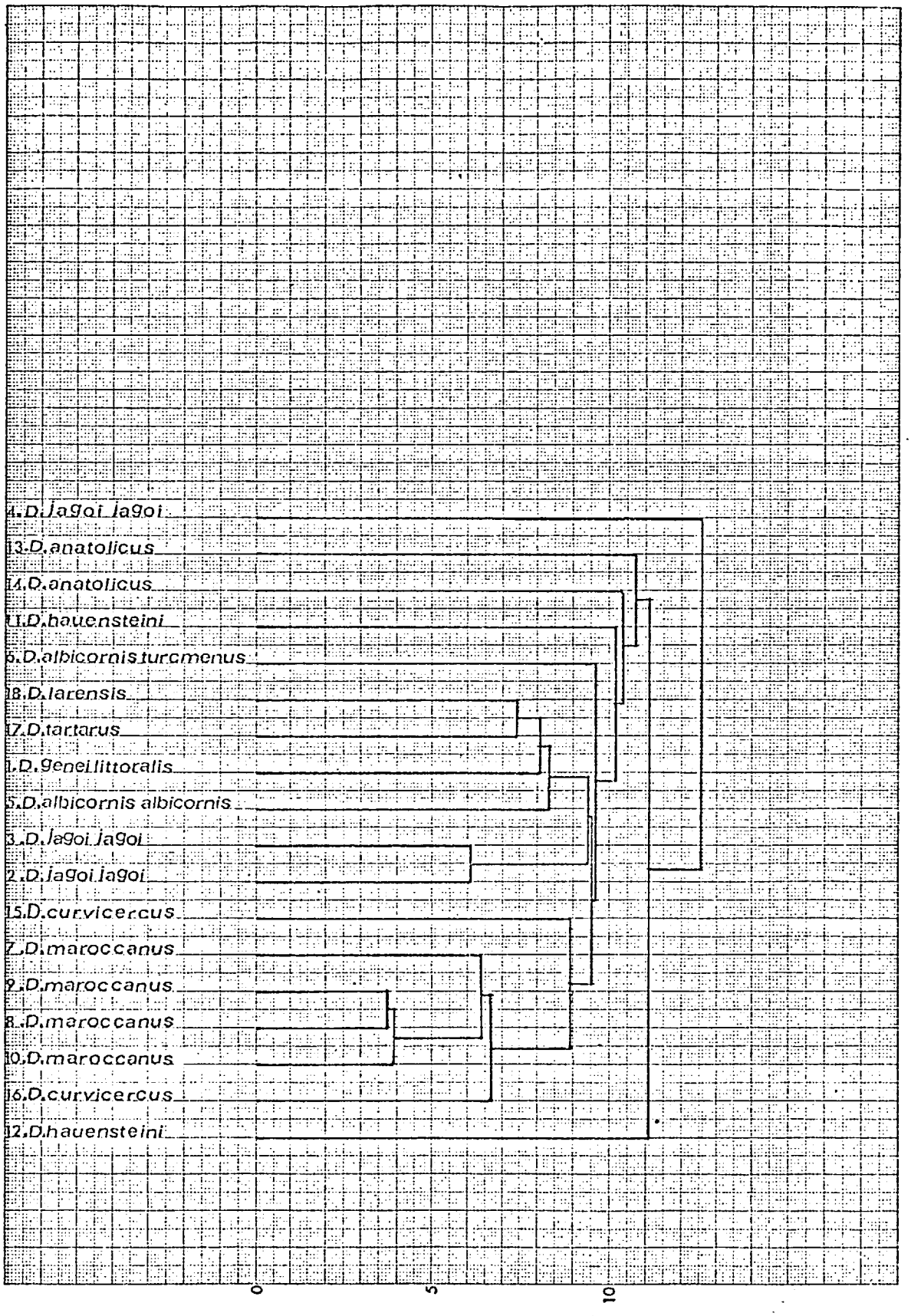
(a) that centred on *D. maroccanus* and *D. curvicercus*;

(b) that centred on *D. larensis*, *D. tartarus*, *D. genei*, *D. albicornis*, *D. genei littoralis* and *D. jagoi jagoi*. Peripheral to this last group are *D. hauensteini*, *D. anatolicus*, *D. albicornis turcmenus* and somewhat more surprisingly one specimen of *D. jagoi jagoi*.

Certain combinations are no surprise. All the *D. maroccanus* material falls out together, while two specimens of *D. jagoi jagoi* are adjacent. On other grounds we would not expect such close association of *D. maroccanus* and *D. curvicercus*, or of *D. tartarus* and *D. larensis*. Thus, the analysis of the relative lengths of the chromosomes analysed in this way produces results which cut right across the subgeneric groups erected on other characters.

FIG. 191 Dendrogram of phenetic distance between standardised values of chromosome length.

1. D. genei littoralis subsp.n. (Israel, Ziqim)
2. D. jagoi jagoi subsp.n. (Israel, Jericho)
3. D. jagoi jagoi subsp.n. (Israel, Betgoverin)
4. D. jagoi jagoi subsp.n. (Iran, Somar)
5. D. albicornis albicornis (Eversmann) (Iran, Moghan)
6. D. albicornis turcmenus Uvarov (Iran, Sarakhs & Aghonge)
7. D. maroccanus (Thunberg)(Iran, Darehgaz)
8. D. maroccanus (Thunberg) (Iran, Mashad, Aghonge)
9. D. maroccanus (Thunberg) (Iran, Moghan)
10. D. maroccanus (Thunberg) (Iran, Kazerun)
11. D. hauensteini (I. Bolivar) (Iran, Moghan)
12. D. hauensteini (I. Bolivar) (Iran, Kazerun)
13. D. anatolicus (Krauss) (Israel, Bab-el-Hawa)
14. D. anatolicus (Krauss) (Iran, Kazerun)
15. D. curvicercus Uvarov (Israel, Jerusalem)
16. D. curvicercus Uvarov (Israel, Betgoverin)
17. D. tartarus (Stschel.) (Iran, Aghonge, Darehgaz & Sarakhs)
18. D. larensis sp.n. (Iran, Kazerun)


4.D.lagoi lagoi
13.D.anatolicus
14.D.anatolicus
11.D.hauensteini
6.D.albicornis turcmenus
18.D.larensis
17.D.tartarus
1.D.genei littoralis
5.D.albicornis albicornis
3.D.lagoi lagoi
2.D.lagoi lagoi
15.D.curvicercus
7.D.maroccanus
9.D.maroccanus
8.D.maroccanus
10.D.maroccanus
16.D.curvicercus
12.D.hauensteini
0
5
10