Desert Locust

DL 1

CLASSIFICATION OF PAMPHAGIDAE (ORTHOPTERA: ACRIDOIDEA) IN FEZZAN REGION OF LIBYA. Abdulgader Ali Ajaili and Mohammad Kamil Usmani, General Science Department, Faculty of Eng. & Technology, Sebha University, P.O. Box 68, Brack Al-Shati, Libya, Email: dr_ajaili@hotmail.com, dr_ajaili@yahoo.com

The present study is based on six genera of the family Pamphagidae. Brief diagnosis of the family Pamphagidae is given. Key to the subfamilies and genera belonging to this family in Fezzan region "Fezzanian Pamphagidae" was given mainly based on conventional as well as genitalic characters. Presence or absence of teeth in the upper side of middle tibia; presence or absence of external apical spine of hind tibia; long or short condition of aedeagal sclerites; long or short condition of ovipositor valves; with or without a ridge or tooth and strongly or slightly widened condition of ventral valve of ovipositor; shape of diverticula of spermatheca; presence or absence of setae on posterior margin of female subgenital plate, are used as stable characters for separating the subfamilies. Oblique or vertical condition of frons, sulcated or flattened condition of frontal ridge, shape of antennae, shape and ratio of length and width of pronotum, ratio of length of prozona and metazona of pronotum, presence or absence of median and lateral carinae on pronotum, number of sulci crossing dorsum of pronotum, median carina with or without longitudinal furrow; slightly or deeply incised condition of frontal crest, bidentate or trilobate condition of median carina in prozona; shape of prosternal process; shape of tegmina; presence or absence of fascia on hind wings; long and narrow or short and wide condition of hind femur; shape of male subgenital plate, supra-anal plate and cerci; narrow or wide condition of epiphallus; shape of posterior margin of female subgenital plate, presence of setae on the whole posterior margin or confined to lateral margins only; toothed, tuberculated, or smooth condition of ovipositor valves, length of the lateral apodeme in relation to the dorsal valves were used as useful generic characters.

DL 2

EFFECT OF TWO ENTOMOPATHOGENES (*BEAUVERIA BASSIANA* AND *METARHIZIUM ANISOPLIAE*) ON SOME PHYSIOLOGICAL PARAMETERS OF THE DESERT LOCUST *SCHISTOCERCA GREGARIA* FORSKAL. B. Doumandji-Mitiche, S. Doumandji, N. Kaidi and S. Hemour, Department of Agricol and Forestry Zoology, National Agronomic Institute, El-Harrach, Algiers, Email: doumandjimitiche@yahoo.fr

The effect of the entomopathogens *Beauveria bassiana* and *Metarhizium anisopliae var acridum* on some physiological parameters of the desert locust such as breathing rhythm, the cardiac rhythm and the hemogramme was evaluated. The used locusts were collected from Adrar region. *B. bassiana* was isolated from bees collected from a pond in Reghaia region during April, 2003 and was used at a dose of 2.83×10^6spores/ml. in distilled water, which is the LC50 calculated previously. The entomopathogen *M. anisopliae var acridum* was obtained in May, 2005 from the National Institute of Plant Protection in the form of the biopesticide "Green muscle", formulated in an oily suspension and used at the dose of 14×10^6 spores/ml, as a contact treatment. Physiological disorders were noticed from the 3rd day after treatment, and translated by decline of the frequency of stigma openings from 85.33 to 36.30 openings/mn and from 80.42 to 38.40 openings/mn, respectively for females and males treated by *B. bassiana*, and a decline from 85.88 to 42.38 openings/mn and from 85.33 to 44.08 openings/mn, respectively for females and males treated by *M. anisopliae*. A similar decrease in heart rhythm was noted for to the treatment by *B. bassiana* with a decline from 78.09 to 35.65 beatings/mn in females and from 77.42 to 37.12 beatings in males. The treatment by *M. anisopliae* reduced the number of the cardiac beatings from 80.30 to 44 beatings/mn for females and from 82.05 to 44.25 beatings/ mn for males. The qualitative study of the hemogramme of *S. gregaria* allowed us to identify 3 categories of cells; prohemocyties, plasmatocyties and granulocyties. The quantitative study indicated that on the 3rd day after treatment, decline from 113.25 to 19.50 prohemocyties/5 µl of hemolymph and from 151.25 to 23.25 plasmatocyties/5 µl of hemolymph was observed.

DL 3

MORPHOMETRY AND DIET OF THE DESERT LOCUST *SCHISTOCERCA GREGARIA* (IN SOME REGIONS OF ALGERIA. B. Doumandji-Mitiche, Y. Kherbouche and S. Hemour, Department of Agricol and Forestry Zoology, National Agronomic Institute, Algiers, El-Harrach, Algiers, Email: doumandjimitiche@yahoo.fr

Following the invasion of the desert locust *Schistocerca gregaria* (Acridida: Cyrtacanthacridinae) to Algeria in February, 2004 and the outbreaks which followed, it was useful to make a bioecological study (biometry and diet) of this pest in various regions of the Algerian Sahara. The comparison of E/F and F/C ratios allowed us to observe that populations collected from the regions of Laghouat (n=12 females, 8 males), Biskra (n=27 females, 25 males), Djelfa (n=7 females, 6 males), Adrar (n=3 females, 8 males), Oued Souf (n= 2 females, 25 males) and Touggourt (n=45 females, 55 males) were in the gregarious stage with an average of 2.19±0.21 ≤E/F≤ 2.44±0.09 and 3.28±0.12 ≤F/C≤ 3.47±0.27 for the females and 2.19±0.21 ≤E/F≤ 2.37±0.08 and 3.24±0.09 ≤F/C≤ 3.48±0.20 for the males. The majority of the individuals of these same populations were transients congregants, while some were gregarious. The study of the diet was conducted in two stations, Boudda and Baâmar situated in Adrar (0º11'E.; 27º49'N) at 1543 km south of Algiers. The selection of the region was justified by the permanent presence of this locust on the irrigation pivots. In the station of Boudda (a palm plantation situated at 20 km of the city of Adrar), five botanical species were identified in the feces of males (n=15) and females (n=10). *Phoenix dactylifera* was the most attacked species with 62.86% for males and 62.05% for females. The second species attacked was *Arundo plinii* (Poacea) at the rate of 27.14% for males and 32.55% for females. *Arachis hypogera*, *Mentha specata* and *Punica granatum* were less attacked. In the station of Baâmar (a small field with vegetable and cereal crops situated in 45 km in the southeast of the city of Adrar) six botanical species were identified in the feces of females (n=14) and four in those of the males (n=15). The botanical species attached most by the females were *Arundo donax* (57.18%), *Solsa vermiculata* (12.94%) and *Lycopersicum exulentum* (11.93%). As for males, *Arundo donax* was attacked most (85.53%), followed by *Solsa vermiculata* (85.53%) and *Phoenix dactylifera* (7.62%).

DL 4

A STUDY ON OVARY DEVELOPMENT OF THE LOCUST *CALLIPTAMUS BARBARUS* IN ARID AND WET CLIMATES IN ALGERIA. Benzara Abdelmadjid[1] and Alain Louveaux[2]. (1) Institut National Agronomique, El-Harrach, Alger, Algeria, Email: benzaraabdelmadjid@yahoo.fr; (2) Labo ESE Bât. 362, Université Paris Sud, F91405 Orsay, Paris, France.

The temporal fecundity of *Calliptamus barbarus* (Orthoptera: Acrididae) is badly known until recently. It appears indeed that the production of ovules is much more important in the arid than in the wet climate. The maximum number of ovules was 56 and 58, respectively, in the wet and the arid climates. Laying of eggs do not happen more than twice in both climates. On the other hand, the resorption of eggs is very high when the climatic conditions are unfavourable. The number of ovules retained in the chalice of the ovary is less than the traces of layings. That means the female laid eggs at least once. The retention of eggs begins September and continues until October regardless of the climate. The ovary output reaches 79% in the arid climate and 94% in the wet climate. It appears that the fecundity increases in wet climate and decreases in the arid climate but the reproductive potential of *Calliptamus barbarus* remains average compared to other locust species of the same family.

DL 5

STUDY OF THE ACTION OF ENTOMOPATHOGENIC FUNGUS *METARHIZIUM ANISOPLIAR* VAR. *ACRIDIUM* ON A DESERT LOCUST *SCHISTOCERCA GREGARIA*. Bahia Doumandji-Mitiche[1] and Fatima Zohra Bissaad[2]. (1) Department of Agricol and Forestery Zoology, National Agronomic Institute, El-Harrach, Algiers, Algeria; (2) Department of Biologie, Faculty of Science, University of Boumerdès, Algeria, B P 35000, Boumerdes, Algeria, Email: bissaad@yahoo.com

Chemical pesticides largely contributed to crop protection against the desert locust. However, it had negative effect on the environment, human and animal health and reduced the population of useful insects. In the search of new environment friendly techniques, a bio-pesticide "Green Muscle" was evaluated in this study. Three doses applied by ingestion were applied on the fifth stage larvae of *S. gregaria*. The treatments

were D1=10^6 spores, D2 = $2x10^6$ spores and D3 = $4x\ 10^6$ spores per ml. The best results were obtained with the highest concentration. The examination of the various parts of the digestive tracts of L5 of *S. gregaria* under the optical microscope highlighted notable differences in structure of the treated individuals compared with the control.

DL 6

LABORATORY SCREENING FOR INSECTICIDAL PROPERTIES OF SOME PLANT PRODUCTS AGAINST THE MIGRATORY LOCUST, *LOCUSTA MIGRATORIA* LINNE. Abdalla M. Abdalla[1], M. H. Luong-Shovmand[2], M. Lecoq[2] and S. El-Bashir[3]. (1) University of Kordofan, P.O. Box 160, El-Obeid, Sudan; (2) Centre de Coopération Internationale en Recherche Agronomique pour le Developpement, Montpellier, France; (3) Department of Crop Protection, Faculty of Agriculture, University of Khartoum, Shambat, Sudan, Email: khalil2004@hotmail.com

The development of environment friendly locust control methods have attracted attention in recent years. Many products, including botanicals, were extensively evaluated as possible alternatives to the commonly used chemical pesticides. In this paper the results of laboratory tests of extracts of four plants, namely *Mucuna pruriens* (Fabaceae), *Adenium obesum* (Apocynaceae), *Azadirachta indica* (Meliaceae) and *Calotropis procera* (Asclepiadaceae) against the migratory locust (*Locusta migratoria*) will be presented. Water or water/ethanol extracts were screened for their locusticidal properties, both as contact and stomach insecticides. Knockdown, mortality and time to death were assessed as indicators of efficacy. The bio-tests have shown that *Mucuna* extracts act both as contact and stomach insecticides. Up to 99% mortality of migratory locust was achieved by direct spraying of water or water/ethanol *Mucuna* extracts at 50 g/. Similar killing rate was also obtained when locusts were fed on wheat seedlings treated with *Mucuna* (water/ethanol extract) at 50 g/l. *Mucuna* extracts, appeared to act faster on locust than neem extracts. The study concluded that *Mucuna* extract is a potential natural product effective against many crop pests.

DL 7

THE DISTRIBUTION OF INVASIVE AND REMISSIVE POPULATIONS OF THE MOVING LOCUST *SCHISTOCERCA GREGARIA* (FORSKÅL, 1775) IN ALGERIA. A. Guendouz-Benrima[1] and B. Doumandji-Mitiche[2]. (1) Institut d'Agronomie, Université de Blida, B.P 09, 09470, Soumaa, Blida, Algérie, Email: atiguen@yahoo.fr; (2) Institut National Agronomique d'El Harrach, 16200, Algeria.

The gregarious ability of the moving locust *Schistocerca gregaria* Forsk (Insecta: Orthoptera) lead to comparatively study its behaviour during the remissive period (dominating lonely phase) and during the invasive period (dominating gregarious phase). In this study, we are presenting some adults and larvae frequency maps in Algeria prepared by FAO/COPR 1937–1991. The biogeography analysis of the moving locust in Algeria showed that the frequency sites are contagiously spreading. During invasions, the production area is stretched mainly in the anthropized Mediterranean regions threatening the agriculture of the country. During the remissive period, the reproduction area spread from the central Sahara to the meridional Sahara. Only the central Sahara and meridional Sahara are concerned with regular reproduction of the moving locust. Countries adjacent to Algeria are concerned with this situation and that for close monitoring and exchange of information among all countries affected by locust attack.

DL 8

EVALUATION OF THE BIOLOGICAL IMPACT OF BACTERIA ON DESERT LOCUST PILGRIM *SCHISTOCERCA GREGARIA*. H. Mohanad Kaci[1] and B. Doimandh-Mitiche[2]. (1) Department of Biology, University M'hamed Bougara, Boumerdes, Algeria, Email mkbio2005@yahoo.fr; (2) INA, El-Harrach, Algiers, Algeria

Centuries ago, before the Christian era, problems caused by the Orthoptera have always caught attention. History witnessed great invasions of locust. Modern techniques made use of efficient chemical insecticides, to which Acrididae are particularly sensitive. However, the massive use of chemical insecticides has many disadvantages. That is why scientists looked for alternatives such as biological control. The efficiency of four bacteria (*Bacillus subtilis, Bacillus thuringiensis, Bacillus larvae* and *Pseudomonas aeruginosa* to control *Schistocerca gregaria* stages L_1, L_2, L_3 and L_4 were evaluated. Different concentrations of the bacterial suspension were added to the insects died placed together with the nymphs in

smaller cages. Insects mortality was checked daily. The results obtained indicted that the locust mortality rate increased whit the increase in the quality of the bacteria used. However, certain resistance towards the bacteria was observed in the advance developmental stage of the locust.

DL 9

EFFECT OF DIFLUBENZURON ON THE LARVAE OF THE FOURTH AND FIFTH STAGE LARVAE OF THE DESERT LOCUST *SCHISTOCERCA, GREGARIA* UNDER LABORATORY CONDITIONS. Tail Ghania[1], Batrick Bourchoroun[2] and Bahia Doumandji Mitiche[3]. (1) Department of Biology, Faculty of Agronomy, Veterinary and Biology Sciences, University Saad Dahleb of Blida, Algeria, Email: g-tail@caramail.com; (2) Biear & Marey Koury University, Paris 6, France; (3) Department of Agricultural and Forest Zoology, National Institute Agronomic El-Harrach, Algiers, Algeria.

Diflubenzuron, a benzoylphenylurea (BPU) was evaluated on *Schistocerca gregaria* (Orthoptera, Acrididae). Treatment was applied on newly 4th and 5th instar larvae for 24 h. The compound exhibited insecticidal activity and mortality occurred after earlier inhibition of their development or by their inability to complete their ecdysis. Treatment resulted in a significant larvicidal effect and in an inhibition of adult emergence. Moreover, the compound disturbed insect growth and development since several morphological types with an increase in the duration of larval stage were observed.

DL 10

BIOLOGICAL ACTIVITY OF AN INSECT GROWTH REGULATOR: TEFLUBENZURON ON LARVAL CUTICLE AND MIDGUT LEVEL OF *SCHISTOCERCA GREGARIA*. Fatma Acheuk[1] and Bahia Doumandji Mitiche[2]. (1) University of Boumerdes, Département of Biology, Algeria; (2) Institut Naional of Agronomy, Département of Zoology, Algeria, Email: criquet72@yahoo.fr

This study was carried out to evaluate in the laboratory the biological activity of the Teflubenzuron on the morphological aspect of the cuticle and the midgut of the 5th instars larvae of *Schistocerca gregaria*. Topical application of a concentration of 2 µg was deposited beneath the pronotum of the 5th stage larvae. The Teflubenzuron did not have any effect on the external morphology of the treated larvae at such concentration. However, Teflubenzuron had a clear effect on the post ecdysial cuticle (endocuticle) and produced an amorphous structure in the treated larvae. At the mesenteron, the severity and speed of injury was observed in epithelial cells.

DL 11

IMPACT OF ENTOMOPATHOGENIC FUNGUS *METARHIZIUM FLAVOVIRIDE* EXPOSED TO ULTRAVIOLET RADIATION ON *SCHISTOCERCA GREGARIA*. Fatma Zohra Kara and Bahia Doumandji Mitiche, Department of biology, Faculty of Science Agrovétérinaires and biological, University Saad Dahleb, Algeria, Email: ihcene_faiza@yahoo.fr

Schistocerca gregaria is one of the most known serious pests at an international scale and most dangerous in Maghreb countries. It causes considerable damage to a given location and to move quickly long distances by crossing borders and to colonize in a very short time zones distant from each other. The discovery of chemical insecticides gave new tool to control locust. But intervention with insecticides could not stop the locust attack completely. Moreover, this approach was a source of pollution with negative effects on the environment. The use of microbial agents will be a safer alternative. This work is a contribution to the knowledge of the fungus *Metarhizum flavoviride* and the effect of UV radiation on its effectiveness to control *S. gregaria*. Results showed that the UV treated fungus grew extremely well and effectively infected the locust. Following the treatment with the UV irradiated fungus, the protein content in the locust blood reached 3.14 µg/l, whereas, the protein content was 28.3 µg/l in the locust treated with an unradiated fungus. Likewise, sugar content in the blood of the locust treated with radiated fungus reached 10 µg/l, when it was 40.9 µg/l in the blood of the control. Ovaries of locust females treated with radiated fungus were reduced in size (50 mm), compared to those of the control (82 mm).