생 약 학 회 지
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Computer Services for Research on Plants for Fertility Regulation*

Norman R. Farnsworth, William D. Loub, Doel D. Soejarto, Geoffrey A. Cordell,
Mary Louise Quinn and Karen Mulholland
Department of Pharmacognosy and Pharmacology, College of Pharmacy
University of Illinois at the Medical Center, Chicago, Illinois, U.S.A.

Introduction

NAPRALERT, an acronym for NAtural, PRoducts ALERT, is a specialized data retrieval system for natural product chemistry and pharmacology. The program, in its present computerized form, grew out of an attempt to document manually on paper the world literature with regard to the chemistry and pharmacology of natural products, primarily associated with plants. This was started in the department of Pharmacognosy at the University of Pittsburgh in the early 1960's. Ten years later, it took on a simple computerized form through a collaboration with Schering A.G. of Berlin, West Germany. Following an end to this collaborative effort in 1975, the program, now at the University of Illinois at the Medical Center in Chicago, was expanded to include a more comprehensive data base file covering marine, micr obial and animal sources as well.

The new data base design utilizes four distinct record types, i.e. demographic, taxonomic, chemical and pharmacologic, to assemble under sixty-five field names or categories, data from a variety of literature sources. Thus, a comprehensive computerized data file has been established which is able to store information in detail and provide retrieval through a series of specialized formats. This article discusses in some detail the utilization of the NAPRALERT data base within the Special Programme of Research, Development and Research Training in Human Reproduction of the World Health Organization (W.H.O.) program to identify indigenous plants exhibiting fertility regulating properties. Earlier papers describing various aspects of NAPRALERT have been published[1,2].

Program Organization

In order to implement this new concept of a detailed computerized surveillance of the natural product literature, the program was organized into four major areas of management, i.e. literature collection, coding, verification of the accurate transfer of information prior to and following its entry into the data base and finally data entry procedures, including the generation of a permanent file of collected literature. A scheme of this organization is presented in Figure 1 and its application is further described in the following paragraphs.

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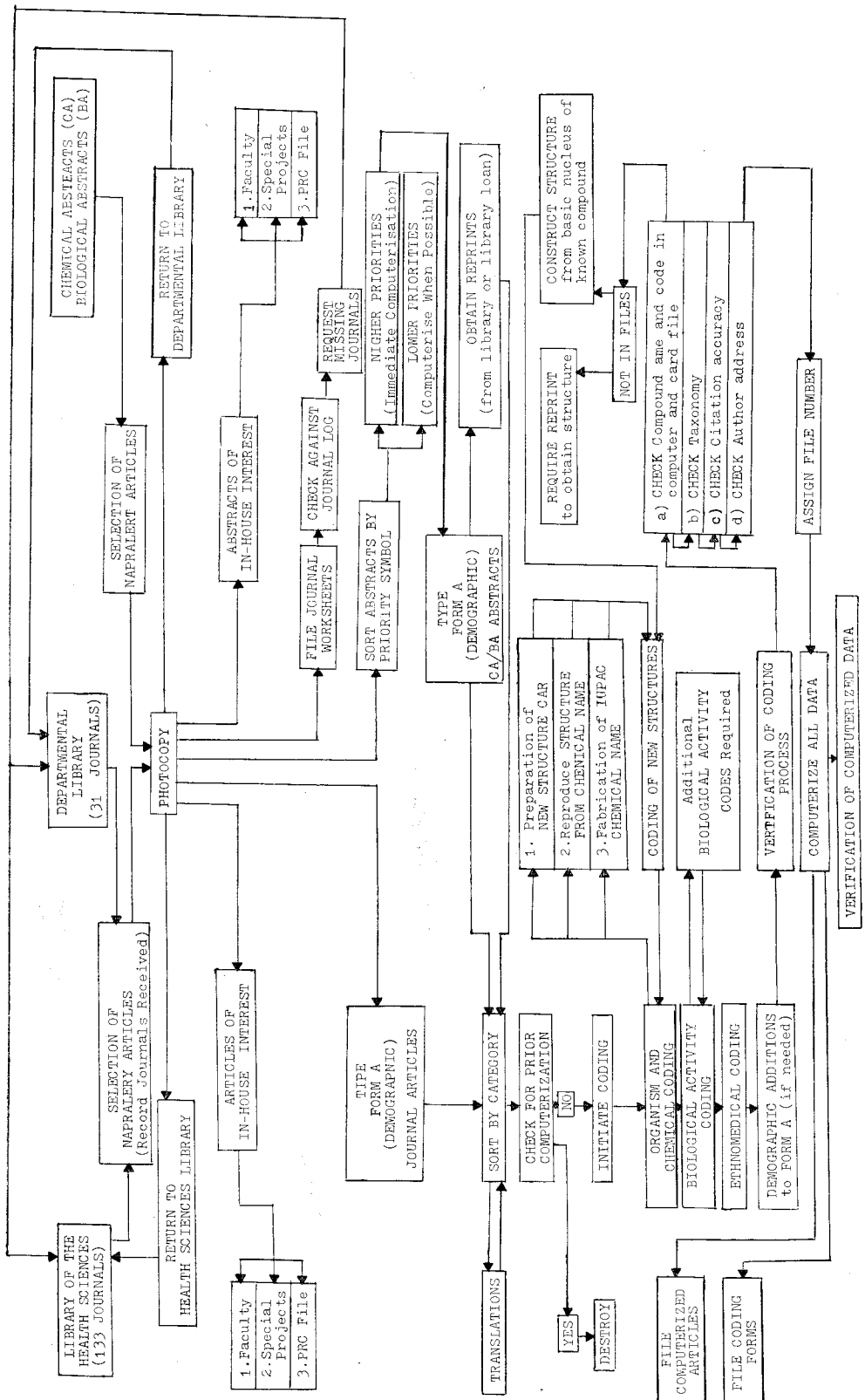


Fig. 1. NAPRALERT program organization

A first step in the organization of NAPRALERT was the development of an adequate source and a reliable acquisition program for the world natural product literature. The Library of the Health Sciences on the Medical Center campus, as well as other nearby Chicago library collections provide a particularly rich source of such information. This is further supplemented through the regular acquisition of more obscure journals, dealing almost exclusively in natural product research publications, which are kindly provided through a number of individuals and institutions interested in the program.

Coverage of the literature from these various sources has included a thorough page by page search of *Chemical Abstracts* and *Biological Abstracts*. *Chemical Abstracts* alone provides the opportunity to review more than 400,000 documents each year, collected from over 14,000 individually published journals (1, 2). In addition to these secondary sources, doctoral level scientists directly review the more than 160 journals obtained from the Library's periodical department, interested contributors or departmental subscriptions. These primary literature sources, given direct review, were chosen for their relevancy to natural product literature citations and it has been estimated that approximately seventyfive per cent of all new research papers devoted to natural prroduct data appear in these journals.

Coding the variety of reseach parameters encountered under the NAPRALERT collection process has necessitated the implementation of a series of alphanumeric codes to represent many of the scientific terms computerized. Such a procedure not only reduces dramatically the number of spelling errors during data entry, but also makes storage of the information more cost efficient. The types of information which are coded and the field names used to enter and maintain this information in the NAPRALERT data base are listed in Table 1.

Although financial constraints have not allowed

Table I. Field names and types of information computerized by NAPRALERT

Field name	Description
Record type-Demographic	
Citation number	File number assigned sequentially at time of data entry.
Citation title	Accommodates first 765 characters of the title.
Author	Lists all author names associated with the article.
Journal	Stores journal name or appropriate alphanumeric code.
Volume number	Volume designation of the above journal entry.
Issue number	Accommodates issue number when needed.
Page number	Number of first page on the article.
Last page	Number of the last page of the article.
Year	Year of publication.
Language	Language used in the article, i.e. German, English, etc.
Article type	Designates type of article, i.e. research, review, etc.
Abstract	Lists title of secondary reference source, i.e. *C.A.*
Reference volume number	Secondary source volume number.
Abstract number	Secondary reference abstract number.
Paragraph number	Secondary reference paragraph number.
Address code	Alphanumeric address code if one has been assigned.
Department code	Departmental address for senior author, if any.

Table I. (*Continued*)

Field name	Description
College address	School, college or institute name in senior author address.
University address	University, institute or company name in address.
City	City for senior author's address.
State	State, district or province for address.
Zip code	Zip code, if given.
Country	Country of residence for senior author.
Grant agency	Agency supporting reported research.
Grant number	Granting agency identifying number.
Record type-Organism	
Organism	Code identifying organism class, i.e. angiosperm, gymnosperm, dicot, monocot, etc.
Family	Botanical family name of the organism studied.
Genus	Botanical genus name of the organism studied.
Species	Botanical species name.
Species citation	Species authority citation.
Subspecies	Subspecies name, if any.
Subspecies citation	Subspecies authority citation, if any.
Common name	Accommodates common names of the organism.
Taxon synonym	Synonym for the taxon and its authority.
Organism part	Lists organism part studied.
Part condition	States condition of organism part studied, i.e. dried, fresh, etc.
Amount utilized	Quantity of organism used in the study.
Record type- Compound	
Compound isolated	Amount of compound isolated, if any.
Organism country	Geographic source of organism studied.
Compound name	Compound name, vernacular name where possible.
Compound code	A binary numeric code for the chemical class, i.e. indole alkaloid, flavone, steroid, proteid, etc.
Sub-structure code	Stores a three digit numeric code for the carbon skeleton.
Functional group code	Stores two character codes for functional groups present.
Record type-Pharmacology	
Worktype	Alphanumeric sorting code to designate type of work performed, i.e. *in vitro, in vivo, in situ* and/or in humans.
Major phararmacologic activity	Binary code for 16 different pharmacological classes of study, i.e. CNS, chemotherapeutic, antifertility, etc.
Specific pharmacologic activity	Three digit code for specific pharmacological activity studied. 1,000 codes available, to date.
Director codes	Enters "PDC" code (see Table 4).
Weighting codes	Enters weighting point designator (see Table 2).
Alert codes	Enters "Alert Data" codes for sorting, efficiency.
Experimntal modifications	Stores miscellaneous statements describing a special disease conditoin or test parameter.
Extract	Binary code used to identify type extract studied.
Mode of administration	Binary code used to identify mode of administration.
Test species	Binary code describing type of animal used, if any.
Sex	Sex of above animal, if appropriate

Table I. *(Continued)*

Field name	Description
Dose expression	Identifies type and numeric amount of dose, i.e. LD_{50} 1.0, MLD 2.5 or concentration, i.e. MIC 25.0
Dose unit	Dose unit of above dose or concentration, i.e. mg, mcg, etc.
Per unit weight	Per unit weigt of above dose or concentration, i.e. kg, per plate, gm, person, etc.
Qualitative result	Qualitative expression of result, i.e. active, inactive, equivocal.
Quantitative result	Numerical expression of result data.
Expression	Type of quantitative result, i.e. increased life span (ILS).
Pathological system	Alphanumeric code for disease test organism substrate or tissue used.

computer entry of all of the natural product data collected on an absolute basis, the following general guidelines apply to the types of information that have been covered and are currently computerized. First, all literature reporting chemical compounds present in or isolated from natural sources are given immediate priority for data entry. These data include the taxonomic source in detail, the organism part from which the compound was derived, its geographic source and percentage yields, where this has been stated or can be calculated from the data presented. Primary interest has been with "secondary" chemical constituents, and articles reporting predictable occurrences of ubiquitous simple sugars, amino acids, fatty acids and the like are not usually computerized.

Secondly, all literature describing biological effects of extracts prepared from plants, animal, microbes and marine organisms, or for chemical compounds of natural origin, are also given immediate priority for computerization. In most cases, biological effects for well established natural products such as atropine, digitoxin, reserpine, tubocurarine, the penicillins, etc., are not considered unless they represent unique types of activity or unusual toxic effects.

In addition to maintaining current literature coverage on the subject matter indicated above, a large number of retrospect searches, reaching back into the early 1900 or late 1800 literature have been carried out and the data computerized. NAPRALERT, with regard to cytotoxic and/or antitumor effects of natural products, as well as natural products affecting mammalian reproduction, is perhaps the most extensive and complete data base in existence today. Presently, more than 35,000 individual citations have been computerzed in the form of more than one-half million individual records. In addition to the wide variety of biological activities stored in these records, more than 50,000 different chemical compounds of natural origin are also described. Folklore (ethnomedical) information contained in the data base has been accumulated where mentioned in a scientific article or following a partial or complete computerization of more than 400 books on the subject, the latter representing virtually every country in the world.

Negative as well as positive data, whether dealing with biological effects or the analysis of chemical constituents, are computerized into the NAPRALERT data base file. Important to the WHO Task Force on Indigenous Plant for Fertility Regulation has been the assignment of various alert codes and numerical weighting values for purposes of applying a predictive analysis to the data contained in the NAPRALERT file. Tables 2 and 3 list some of the criteria used to assign these values.

Table II. Positive and negative weighting values used to rank-order experimental and/or ethnomedical data computerized

Type of data assessed	Type of weighting
Statistical data given in the report.	+
Data reported by author are adequate to support conclusion.	+
Well designed and executed study with believable positive results reported.	+
Superb study: Data support conclusions of the author in all respects.	+
Poor experimental design. Data lacking to support conclusions of the author.	−
Control animals not used in the study.	−
Data reported in article are insufficient to support the conclusions of the author(s).	−
Experimental details are inadequate to evaluate the data.	−
Details of ethnomedical use are too vague to evaluate.	−
Ethnomedical use may be associated with "Doctrine of Signatures".	−
Confusing data are reported making it difficult to assess the results. See notes attached to original manuscript in file.	−
Control animals did not receive the solvent or suspending agent used for test material.	−
Doses employed do not make sense. See comments attached to original article for explanation.	−
This plant is predictably hepatotoxic and/or carcinogenic	−
Reported positive results may be due to a nutritional deficiency in the test animal.	−
Data not statisticaly analyzed.	−
Correct identification of the plant highly questionable.	−
Data not believable. See comments attached to original article for explanation.	−
Positive data reported are of questionable significance to fertility regulation.	−
Dose-response relationship invalid.	−
Reported effect diminishes on repeated dosing.	−
Ethnomedical use most likely based on magic, ritual or superstition.	−
Data reported are inconsistent. See remarks attached to original article for explanation.	−
Data reported are adequate to support conclusions of the author.	+

Table III. Approximate weighting values assigned to ethnomedical data

Computer points assigned	Criteria
150～200	Reference has details concerning dosage regimen and has been reported as part of an anthropological and/or ethnomedical study.
100～150	Field notes by scientific investigators, i.e. notes on herbarium voucher specimens, etc.
100～125	Same as above, but specific details are lacking.
100～125	Plant is claimed to be used in an organized system of medicine, i.e. Traditional Chinese Medicine, Ayurvedic Medicine, etc., and details of dosing with the preparation are given.
50～ 75	Same as above, but details are lacking.
50～ 75	Ethnographic data only are given.
50～ 75	Incidental mention of use in a scientific paper as an introduction, without details.

The Predictive Analysis Program

When the new NAPRALERT data base was conceived in 1975, a prime consideration in its construction was the development of a capability to evaluate the world literature on natural products for the purpose of identifying new sources of clinical drugs. Thus, when the WHO Special Programme of Research Development and Research Training in Human Reproduction established a Task Force on Indigenous Plants for Fertility Regulation, the first opportunity to utilize NAPRALERT as a predictive tool to identify leads was challenged.

A review of the NAPRALERT data base for plant sources having biological, chemical or folkloric data indicating a possible involvement in fertility regulation produced a list of more than 1,300 plant species. A series of retrospective searches of the literature, directed toward this same type information, provided a list of more than 3,200 additional species having related properties. It therefore became prudent to develop a means to rank order the more than 4,500 plant species in such a manner that the most promising 300 or so could be identified for evaluation in experimental protocols, since random selection from a list of plants this size could not be considered a feasible approach to the problem.

Using a multidisciplinary approach, e.g. the input of pharmacologists, reproductive physiologists, chemists and botanists prime consideration was given to the identification of those biolog ical activities which result in some form of fertility regulation. These were further identified with one or more appropriate modes of administration, designated by nine "Priority Designator Codes" (PDC). Table 4 presents a description of these codes. A second consideration was the identification of those fertility regulating activities of priority interest to the WHO Task Force namely interference with the implantation process in the female and those which may interefere with spermatogenesis and/or sperm maturation in the male.

A program was then developed whereby the computer could apply these considerations to the list of plants in question by assessing the collective values of positive and negative weights assigned according to the subjective codes

Table IV. Priority designator codes (PDC)

PDC	Fertility regulation application
A	Used once per month by the female, just prior to expected menstruation.
B	Male antifertility agent (Used by the male).
C	Used by the female after *one* missed menses.
D	Post mid-cycle (post-ovulatory) coital (interceptive, anti-implantation) use by the female.
E	Continuous administration by the female (could be postcoital), that was not used *only* post-ovulatory.
F	Unable to calssify more specifically (human and/or animal data, ethnomedical and/or experimental), but only designated as "contraceptive", etc.
G	Male antifertility agent, used in the female (could also be continuous administration, but definitely not "D" above).
H	Used by the female after *more than one* missed menses.
I	Used by the female just *after* menstruation.

presented in Table 2 and 3. These values, used to rank-order the list of plants, were further modified by criteria established under combinations of the PDC process to identify the biological attributes of interest to the Task Force Programme. For three successive years, 1978~1980, this predictive computer program has been applied to the most current data available in the NAPRALERT data base and a rank ordered list of plants prepared.

The Task Force on Indigenous Plants for Fertility Regulation, in addition to being multidisciplinary, supports a collaborative multicentered program involving research groups in Hong Kong, the Republic of Korea, Sri Lanka and the United States. Plants identified through the above process as most promising were then assigned to these centres primarily on the basis of their indigenous character. Modifications in the predictive program, arrived at by experimenta tion, were applied to the computer analysis and the resulting changes in the rank ordering of plants on the list were reflected in changes of assigned plants to each of the Centres.

To date, approximately fifty plants from the top 300 on the list have been tested and several of these appear to have reproducible anti-implantation activity in two different animal models. The real practical value of these plants and this novel approach to drug development must await further studies, but it would appear that NAPRALERT has performed a very important service with regard to the aims of this WHO program.

Future Computer Services Available to the WHO Special Programme

Up to the present, the NAPRALERT system has served to provide the Task Force on Indigenous Plants for Fertility Regulation with the global literature concerned with alleged and/or experimental data on plants as they relate to any aspect of fertility regulation. It has also provided a unique system for analyzing all of the data in these literature reports in order to identify promising candidate plants for experimental studies. Initial test results seem to indicate that the number of plants required to uncover anti-implantation activities is far less than if a random selection process was used. It will only be considered as a valid procedure after active compounds of known structure are isolated from the plants being studied.

Our literature surveillance activities will continue in the future, although at this time there does not appear to be a need for periodic evaluation of data to identify further plants that should be included in the activities of the Task Force. At some future date, however, such an analysis can be performed if required. If the progress of this program can draw on the experience of conventional drugdevelopment programs, one can anticipate that many of the active leads will not culminate in agents useful in humans. Some of the active principles will prove to be too toxic, some will be unstable, and others will be obtainable in only trace quantities and may have structures that are not amenable to commerical synthesis. Thus a continuous infusion of new leads into the program will be necessary.

Based on a systematic surveillance of the literature concerned with fertility regulating plants over the past three years, it is obvious that the number of publications is markedly increasing. Apparently the activities of the Special Programme have attracted sufficient attention as to stimulate other investigators in the field of natural products to initiate research on fertility regulating plants. Thus, in order to provide all scientists involved in the activities

of the Task Force on Indigenous Plants for Fertility Regulation with current literature in this field, the Special Programme has set forth the following areas in which NAPRALERT will continue to provide service.

1. To provide bimonthly reports on current literature containing information pertinent to the biological effects (ethnomedical and experimental) of plants relating to fertility regulation. These bimonthly reports will provide full citations of each article, but will not provide the details in each report.

2. Biannual updates on all computerized data for each plant being actively studied in each of the centres will be provided. These will be extensions of the quarterly update reports that have been provided in the past and will consist of expanded computer output of (a) ethnomedical, (b) in vitro, (c) in situ and/or in vivo, and (d) human effects of plants that have been assigned to each Centre. In addition, updated information on chemical compounds reported present in these plants will be provided.

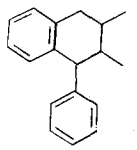
3. Since many of the articles from which data have been computerized may not be available in some of the centres, copies of the articles will be provided to investigators.

4. As chemical work accelerates in each of the centres, there are elements of the NAPRALERT data base that can prove useful to speed up the identification and/or structure-elucidation of isolated active compounds.

A recent example can be cited as to how NAPRALERT can be used to identify compounds.

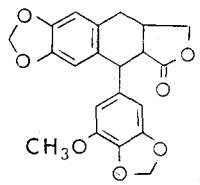
We isolated a crystalline compound form *Amyris pinnata* and obtained all of the usual spectral data, e.g. UV, IR, PMR, CMR, MS and specific rotation. Analysis of the data indicated that our isolate was a lignan having the skeletal type **I**, which containe at least one methoxyl group, at least one methylenedioxy group, a lactone that was not α,β-unsaturated: phenolic hydroxy groups were absent.

A query of the NAPRALERT data base for a list of compounds having these characteristics indicated that 153 linans of skeletal type **I** were available. However, the print-out indicated that only six contained the skeleton and functional groups previously indicated.



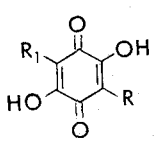
I

These were found to be austrobailignan 1 (**II**), austrobailignan 2, bursehernin, morelensin, deoxypodophyllotoxin. An inspection of physical data for all of these compounds revealed that austrobailignan **I**, (**II**) was identical in all respects with our isolate.



I I

Another application of the data base was to identify all naturally occurring compounds having the same general molecular features as embelin (**III**), a benzoquinone of interest to the Task Force. Prenyl side chains, characteristic of the ubiquitous ubiquinone and related compounds were to be excluded, as were compounds having methoxy substituents. It was found that only five compounds could be identified in the data base, e.g. embelin (**III**), maesaquinone (**IV**), polygonaquinone(**V**), rapanone(**VI**) and bhogatin(**VII**). It can be anticipated that all of



Compound name		R	R_1
Embelin	Ⅲ	-n-$C_{11}H_{23}$	H-
Maesaquinone	Ⅳ	-$CH_2(CH_2)_{12}$-CH=CH$(CH_2)_3$-CH_3	CH_3-
Polygonaquinone	Ⅴ	-n-$C_{21}H_{43}$	CH_3-
Rapanone	Ⅵ	-n-$C_{13}H_{27}$	H-
Bhogatin	Ⅶ	-n-C_9H_{19}	CH_3-

these compounds would have similar biological effects, but perhaps one or more could be more active and less toxic than the parent embelin.

5. On request we will be able to provide chemical and/or biological activity profiles on all species of a genus being investigated for fertility-regulating activity. Quite often information on related species of the same genus can aid the investigator in designing schemes for the rapid and efficient isolation of active principles.

In the past, we have had problems in photocopying computer output, since reduction of normal computer sheets, coupled with the often mediocre clarity of print, has produced difficulties in reading the data provided to investigators. We are now utilizing a Xerox 9700 printer, coupled with computer output, to generate much clearer copy. An example of the new format is presented in Exhibit 1, in which representative data from profiles on *Plumbago rosea* L. have been printed.

In conclusion, NAPRALERT represents a unique data base of information concerned with the chemistry and pharmacology of natural products. It is the largest known collection of data on plants with fertility-regulating potential available today. We are confident that there are many different applications of the data base that will enhance the productivity and efficienty of scientific studies being carried out on fertility regulating plants and encourage all of those affiliated with the WHO Task Force on Indigenous Plants for Fertility Regulation to take advantage of its availability. We are anxious to provide any service to colleagues, and welcome inquiries at to the applicability of the data base to solve problems related to their research.

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Exhibit I. A Computerized profile of ethnomedical, biological and chemical data for *Plumbago rosea*

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ETHNOMEDICAL INFORMATION ON  PLUMBAGO ROSEA

    (THIS PLANT IS COMMONLY KNOWN AS BINASA : CHERAKA MERAH : CHERAKA MERAH (MALAY) : CHET TAMUM PLONGDENG : CHITRA : FIRE PLANT
LAL CHITRA : LAL CHITRA (HINDOUSTANI) : LAL CHITRAK : LAL-CHITA : LALCHITRA : LAUREL : LEADWORT,OFFICINAL : LEDWORT,ROSY-FLOWERED
OFFICINAL LEADWORT : PLANT,FIRE : ROKTA-CHITA : ROSY-FLOWERED LEADWORT : SETAKA : SHITTURRIJE : SITAKA : TJERAKA MERAH : )

    (SYNONOMOUS LATIN BINOMIALS FOR THIS SPECIES ARE CLAIMED TO BE PLUMBAGO COCCINEA : PLUMBAGO INDICA : )


PLUMBAGO ROSEA , PLUMBAGINACEAE  BARK PHILIPPINES
    USED AS AN ECBOLIC
      HOT H2O EXT*ORAL*HUMAN(PREGNANT)** A4508(47.1)
PLUMBAGO ROSEA , PLUMBAGINACEAE  PART NOT SPECIFIED INDONESIA
    USED AS AN ABORTIFACIENT
      TYPE EXT NOT STATED*ROUTE NOT GIVEN*HUMAN(PREGNANT)** A0682(46.1)
PLUMBAGO ROSEA , PLUMBAGINACEAE  PART NOT SPECIFIED PAKISTAN
    USED TO PROCURE ABORTION
      TYPE EXT NOT STATED*ROUTE NOT GIVEN*HUMAN(PREGNANT)** A1908(28.1)
    USED FOR POST-PARTUM HEMORRHAGE
      TYPE EXT NOT STATED*ROUTE NOT GIVEN*HUMAN ADULT*FEMALE* A1908(28.2)
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT EAST INDIES
    USED AGAINST INTERMITTENT FEVER
      HOT H2O EXT*ORAL*HUMAN ADULT** A4712(7.7)
    USED AGAINST SCABIES
      HOT H2O EXT*EXTERNAL*HUMAN ADULT** A4712(7.4)
    USED AGAINST CANCEROUS DISEASES
      HOT H2O EXT*ORAL*HUMAN ADULT** A4712(7.3)
    USED AGAINST ULCERS
      HOT H2O EXT*ORAL*HUMAN ADULT** A4712(7.5)
    USED AS A DIURETIC
      HOT H2O EXT*ORAL*HUMAN ADULT** A4712(7.6)
    USED TO PRODUCE ABORTION
      HOT H2O EXT*ORAL*HUMAN(PREGNANT)** A4712(7.2)
    USED AS AN EMMENAGOGUE
      HOT H2O EXT*ORAL*HUMAN ADULT*FEMALE* A4712(7.1)
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT INDIA
    USED AS AN ABORTIFACIENT
      TYPE EXT NOT STATED*ORAL*HUMAN(PREGNANT)** A4132(234.1)
    USED TO EXPEL THE FETUS FROM THE WOMB,WHETHER DEAD OR ALIVE
    CHEW THE ROOTS FOR 7 DAYS,MORNING AND EVENING,ALONG WITH BETEL NUT AND ABORTION RESULTS
      PLANT*ORAL*HUMAN(PREGNANT)** A6590(122.1)
    INTRODUCE ROOT INTO VAGINA TO INDUCE ABORTION
      ROOT*VAGINAL*HUMAN(PREGNANT)** A6590(122.2)
    USED AS AN ABORTIFACIENT:INTRODUCED INTO THE VAGINA AND APPLIED DIRECTLY TO THE NECK OF UTERUS
      ROOT*VAGINAL*HUMAN(PREGNANT)** A0115(110.1)
    USED AS AN ABORTIFACIENT
      HOT H2O EXT*ORAL*HUMAN(PREGNANT)** W0002(6.1)
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT INDONESIA
    SAID TO CAUSE DEATH WHEN POULTICE IS APPLIED VAGINALLY
      H2O EXT*VAGINAL*HUMAN ADULT** A4162(21.2)
    *USED AS AN ABORTIFACIENT
    POULTICE APPLIED LOCALLY
      H2O EXT*VAGINAL*HUMAN(PREGNANT)** A4162(21.1)
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT MALAYA
    USED AS AN ABORTIFACIENT
    MIXED WITH LAWSONIA ALBA,GARDENIA GRIFFITHII,CANANGA ODORATA,GONIOTHALAMUS TAPIS
      HOT H2O EXT*ORAL*HUMAN(PREGNANT)** A3602(3.1)
        PLANT MIXTURE USED. ACTIVITY COULD BE DUE TO OTHER THAN THIS ONE
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT MALAYSIA
    INSERTED IN THE OS UTERI AS AN ABORTION STICK OR USED ORALLY IN FORM OF A DECOCTION
      PLANT*VAGINAL*HUMAN(PREGNANT)** A4587(26.1)
    MENTIONED BY SANSKRIT WRITERS AS AN ABORTIFACIENT
    DRIED ROOTS CLAIMED LESS ACTIVE THAN FRESH ROOTS
      PLANT*ORAL*HUMAN(PREGNANT)** A6590(121.1)
    INTRODUCE ROOT IN VAGINA TO INDUCE ABORTION
      ROOT*VAGINAL*HUMAN(PREGNANT)** A6590(121.2)
    DECOCTION WITH CROTON CAUDATUM GIVEN TO PRODUCE ABORTION
      HOT H2O EXT*ORAL*HUMAN(PREGNANT)** A6589(216.1)
        PLANT MIXTURE USED. ACTIVITY COULD BE DUE TO OTHER THAN THIS ONE
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT PHILIPPINES
    TAKEN INTERNALLY OR APPLIED LOCALLY TO THE GENITAL ORGANS IT ACTS AS AN ABORTIFACIENT
      ROOT*ORAL*HUMAN(PREGNANT)** A0115(109.1)
    TAKEN INTERNALLY OR APPLIED LOCALLY TO THE GENITAL ORGANS IT ACTS AS AN ABORTIFACIENT
      ROOT*VAGINAL*HUMAN(PREGNANT)** A0115(109.2)
PLUMBAGO ROSEA , PLUMBAGINACEAE  ROOT THAILAND
    USED TO PROCURE ABORTION
      TYPE EXT NOT STATED*ROUTE NOT GIVEN*HUMAN(PREGNANT)** A6590(120.1)
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BIOLOGICAL ACTIVITIES FOR EXTRACTS OF PLUMBAGO ROSEA

PLUMBAGO ROSEA . PLUMBAGINACEAE PART NOT SPECIFIED HAWAII
ANTIIMPLANTATION EFFECT* IN VIVO* TYPE EXT NOT STATED*MOUSE*FEMALE**SC* DOSE 0.2 ML/ANIMAL* INACTIVE*** A5104(110.1)
PLUMBAGO ROSEA . PLUMBAGINACEAE ROOT INDIA
EMBRYOTOXIC EFFECT* IN VIVO* H2O EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** A2426(6.4)
EMBRYOTOXIC EFFECT* IN VIVO* ETOH(95%)EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** A2426(6.5)
EMBRYOTOXIC EFFECT* IN VIVO* PET ETHER EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** A2426(6.6)
ANTIIMPLANTATION EFFECT* IN VIVO* H2O EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** A2426(6.1)
ANTIIMPLANTATION EFFECT* IN VIVO* ETOH(95%)EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** A2426(6.2)
ANTIIMPLANTATION EFFECT* IN VIVO* PET ETHER EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** A2426(6.3)
HYPOTENSIVE ACTIVITY* IN VIVO* H2O EXT*DOG**IV* /* INACTIVE*** A2318(1.8)
MYOCARDIAL DEPRESSANT ACTIVITY* IN SITU* H2O EXT*FROG**HEART** /* ACTIVE*** A2318(1.7)
SMOOTH MUSCLE STIMULANT ACTIVITY* IN VITRO* H2O EXT*GUINEA PIG**ILEUM** /* ACTIVE*** A2318(1.6)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*RAT*FEMALE*UTERUS(NON-PREG)** CONC UNKNOWN* ACTIVE*** A2318(1.1)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*RAT(PREGNANT)**UTERUS(PREG)** CONC UNKNOWN* ACTIVE*** A2318(1.2)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*GUINEA PIG(PREGNANT)**UTERUS(PREG)** CONC UNKNOWN* ACTIVE*** A2318(1.3)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*GUINEA PIG*FEMALE*UTERUS(NON-PREG)** CONC UNKNOWN* ACTIVE*** A2318(1.4)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*HUMAN ADULT*FEMALE*UTERUS(UNSPEC.COND)** CONC UNKNOWN* ACTIVE*** A2318(1.5)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*RAT*FEMALE*UTERUS(NON-PREG)** CONC UNKNOWN* STRONG ACTIVITY*** A2600(3.1)
UTERINE STIMULANT EFFECT* IN VITRO* H2O EXT*GUINEA PIG*FEMALE*UTERUS(NON-PREG)** CONC USED 1-9M /* ACTIVE*** A4219(5.1)
UTERINE STIMULANT EFFECT* IN HUMANS* H2O EXT*HUMAN ADULT*FEMALE**ORAL* DOSE NOT STATED* ACTIVE*** A4219(5.2)
ABORTIFACIENT EFFECT* IN VIVO* H2O EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* EQUIVOCAL*** W1362(19.1)
ABORTIFACIENT EFFECT* IN VIVO* ETOH(95%)EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* EQUIVOCAL*** W1362(19.4)
ABORTIFACIENT EFFECT* IN VIVO* PET ETHER EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** W1362(19.5)
EMBRYOTOXIC EFFECT* IN VIVO* H2O EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** W1362(19.2)
EMBRYOTOXIC EFFECT* IN VIVO* ETOH(95%)EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** W1362(19.3)
EMBRYOTOXIC EFFECT* IN VIVO* PET ETHER EXT*RAT*FEMALE**ORAL* DOSE 100.0 MG/KG* INACTIVE*** W1362(19.6)
PLUMBAGO ROSEA . PLUMBAGINACEAE STEM INDIA
UTERINE STIMULANT EFFECT* IN VITRO* HOT H2O EXT*RAT*FEMALE*UTERUS(ESTROG)** CONC UNKNOWN* WEAK ACTIVITY*** A2332(12.1)
UTERINE STIMULANT EFFECT* IN VITRO* HOT H2O EXT*RAT(PREGNANT)**UTERUS(PREG)** CONC UNKNOWN* ACTIVE*** A2332(12.2)

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A2600 EVALUATION OF SOME INDIGENOUS DRUGS FOR STIMULANT EFFECT ON THE RAT UTERUS. A PRELIMINARY REPORT
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W0823 PLANT POLYPHENOLS. 5. OCCURRENCE OF AZALEIN AND RELATED PIGMENTS IN FLOWERS OF PLUMBAGO AND RHODODENDRON SPECIE
HARBORNE,JB:
ARCH BIOCHEM BIOPHYS 96 171- 1962
(* * JOHN INNES INST * HERTFORD * * * ENGLAND)

COMPOUNDS ISOLATED FROM OR IDENTIFIED IN PLUMBAGO ROSEA

PLUMBAGO ROSEA . PLUMBAGINACEAE ROOT INDIA
IDENTIFICATION OF
PLUMBAGIN 2300234
GLUCOSE 17001E1E7
FRUCTOSE 17001E1E7 A0480(1.1)
PLUMBAGO ROSEA . PLUMBAGINACEAE ROOTBARK INDIA
ISOLATED FROM
PLUMBAGIN 2300234 A0481(2.1)
ISOLATION FROM AFTER SAPONIFICATION
SITOSTEROL,BETA: 45027E786
OLEIC ACID 1600211
LINOLEIC ACID 1600211
LIGNOCERIC ACID(?) 1600111
ARACHIDYL ALCOHOL(?) 12001E1 A0481(2.2)
IDENTIFICATION OF
GLUCOSE 17001E1E7 A0481(2.3)
PLUMBAGO ROSEA . PLUMBAGINACEAE ROOT INDIA
IDENTIFICATION OF
NAPHTHOQUINONE,ALPHA: 23002
NAPHTHYLAMINE,ALPHA: 500327788
BENZENE,META-DINITRO: 2400125
NAPHTHOQUINONE,ALPHA-HYDROXY: 2300234 A0662(1.1)
PLUMBAGO ROSEA . PLUMBAGINACEAE FLOWERS .
ISOLATED FROM
PELARGONIDIN-3-O-ALPHA-L-RHAMNOSIDE 200090134
CYANIDIN-3-O-ALPHA-L-RHAMNOSIDE 200090134
DELPHINIDIN-3-O-ALPHA-L-RHAMNOSIDE 200090134
AFZELIN 200020134 A7203(2.1)
PLUMBAGO ROSEA . PLUMBAGINACEAE FLOWERS .
ISOLATED FROM
PELARGONIDIN-3-O-ALPHA-L-RHAMNOSIDE 200090134
DELPHINIDIN-3-O-ALPHA-L-RHAMNOSIDE 200090134
CYANIDIN-3-O-ALPHA-L-RHAMNOSIDE 200090134
AZALEIN 2A002013470 (NOT FOUND)
KAEMPFEROL-3-O-ALPHA-L-RHAMNOSIDE 20002E70134 W0823(2.1)

PHYTOCHEMICAL SCREENING FOR PLUMBAGO ROSEA

PLUMBAGO ROSEA . PLUMBAGINACEAE ROOT INDIA
PHYTOCHEMICAL SCREENING SHOWS ALKALOIDS ABSENT A0480(1.2)
PHYTOCHEMICAL SCREENING SHOWS GLYCOSIDES ABSENT A0480(1.2)
PHYTOCHEMICAL SCREENING SHOWS SAPONINS ABSENT A0480(1.2)
PLUMBAGO ROSEA . PLUMBAGINACEAE ROOTBARK INDIA
PHYTOCHEMICAL SCREENING SHOWS ALKALOIDS ABSENT A0481(2.4)
PLUMBAGO ROSEA . PLUMBAGINACEAE ROOT
PHYTOCHEMICAL SCREENING SHOWS ALKALOIDS PRESENT A0532(1.1)
PHYTOCHEMICAL SCREENING SHOWS SAPONINS PRESENT A0532(1.1)
PHYTOCHEMICAL SCREENING SHOWS STEROLS AND/OR TRITERPENES PRESENT A0532(1.1)