SESSIONS OF THE ACADEMIA BRASILEIRA DE CIÊNCIAS

SUMMARY OF COMMUNICATIONS

STORM SURGE MODELING AND FORECAST FOR THE SOUTH-WESTERN ATLANTIC OCEAN

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Presented by IGOR G. PACCA

Storm surges over the Atlantic Coast of South America have important effects in terms of coastal erosion, sediment dynamics and harbor activities, among many others. The aim of this project is to present a numerical system for storm surge forecasts in the South-Western Atlantic Ocean, basically from the northern Argentinean shelf (42°S) to the Rio de Janeiro coast (21°S), hereafter called SWAO region. The idealized system would be able to provide disturbances in the surface elevation and shelf currents fields related to the passage of meteorological systems over the studied area. It is very important to mention the cyclogenetic characteristics of the region of interest, which play an important role for storm surge events.

Mesoscale meteorological forecasts for the study area can be supplied by operational runs of the Regional Atmospheric Modelling Systems (RAMS) at the Department of Atmospheric Sciences of University of São Paulo. The model assimilates large scale analysed and predicted fields provided by global models (normally NCEP and CPTEC, and occasionally ECMWF) and improves the forecast considering regional aspects in a 32km grid.

The oceanic part of the proposed system is based on the Princeton Ocean Model (POM) simulations for the SWAO area with approximately 10km resolution, which will be forced by predicted wind fields provided by RAMS as described above. The use of mesoscale wind fields in previous hindcasting simulations shown better results in comparison to wind fields directly from global models. — (*November 19, 1999*) .

SUMMER CONVECTION IN URBAN ENVIRONMENTS AND THE FLASH FLOODS

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Presented by IGOR G. PACCA

The Metropolitan Area of São Paulo (MASP) is one of the largest urban environments of the planet with about sixteen million inhabitants. Flash floods in the MASP are more often in the summer (Pereira Filho *et al.* 1991). Anomalous atmospheric circulation patterns developed under the influence of the El Niño in South America during February 1998. A large-scale high-pressure system anomaly over the State of São Paulo inhibited organized rainfall. Rainfall accumulations were above average along the coastline and below average elsewhere (Climanálise 1998). Furthermore, heavy showers and flash floods were above average in the MASP within this period. These events were monitored with the São Paulo weather radar (Braga Junior 1988). Radar measurements were used to estimate the rainfall spatial frequency and distribution. The results indicate a nucleous of rainfall accumulation over the MASP higher than four times the spatial average

within 150km from the São Paulo weather radar. Similarly, there is a nucleous of high rainfall probability over the MASP between 1400 UTC and 2000 UTC. GOES-8 IR data reveals above average temperatures within the MASP caused by the local heat island effect (Lombardo 1984). Furthermore, surface data from IAGUSP indicate the increase of moisture content due to inflow of the sea breeze (De Oliveira & Silva Dias 1982). These data suggest there might be a strong interaction between the heat island and the sea breeze to destabilize the atmosphere. On the other hand, infiltration has been largely reduced within the MASP with a proportional increase in surface runoff. Since the summer rainfall tend to be higher within the MASP, it can be inferred that there is higher risk of flash floods in this area. Moreover, the urban environment tends to have a positive feedback on flash floods. Higher temperatures combined with the sea breeze moisture inflow generate stronger updrafts and higher rainfall accumulations that results in large amounts of runoff and associated flash floods. Therefore, as the MASP increases, the flash floods tend to be more destructive. — (*November 19, 1999*) .

HYDROGEOLOGY OF BRASÍLIA (DF) SOBRADINHO RIVER BASIN

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Presented by Igor G. Pacca

The Sobradinho river basin is located in the center-north portion of the Distrito Federal and comprises an area of 144 km^2. At least 22,500 persons depend exclusively on the groundwater. The studied area is geologically composed by metasedimentary rocks of proterozoic age covered by a thick weathering mantle. Two aquifer domains were individualized in the hydrogeological context, which are the Porous Domain and the Fractured Domain. The Fractured Domain was classified in two systems named Paranoá and Canastra. The Paranoá System was subdivided in four aquifer systems: Sandy Metarythmite (mean yield 26.7 m^3/h), Quartzite (mean yield 8.7 m^3/h), Clayey Metarythmite (mean yield 4.6 m^3/h) and Psamitic-Pelitic Carbonated (mean yield 15.7 m^3/h). As there were no wells in the Canastra System it remained individed. The main producing fractures in the wells are concentrated until the 100m deepness. The Porous Domain is represented by the weathering mantle (soil and weathered rock), which achieves more than 100m thickness, and is associated to unconfined aquifers with great lateral continuity. The thickness and permeability of the weathering mantle are strongly influenced by the geological basement. The Porous Domain is exploited by excavated wells. The mean annual rainfall in the area is of 1,442.5mm. Approximately 28% of the rainfall takes part in the aquifer recharge. The main groundwater use is domestic. The waters have good physical-chemical quality. Bacteriological contamination in water samples from the weathering mantle is related to the technical constructive deficiencies of the excavated wells and the nearness between cesspit and well. Technical constructive problems with sanitary protection and procedures of unactivation and abandonment of the deep groundwater wells were recognized. — (*November 19, 1999*) .

PANTANAL WETLAND RIVERS AND LAKES WATER LEVEL MONITORING USING TOPEX-POSEIDON SATELLITE ALTIMETRY: PRELIMINARY RESULTS

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Presented by Igor G. Pacca

Topex-Poseidon radar altimetry operating since 1992 was originally designed to study large scale oceanographic processes with high accuracy. Satellite repeating tracking period is almost 10 days. Topex sensor data over continental areas have been used to monitor water level variations over large lakes and rivers in remote areas, where gauge stations are not available or water-level data are not easily accessible (Birkett, C.M., 1998, Water Resour. Res., 34, 1223). Along track data are $\sim$500m spaced and the average lateral track spacing is $\sim$350km near the equator. In the present work we discuss the results of monitoring three different sites within the Pantanal Wetland, SW Brazil, between years 1993 and 1998, using the averaged altimeter data. Site number one is a large lake located on the eastern margin of the Paraguay river, close to Ladario gauge station. Water layer is more than 3-m thick and the accuracy in measuring water level variation is $\pm$12cm. Site number two is separated from site one by $\sim$350km and it is located between Cuiabá and São Lourenço rivers. In this area,

a larger dispersion in measured data is observed due to the size of water body and a more complex reflected signal waveform possibly caused by the topographic interference. In spite of this dispersion, it is still possible to recognize a time shift of 3 months in the maximum-minimum water levels between sites one and two. In areas where the water layer is less than 0.5m, large scatter of altimeter data is observed during the dry season. In those areas it is only possible to discriminate between dry and wet periods. The use of radar waveform data (echo) can improve the estimate of water level variation. Better lateral coverage can be obtained by using radar altimeter data from ERS 1/2 missions but in this case, the repeating period is 35 days. — (*November 19, 1999*) .

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TESTS ON THE GEOPOTENTIAL MODEL EGM96 IN SÃO PAULO STATE REGION

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The geopotential models defined by sets of coefficients which represent the anomalous gravitational potential expanded in spherical harmonics, are computed by combining data of different kind and accuracy. Today, the geopotential models have become part of the geodesic reference systems, and are being widely used as reference field of the terrestrial and oceanic gravity data for local and regional representations of the Earth's gravity field. However the geographic distribution of the available gravity data for the computation of high degree coefficients is still very irregular in global terms, and the gravity field computed from these models reflects this deficiency. Therefore, in representing the anomalous gravity field in regions with lack of gravity data, the spatial resolution corresponding to the higher degree of the geopotential model must be tested in order to select the best degree to be used. The Earth Gravitational Model 1996 (EGM96), available since 1998, was computed from a joint work by National Imagery and Mapping Agency (NIMA), NASA through the Goddard Space Flight Center (GSFC) and the Ohio State University (OSU), with the colaboration of many other international institutions. The EGM96 is a geopotential model complete up to degree and order 360, which means a spatial resolution of 30 arc minutes. As the effective resolution provided by the geopotential models changes from one region to another, the use of EGM96 model in representing the deterministic component of the anomalous gravity field in São Paulo state (latitude: 17° to 27°S; longitude: 42° to 55°), raise up the following question: What is the best degree of the model to represent this component? To answer this question, two digital gravimetric models with resolutions of 30 arc minutes (MGD30) and 60 arc minutes (MGD60) have been used. The methodology consists in computing the differences between the models MGD30 and MGD60 with the values obtained from the model EGM96 up to degree 360 (EGM30) and 180 (EGM60), respectivelly, and to compute the statistics of the differences. The results of the statistical analysis show that, in the studied region, the effective spatial resolution provided by the model EGM96 corresponds to degree 180, which means 60 arc minutes. — (*November 19, 1999*) .

EFFECT OF THE ESSENTIAL OIL FROM *Piper solmsianum* C.DC. LEAVES IN MICE BEHAVIOUR*

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The leaf essential oil from *Piper solmsianum* was obtained by hydrodistillation using a Clevenger-type apparatus. GC/MS analysis of this oil showed to be composed by monoterpenes, sesquiterpenes and arylpronanoids. Sarisan (39.23%) and Δ3-carene (23.29%) were identified as the major constituents of the volatile mixture. The *P. solmsianum* essential oil and its major compound (sarisan) were tested to verify their influence upon mice behaviour. Groups of adult albino mice were used in each experiment. Emulsions of the essential oil (5.0% and 10.0%, v/v) and of sarisan (5.0%, v/v) were prepared. The animals received the essential oil i.p. in the preliminary tests. The oil was also tested with pen-

tobarbital (30mg/kg s.c.) and with diazepam (2.5mg/kg s.c.). Pure emulsions of sarisan were also tested as well as combination of sarisan with pentobarbital. Both essential oil and sarisan showed to have exciting and depressant effects on the tested animals. — (*November 23, 1999*) .

* Supported by: CNPq/CAPES.

GENETIC DIFFERENTIATION BETWEEN *Plectranthus grandis* CRAMER AND *Plectranthus barbatus* ANDR. (LAMIACEAE)*

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The genus *Plectranthus* belongs to the family Lamiaceae, sub-family Nepetoidea, superorder Lamiiflorae (Dahlgren 1980) and encompasses 350 species widespread in subtropical and tropical regions. Several species of *Plectranthus*, have economic importance for being source of aromatic essential oil, and as ornamental plants. Besides, they are used as spices in cookery, being appreciated by the flavour. In Brazil *Plectranthus grandis* and *Plectranthus barbatus* are usually used in folk medicine to treat many diseases, the most popular use being for gastric lesions. The increased use of these phytomedicines and the frequent mix-up of similar Lamiaceae species or "quasi-species" have brought strong health problem for the population. Thus this study intent to look for an irrefutable method to validate the medicinal plant material. The Amplified Fragment Length Polymorphism (AFLP) is a multilocus marker technique, which shows higher informative value when compared with others DNA based fingerprinting methods and it has been used as a valuable tool to study patterns of genetic variability. The genomic DNAs have been extracted from plant leaves using a hexadecyltrimethylamine bromide (CTAB) extraction method; digested with EcoRI and Msel enzimes; selectivity amplified by polymerase chain reaction (PCR) and analysed by polyacrylamide gel electrophoresis. The analysis of AFLP products showed genetic variation among and within populations of *Plectranthus*. — (*November 23, 1999*) .

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A SURVEY OF CHEMISTRY AND BIOLOGICAL ACTIVITIES OF CHRYSOBALANACEAE*

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Chrysobalanus icaco L. and *Licania tomentosa* Aubl., known as abajeru and oiti, respectively, belong to Chrysobalanaceae, order Rosales, superorder Rosiflorae (*sensu* Dahlgren 1980). The family Chrysobalanaceae encompasses 17 genera and about 450 species represented by trees and shrubs. Several species are cultivated for their fruits. The most important of them is coco plum, *Chrysobalanus icaco*. In Brazil *Licania rigida* is grown for oil extraction which is used as a substitute of tung oil, while the oil of *Licania arborea* is used in candle and soap industry. *C. icaco* and *L. tomentosa* leaf infusions are used popularly in Brazil as diurectic and hypoglycemic agents. These ethnopharmacological indications have been experimentally confirmed for abajeru. The 5% infusion of abajeru has shown a distinct hypoglycemic effect, correcting the fasting hyperglycemia caused by alloxan, and presenting a protection effect against alloxan toxic doses. The chemical features of Chrysobalanaceae species includes flavonoids, terpenoids (triterpenes and diterpenes), steroids and tannins. The plant materials for this study were collected in Rio de Janeiro and extracted successively with hexane and methanol. The resulting methanol extract was fractionated by liquid-liquid partition with hexane, chloroform, ethyl acetate and butanol. It was possible to isolate from *C. icaco* and *L. tomentosa*, using chromatographic methodology, steroids, triterpenoids and flavonoids. These compounds have been identified by comparison of the spectral data (NMR ^{1}H, ^{13}C, MS/GC) with the literature records. The antimicrobial activity was determined for *C. icaco* and *L. tomentosa* extracts and fractions using the disk diffusion method. Analgesic and antiinflammatory activities were evaluated for *C. icaco* and showed activities of

84,4% and 60,3% respectively. The methanol extract from *C. icaco* leaves was investigated for their activity in HeLa cells and as angiogenic/antiangiogenic. The results showed drastic inhibition in HeLa cells and modification of the protein profile for high concentrations (100 and 200 μg/ml) after 48h of incubation. The angiogenic/antiangiogenic potential was made in corioalantoid membrane (CAM) model. The results showed an average reduction about 44% of the new vessels formation. Thus *C. icaco* extract has potencial activities for cancer and diabetic treatments. — (*November 23, 1999*) .

* Supported by: CNPq/CAPES.

PHARMACOLOGICAL EVALUATION OF *Cecropia purpurascens* BERG*

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The genus *Cecropia* comprises about 50 tree species, well distributed in South and Central Americas. In Brazil, *Cecropia* representatives can be found in the North (Amazon Forest), Central-Western part, as well as Southeast and South. However they are rarely found in the Northeast dry areas.

Cecropia purpurascens Berg is a tree of 6-15m high very common in the surroundings of Manaus and shows quite distinct morphological features. *Cecropia* species are used by native South American populations to treat several ailments. Among the therapeutic effects attributed to these plant are: diuretic, cardiotonic, astringent, anti-inflammatory, to control high blood pressure, to treat bronchitis and asthma. Some species have been used also as leishmanicide drug. Particularly this aspect has stimulated the pharmacological study of *Cecropia purpurascens* that has been used by the Amazon population for this purpose.

Cecropia purpurascens was collected near Manaus, AM and a botanical sample is kept at Alberto Castellanos, Herbarium FEEMA-RJ under the register number GUA43134. Leaves were submitte to successive extraction with hexane, dichloromethane, ethyl acetate and methanol. The obtained extracts were evaluated for leishmanicide activity on *Leishmania amazonensis* promastigote forms. The dichloromethane extract showed 90% inhibition and the biomonitored fractionation of this extract led to an acid triterpene, the ursolic acid, as the active compound. — (*November 23, 1999*) .

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"Sapium glandulatum* COMPLEX" (EUPHORBIACEAE)

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The genus *Sapium* Jacq belongs to the family Euphorbiaceae and it is formed mainly by neotropical species. The known "*Sapium glandulatum* Complex" shows controversy points in its characterization that need to be clarified. Two species *Sapium glandulatum* (Vell.) Pax and *S. sellowianum* (Mull. Arg.) Huber were selected for a detailed analysis in order to achieve better taxonomic positions. Studies on palinology, anatomical and chemical ecology, for the first time have been realized for this differentiation between them. The obtained results about pollen grain ornamentation showed clear differentiation between these species. The stomata distribution was another taxonomic character that helped to separate the two considered species. *S. glandulatum* showed anfistomatic leaves while for *S. sellowianum* the presented leaves are hipostomatics. Leaf epicuticular waxes were extracted from the two species and evaluated monthly for one and half year. Thus the variability of leaf waxes and water contents as well as leaf condensed tannins and total phenolic compounds could be esteemed and correlated with meteorological data. The epicuticular waxes showed to contain n-hydrocarbons, preferentially with odd carbon number chains, that were useful to distinguish the two refered *Sapium* species. While *S. glandulatum*, either from forest or from restinga, produces the major hydrocarbon constituents having C_{27} and C_{29} chains, *S. sellowianum* has the two main hydrocarbons with C_{25} and C_{27} chains. Search for essential oils was unsuccessful for the tried plants. Chromatographic profile pointed out the

presence of forbol ester (TPA) in *S. glandulatum* and *S. sellowianum*. Preliminary studies on analgesic and anti-inflammatory activities of leaf aqueous extracts from *S. glandulatum* and *S. sellowianum* gave good results. This plant material showed to have toxic property and to be skin irritant. The obtained results brought new knowledge on the "*Sapium glandulatum* Complex" involved taxa and allowed the identification of *S. glandulatum* and *S. sellowianum* as distinct species. — (*November 23, 1999*) .

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ECOLOGY AND VARIABILITY OF CHEMICAL MEDIATORS FROM *Plumbago* SPECIES

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The genus *Plumbago* belongs to the family Plumbaginaceae, order Plumbaginales, superorder Malviflorae (*sensu* Dahlgren, 1980) and it comprises approximately 25 genera with about 500 species. Many biological activities are assigned to these plants such as bactericide, fungicide and parasiticide. Two species were selected for ecological and chemical studies, *Plumbago scandens* L. and *Plumbago auriculata* Lam. (sin. *Plumbago capensis* Thunb). Both species were collected monthly during one year in the *campus* of Fundação Oswaldo Cruz, Rio de Janeiro and have the leaf epicuticular waxes extracted in chloroform. *P. scandens* and *P. auriculata* showed variation in the epicuticular wax contents during the year of study. *P. auriculata* presented the wax highest values in July 1997 and May 1998 while *P. scandens* showed the maximum wax value in May 1998. It has been observed also that the highest epicuticular wax productions happened after the months with higher levels of temperature and rainy weather. The epicuticular wax linear hidrocarbons showed carbon chains from C_{23} to C_{35}, being C_{29} and C_{31} the major representatives of the series. The quantification of condensed tannins for the *Plumbago* species showed higher production for *P. scandens*. Both species exhibited relatively great amounts of total phenols, among which plumbagin is the major component. — (*November 23, 1999*) .

CHEMICAL STUDIES ON CULTIVATION OF *Echinodorus grandiflorus* (CHAM. & SCHL.) MICH.*

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The family Alismataceae comprises aquatic or semi-aquatic herbs with erect or floating leaves that grow as amphiphytes or hydrophytes in fresh water. The genus *Echinodorus* is restricted to the western hemisphere, occurring from the United States of America until Argentina. *Echinodorus grandiflorus* known as "chapéu de couro" is used in folk medicine to treat several diseases, such as throat and skin inflammations, arthritis, rheumatism and syphilis. The plant also acts as a diuretic agent and as uric acid eliminator. This work has quantified the leaf and inflorescence productions and has evaluated the chemical profile of *E. grandiflorus* cultivated in Tanguá, Rio de Janeiro State. It was observed that plants submitted to higher sunlight levels showed an increased production of leaves and inflorescences compared to those growing in shadowed places. Among the chemical groups detected, flavonoids were clearly altered by cultivation treatments, showing a greater production in plants exposed to higher sunlight levels after the inflorescences being removed. — (*November 23, 1999*) .

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ARYLPROPANOIDS FROM *Neoregelia cruenta* (R. GRAHAM) L.B. SMITH (BROMELIACEAE)*

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Neoregelia cruenta (R. Graham) L.B. Smith is a monocotyledonous species belonging to the family Bromeliaceae, order Bromeliales, superorder Liliiflorae (*sensu* Dahlgren, 1980) that has wide distribution on the restingas of Rio de Janeiro State. There are no records in the literature about the chemical composition of this species, neither about its pharmacological potentialities. From the hexanic extract was isolated: a mixture of glyceryl 1,3-bis-*p*-hydroxycinnamate, glyceryl 1,3-bis-*p*-methoxycinnamate, glyceryl 1-*p*-methoxycinnamate-3-*p*-methoxydihydrocinnamate and glyceryl 1-*p*-hidroxycinnamate. Identification of these products were carried out by spectroscopic analysis and comparison with literature data. — (*November 23, 1999*) .

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SECONDARY METABOLITES FROM *Ananas bracteatus* LINDLEY (BROMELIACEAE)*

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Ananas bracteatus belongs to the family Bromeliaceae which fascinates by the exuberance, diversity and beauty of its species as well as its adaptation ability to the different surroundings (wet, dry, arid, rocky, sunny or shady places). The family complexity generates taxonomic and systematic problems difficult to solve. Therefore an increasing interest has been stimulated to know more about the secondary metabolism products of Bromeliaceae species, particularly *Ananas bracteatus*, in order to contribute to answer some of those systematic questions.

Purification of the hexane and the methanolic extracts from leaves and hexane extract from fruits of *A. bracteatus*, through chromatographic techniques, led to 9 compounds that were characterized by spectroscopic analyses as: campesterol, 3β, 6β-cholestanodiol, stigmasterol and sitosterol, from the leaf hexane extract; campesterol, stigmasterol and sitosterol from fruit hexane extract. The methanolic extract from leaves yielded 2-glyceryl ester of p-coumaric acid, a new compound 2-glyceryl ester of ferulic acid, and 5,7,4'-trihydroxy-3,3'-5'-trimethoxy flavone from the dichloromethane fraction; 3β-O-glycopyranosyl sitosterol and 2-glyceryl ester of ferulic acid from the ethyl acetate fraction; and, from the butanolic fraction, 2 new glycosides of ananasic acid. — (*November 23, 1999*) .

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CHEMICAL AND BIOLOGICAL INVESTIGATIONS ON *Nidularium innocentii* LEMAIRE*

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Nidularium innocentii Lemaire belongs to the family Bromeliaceae, order Bromeliales, superorder Liliiflorae (*sensu* Dahlgren, 1982). This family consists of 50 genera and about 2500 species, many of which have economic value as *Ananas comosus* (L.) Merril (pineapple) or are used in popular medicine as anti-inflammatory, analgesic, anti-helmintic and diuretic agents. Among the secondary metabolites, flavonoids, terpenoids and steroids are the common representatives. *N. innocentii* was collected at Poço das Antas National Park, Silva Jardim, RJ. Leaves and rhizomes/roots after drying, were ground and submitted in sequence to extraction with hexane and methanol, yielding the hexane and methanol extracts. Methanol extract of rhizomes/roots suspended in water were submitted to liquid-liquid partitions with hexane, dichloromethane, ethyl acetate and butanol. All the extracts and fractions have been evaluated for analgesic, anti-inflammatory, anti-neoplasic and tripanosomicidal activities. The hexane fraction of rhizomes/roots methanol extract was submitted to silicagel adsorption chromatography. 3-Oxo-friedelin was obtained from a fraction eluted with hexane/ethyl acetate 5% and the steroids campesterol, sitosterol and stigmasterol were eluted with hexane/ethyl acetate 15%. The hexane extract of leaves upon chromatographic techniques yielded a fusidane derivative. The compounds were identified by spectroscopic analysis. — (*November 23, 1999*) .

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