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EUROPEAN RESEARCH OFFICE (9851 DU)
U.S. Department of the Army
Frankfurt/Main, Germany
APO 757, US Forces

Contract DA-91-591-EUC-2674 ✓

"Final Technical Report"

1) Subject of the research.

Search in tropical regions will be made for Arthropods (Insects, Arachnids, Crustacea and Myriapoda) which produce toxic substances. 3)

Methods will be developed for collection, extraction and preservation of toxins from these Arthropods.

The crude extracts will be tested for biological effects.

These substances showing promise will be further concentrated and purified followed by biological, chemical and physical study of the purified products.

2) Name of Contractor.

Prof. M. PAVAN (Istituto di Entomologia Agraria dell'Università di Pavia, P.Botta 10, Pavia, Italy).

3) Contract number: DA-91-591-EUC-2674.

4) Type and number of report. Final Technical Report.

5) Period covered by report: 1 april 1963 - 31 march 1964.

6) The research reported in this document has been made possible through the support and sponsorship of the US Department of Army, through its European Research Office.

The Contractor:



Prof. Mario Pavan, director of
Istituto di Entomologia Agraria
dell'Università di Pavia (Italy)
P. Botta 10

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Pavia, 20 may 1964

1. Subject of research.

Search will be made in tropical regions for Arthropods (Insects, Arachnids, Crustacea and Myriapoda) which produce toxic substances.

Methods will be developed for collection, extraction and preservation of toxins from these Arthropods.

The crude extracts will be tested for biological effects.

Those substances showing promise will be further concentrated and purified, followed by biological, chemical and physical study of the purified products.

2. A brief summary of the nature of the project.

The project is of an experimental nature and based on three fundamental stages, I, II e III, which correspond to the three-year period of the project.

I) Observations of happenings in nature which indicate the probable existence of biologically active substance in Arthropods (Insects, Arachnids, Crustacea and Myriapods); systematic determination of the organisms producing substances and defining research of their natural significance.

Stage I is characterized by its execution taking place predominantly in nature, particularly in rich fauna zones, above all in tropical and equatorial regions, and by a subsequent systematic examination of the animals in the laboratory.

II) When the existence of biologically interesting substances has been detected in certain animal species, the source of supply of raw material will be sought to collect sufficient quantities of such animals in order to begin the preparation of determining extracts. A subsequent collection of larger quantities will be made for intense biological and chemical researches.

Stage II is characterized by the necessity of two kinds of work: in nature for the detection of the sources of raw materials and initial preparations; in the laboratory, perhaps field laboratory, for the preservative preparation of materials in extraction destined for subsequent biological, chemical, physical and other researches.

III) Extensive screening of the properties of raw extracts in various biological tests (animal and vegetable); concentration and purification of the active principles; biological, chemical and physical study of any purified products.

Stage III is characterized by a chiefly laboratorial development. Vast equipment will be necessary for chemical and physical researches, and for the application of numerous biological tests, living and in vitro, on animals, plants and man.

3. Research carried out in the 1st year and still under way.

In accordance with the general lines laid down in section 2, during the first year's work (1st April 1963 - 31 March 1964) we have carried out fauna research in the areas mentioned below to determine the species of Arthropoda interesting for the study of toxic substances.

The Congo Republic: Léopoldville area; Mayombe region; Stanleyville region; Elisabethville region; Bukavu region, near Lake Kivu.

The Rwanda Republic: short research in the area of Kamembe.

The Kingdom of Burundi: short research in the area of Bujumbura.

Kenya: short research in the areas of Nairobi, Nyeri.

Tanganyika: short research in the region of Momella (Mount Neru).

In order to take advantage of local assistance and to be able to use scientific laboratories, research was concentrated mainly in the region of Stanleyville (The Congo Republic) where it was carried out also with the collaboration of Italian staff (three as-

sistants and technicians), and the aid of various Congolese staff. Up to now a total of 180 Arthropod species producing toxic substances have been defined and determined, these being:

35 species belonging to Miriapods

145 species belonging to Insects

Also numerous other species of Miriapoda and Insects producing toxic substances have been collected and are now under examination for determination.

Isopoda which produce toxic substances have not been found.

Arachnida which produce toxic substances have not been determined.

Glands which produce toxic substances have been defined in numerous species; histological preparations for some of them have also been prepared.

The possibility of obtaining sufficient material for the study of biological properties and a primary chemical screening of various species during the 2nd year has been covered.

With the exception of a few species of Hymenoptera, Lepidoptera and Coleoptera (Paederus genus) known to be venomous, all other species cited in this report had never been indicated as producers of toxic substances.

In the second year (1964-1965) research on the biological properties of secretions will be carried out in loco in the region of Stanleyville, with various animal and vegetable tests and with the co-operation of Italian and Congolese assistants and technicians.

Chemical screening will begin in the second year, also in loco, particularly with gas-chromatograph analyses (1) and will be intensely developed in the third year (1965-1966).

(1) This part of the research should already be carried out during the second year (1964-1965) with a gas-chromatograph which we hope to obtain with the financial help of European Research Office.

4. List of Miriapod and Insect species which produce toxic substances, defined hitherto.

I report herewith indications of the genera and species hitherto recognized as interesting for the study of toxic substances and biologically active secretions in general.

The secretive glands have been localized in the group marked (°).

A R T H R O P O D A

Class DIPLOPODA (Myriapoda;)Millipedes).

Sub-class Chilognata, Super-order Helminthomorpha
(Polydesmoidea)

(°) Fam. OXYDESMIDAE:

Oxydesmus falcatus anomalus Att.; Congo.

O. mazolanus Att.; Congo.

O. pallidus Att.; Congo.

Plagiodesmus occidentalis occidentalis Karsch; Congo.

P. occidentalis tuberosus Att.; Congo.

(°) Fam. GOMPHODESMIDAE:

Aulodesmus terreus Att.; Congo.

Gomphodesmus rugosus Att.; Congo.

G. asperulus Att.; Congo.

G. imbecillus Att.; Congo.

G. mansuetus Att.; Congo.

(Juliformia)

(°) Fam. ODONTOPYGIDAE:

Allantogonus longifilis Att.; Congo.

A. ruandensis Krs., Rwanda.

Haplothyrsanus ealanus Att.; Congo.

H. socialis Carl.; Congo, Rwanda.

Odontopyge procerula Krs.; Rwanda.

O. specularis Att.; Burundi.

O. carli Krauss; Congo.

Prionopetalum megalacanthum Att.; Rwanda.

Solenophyllum monocentrum Att.; Congo.

(°) Fam. PREPODESMIDAE:

Cordyloporus ornatus Att.; Congo.

Basacantha nechowi (Karsch); Congo.

(°) Fam. SPIROSTREPTIDAE:

Alloporus fallax Att.; Congo.

Charactopygus frequens Att.; Congo.

Doratogonius scrobiculatus Att.; Congo.

Epistreptus garambanus Chamb.; Congo.

Kartinikus australis Att.; Congo.

Megaskamma dartevillei Att.; Congo.

Onychostreptus erroneus Att.; Congo.

Pachybolus macrosternus Chb.; Congo.

Scaphiostreptus albolimbatus Att.; Congo.

Spirostreptus langi Chamb.; Congo.

S. paneratus Att.; Congo.

S. virgator Silv.; Congo, Rwanda.

Synophrystreptus incertus Att.; Congo.

Trienostreptus robustus Att.; Congo.

Class INSECTA

Order Isoptera (termotes; white ants).

(°) Fam. TERMITIDAE

Nasutitermitinae

Eutermes konduensis Sjöst.; Congo.

E. minusculus Sjöst.; Congo.

E. elongatulus Sjöst.; Congo; Cameroun.

E. ferranti Wasm.; Congo.
E. putidus Sjöst.; Congo.
E. schoutedeni Sjöst.; Congo.
E. arborum Smeath.; Senegal; Cameroun; Gabon; Congo.
E. ueleensis Sjöst.; Congo.
E. diabolus Sjöst.; Congo.
E. torquatus Sjöst.; Congo.
E. dulcis Sjöst.; Congo.
E. nanus Sjöst.; Congo.
Trinervitermes katangensis Sjöst.; Congo.
T. agricola Sjöst.; Congo.
T. brutus Sjöst.; Congo.
T. muneris Sjöst.; Congo.
T. diplacodes Sjöst.; Congo.
T. havilandi Fuller; Congo.
T. posselensis Sjöst.; Congo.
T. oeconumus Träg.; Sudan; Congo.

Order Orthoptera

Fam. PYRGOMORPHIDAE

Taphronota ferruginea F.; Congo.
T. calliparea Schaum.; Congo; Rwanda; Tanganyika;
Burundi.

Order Hemiptera

(°) Fam. BELOSTOMATIDAE

Hydrocyrius (Paracyrius) rectus Mayr; Tanganyika;
Congo.

(°) Fam. REDUVIIDAE

Echtrichodia distincta Sign.; Congo.
Ponctonus fasciatus Pal.; Congo.

(°) Fam. COREIDAE

Acanthocoris spinosus Sign.; Congo.

Anoplocnemis curvipes F.; Congo.

Cletus lanciger Fabr.; Congo.

C. ochraceus H.Sch.; Congo.

Cossutia glaveola Drury; Congo.

Daladeropsis africana Dallas; Congo; Tanganyika;
Cameroun.

Dilycchtha tenuicornis Karsch.; Congo.

Leptocoris apicalis West.; Congo.

Leptoglossus membranaceus Fabr.; Congo.

Mictis metallica; Congo.

Mygdonia tuberculosa Sign.; Congo.

Plectropoda sp.; Congo.

Puppeia cincta Signoret; Congo; Tanganyika.

P. vatia Bergroth; Congo.

(°) Fam. MIRIDAE

Deraecoris sp.; Congo.

Lygus apicalis Fieb.; Congo.

L. ghesquieri Schout.; Congo.

L. ricini Taylor; Congo.

Stenotus sp.; Congo.

(°) Fam. PYRRHOCORIDAE

Disdercus sp.; Congo.

Physopelta festiva Fabr.; Congo.

(°) Fam. PENTATOMIDAE

Agonoscelis longirostris How.; Congo.

A. venosa Thumb.; Congo.

A. versicolor F.; Congo.

Antestia cincticollis Schaum.; Congo.

Aspongopus sp.; Congo.

Aspavia acuminata; Congo.

A. armigera Fab.; Congo.
Atelocera se-rata Fab.; Congo.
Bathycoelis sp.; Congo.
Carbula scapularis Dist.; Congo.
Caura pugillator Fab.; Congo.
C. rufiventris Germ.; Congo.
Cryptacrus comes F.; Congo; Tanganyika.
C. 9-maculatus Sign.; Congo; Cameroun.
Gellia dilatata Sign.; Congo.
Macrina juvenca Burm.; Congo.
Nezara viridula L.; Congo.
Piezosternum sp.; Congo.
Procilia morgani White; Congo.
Solenosterhium liligerum Thumber; Congo.
Sphaerocoris annulus Fabr.; Congo.
Tantia gelei; Congo.
Tessaratoma aethiops; Congo.
Thyoma cryptorhynchus Germ.; Congo.
Veterna sanguinirostris Thumb.; Congo.

(°) Fam. PLATASPIDAE

Libyaspidis punctata Leach.; Congo.
Milletia utveldeana; Congo.
Probaenops dromedarius White; Congo.

Order Lepidoptera

(°) Fam. THAUMETOPOEIDAE

Anaphe venata Btlr.; Congo.
A. panda Bsd.; Congo.
Epanaphe moloneyi Drc.; Congo.

Order Coleoptera (Beetles)

(°) Fam. CARABIDAE

Panagaeinae

Tefflus carinatus Klug.; Congo.

T. zarzibericus ssp. kivuensis Basilewsky; Congo.

T. zebulianus Raffray; Congo.

T. z. ssp. Reichardi Kolbe; Congo.

Callistinae

Chlaenites aruwinus Bat.; Congo.

Fam. STAPHYLINIDAE

Paederus fascipes Curt.; Congo; Mauritania; Tanganyika; Tchad, ecc.

P. malaisei Fagel; Congo; Burundi.

P. sabaenus Er.; Congo; Rwanda; Kenya; Sudan; Tanganyika.

P. overlaeti Fagel; Congo.

P. xanthocerus Epp.; Congo; Burundi; Rwanda.

P. aquatilis Cam.; Congo.

P. tenuis Fagel; Congo.

P. congoensis Bernh.; Congo.

P. amicus Bernh.; Congo; Guinea.

P. junodi Bernh.; Congo; Tanganyika; Rwanda.

P. tandalensis Bernh.; Congo.

P. lineativentris Bernh.; Congo; Angola.

P. capitalis Bernh.; Congo; Tanganyika.

P. kaszabi Fagel; Congo.

P. nakurensis Fvl.; Rwanda; Kenya.

P. ruwenzoriensis Fagel; Rwanda.

P. kivuanus Fagel ; Congo.

P. magnus Fagel; Congo.

P. itombwensis Fagel; Congo.

P. pretiosus Bernh.; Congo; Rwanda.

(°) Fam. TENEBRIONIDAE

- Alcyonotus flavopictus Westw.; Congo.
A. congoanus Geb.; Congo.
Ceropria romandi Chr., Congo.
Eupezus natalensis Lac.; Congo; Tanganyika.
E. brevicollis Har.; Congo.
E. brevicornis F.; Congo.
Metallonotus denticollis Gray; Congo.
M. d. var. rugosus Geb.; Congo.
M. physopterus Har.; Congo.
M. antiquus Har.; Congo.
Nesioticus flavopictus Westw.; Congo.
Strongilium sp.; Congo.
Taraxides punctatus F.; Congo.
T. crenatostriatus Imb.; Congo; Cameroun.
T. aeneipennis Kolbe; Congo.
Toxicum taurus F.; Congo.

Fam. CERAMBIICIDAE

- Cordylomera spinicornis F.; Congo; Gagon; Tanganyika.

Order Hymenoptera

(°) Fam. FORMICIDAE

- Anochactus sp.; Congo.
Macromischoides aculeatus Mayr; Congo.
Megaponera foetens Fabr.; Congo.
Myrmicaria striata Stitz.; Congo.
M. irregularis Sants.; Congo.
M. exigua André; Congo.
Odontomachus haematoda L.; Congo.
Oecophylla longinoda Latr.; Congo.
Paltothyreus tarsatus Fabr.; Congo.
Polyrachis sp. Congo.

(°) Fam. VESPIDAE

Belonogaster junceus F.; Congo.

Polistes marginalis Latr.; Congo; Rwanda.

P. m. africanus Pal.; Congo; Tanganyika.

Polybioides tabida F.; Congo.

P. melaina Meade-Waldo; Congo.

(°) Fam. POMPILIDAE

Hemipepsis (Tetraodontonyx) heros Guér.; Congo.

H. stigmosa Wahis; Congo.

H. punctifera Wahis; Congo.

H. nigripennis Hpt.; Congo.

H. femorata Wahis; Congo.

H. auraticia Wahis; Congo.

H. pellucida Wahis; Congo.

(°) Fam. SPHECIDAE

Paranysson quadridentatus Cam.; Congo.

P. congoensis Arn.; Congo.

(°) Fam. APIDAE

Apis mellifera L. ssp. unicolor Latr.; Congo; Bu
rundi.

A. m. ssp. intermissa Butt.Reep.; Congo; Rwanda.

A. m. adamsoni Latr.; Congo; Rwanda; Burundi;
Tanganyika.

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Annex to Final Technical Report.

I) The results of the research referred to in this Final Technical Report have been obtained with the occasional technical co-operation of the staff of the Agrarian Entomological Laboratory and the occasional aid of staff outside the laboratory. This collaboration was given in Italy, Belgium and the Congo. All the staff who have co-operated have received their due payment and have furnished the contractor with a declaration thereof.

During the research carried out in Africa the contractor assumed numerous African staff in the various localities where research took place and all their assistance has been duly recompensed.

II) The time engaged in drawing up the Final Technical Report has not been taken into consideration.

III) No important equipment has been purchased with the financial grant received in the first year. Any materials purchased were various glass equipment, chemicals and negligible laboratory equipment for the search and capture of insects. This material, of a minimum quantity, was left in the Stanleyville area where the contractor presumes to return for the second annual stage of research.

IV) The material collected (insects, Miriapoda and Spiders) are kept partly in the contractor's collections, and partly stored in the Congo.

The Contractor:

prof. Mario Pavan, director of
Istituto di Entomologia Agraria
dell'Università di Pavia (Italy)
P. Botta, 10.

Pavia, 20 may 1964