



## Design and implementation of web-based open access rapeseed-mustard disease bibliographic information system

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(Received: 10 September 2015; Revised: 15 October 2015; Accepted: 20 December 2015)

### Abstract

The advancement of research in the field of rapeseed-mustard diseases is clear to everyone. The numbers of articles are being published each year, resulting in increase of knowledge at every moment. Problem identification, future planning, implementation, and interpretation of individual research studies all depend on ready access to all of the relevant existing rapeseed-mustard diseases research knowledge. We implemented web-based bibliography information system (RMBiblio), offer researchers easy and fast access of references in the field of rapeseed-mustard disease research. Metadata formats suitable for describing scientific publications have been used in creating the database. System supports a wide range of publication types, and has features like advanced search option, extraction of publications statistics based on a variety of visual form based queries, etc. These sophisticated and versatile searching facilities have been implemented using full text search options, the rows returned are automatically sorted with the highest relevance first. HTML, CSS, was used for development of user interface; PHP is the middleware and MySQL for the backend.

**Key words:** Bibliography, metadata, rapeseed-mustard, references, web-based information system

### Introduction

Rapeseed-mustard is widely grown in majority of Continents with largest area of 8 million ha in Canada followed by 7.5 million ha in China and >6 million ha in India. Rapeseed-mustard is the third most important source of vegetable oil in the world, after soybean and palm oil (Anonymous, 2014). Keeping the importance of crop, the plenty of research on different aspect has been made worldwide for its improvement. In India, ICAR-Directorate of Rapeseed-Mustard Research (DRMR) is a premier institute of Indian Council of Agriculture Research to develop location specific ecological sound and economical viable production and protection technologies for rapeseed-mustard, their assessment and dissemination. Besides the basic and strategic research, it is also co-ordinating and managing the Rapeseed-Mustard research having a strong network of 11 main-and 12 sub-centres spread over 17 states in country. Rapeseed-mustard contributes almost 24% of total oilseed production in India (Chauhan *et al.*, 2012).

Challenge before DRMR is to increase the level of sufficiency in edible oil consumption in changing food habit of ever-growing population in the country with increase or achieve the potential yield cultivars through developing ecologically sound and economically viable agro production and protection technologies for different climatic conditions.

The losses in oilseed crops due to biotic stresses is about 19.9%, out of which diseases cause severe yield reduction at different growth stages. In several researches various plant pathogens are reported to affect the rapeseed-mustard crop. Among them, 18 are considered to be economically important in different parts of the globe (Sharma *et al.*, 2015). The advancement of research in the field of rapeseed-mustard diseases is clear to everyone. The numbers of articles are being published each year, resulting in increase of knowledge at every moment. The publication of research articles represents scientific development in any concern domain of research. Improved plant health depends on finding about its determinants and the application of this

knowledge in the development of resistance and treatment of disease. It depends on the dissemination of research findings and the status of existing information. Identification, planning, implementation, and interpretation of individual research studies all depend on ready access to all of the relevant existing research knowledge in particular domain.

Need, felt to collate vast and scattered information published in several publications on different aspect of research on rapeseed-mustard disease in the form of bibliography database. An online bibliographic database is a database of bibliographic records, an organized digital collection of references to published literature in specific research domain. A bibliographic database may be general in scope or cover a specific research discipline and usually focus on a particular domain of knowledge, and contain various types of publications including journal, conference proceedings, reports, newspaper articles, patents, books, government and legal publications, etc. (Ng and Peh, 2010). Using keywords and browsing by categories, bibliographic databases enable to deliver relevant information for targeted research areas.

The broad objective to develop this online bibliography database is to enabling researchers in the field of rapeseed-mustard disease to gain access to research articles data in this field, the long-term mission is to acquire existing and new research result and convey for new studies to the scientific community, students, and research centers in particular and our whole society in general. The main goal of this work is to apply database technology to solve this problem. The result is supposed to be a web-based open access bibliographic information system for rapeseed-mustard research and named as *RMBiblio*.

### Related Work

Bibliographic databases usually include references and abstracts, indexed by subject-specific keywords so users can retrieve searches for a particular topic of interest. There are several commercial and non-commercial bibliographic databases are available including scientific publications of medical, engineering, agriculture, social science, etc.

In engineering, *Inspec* (<http://www.theiet.org/resources/inspec/>) is a major indexing database in physics and engineering, published by the Institution of Engineering and Technology, *IEEE Xplore* is a scholarly research database that indexes, abstracts, and provides full-text for articles and papers on computer science, electrical engineering and electronics. The database mainly covers material from the Institute of Electrical and Electronics Engineers (IEEE) and *Engineering village* (<http://www.engineeringvillage.com/>) of Elsevier, it indexes scientific literature pertaining to engineering materials, etc.

In medical, *PubMed* (<http://www.ncbi.nlm.nih.gov/pubmed>) is a free resource pertaining to medical developed and maintained by the National Center for Biotechnology Information (NCBI). *MEDLINE* (Medical Literature Analysis and Retrieval System Online, or MEDLARS Online) is a bibliographic database of life sciences and biomedical information maintained by United States National Library of Medicine. *IndMED* (<http://indmed.nic.in/>) Index to Indian Biomedical Journals the ICMR-NIC Centre for Biomedical Information (Indian MEDLARS Centre) has designed and developed a bibliographic database from Indian biomedical literature.

In agriculture, *cabdirect* (<http://www.cabdirect.org/>), published by CABI International, provides abstracts of internationally published scientific research literature in agriculture and the biosciences. *AGRICOLA* (<http://agricola.nal.usda.gov/>) is a database of bibliographic records created by the National Agricultural Library of the US Department of Agriculture and its co-operators. *AGRIS* (<http://agris.fao.org/agris-search/index.do>) is a global public domain database bibliographical records on agricultural science and technology. The database is maintained by FAO.

There are some common databases covering most of area of research like, *ScienceDirect* (<http://www.sciencedirect.com/>) is database of physical sciences and engineering, life sciences, health sciences, social sciences and humanities, operated by the Anglo-Dutch publisher Elsevier.

Scopus (www.scopus.com) is a bibliographic database containing abstracts and citations for journals in the scientific, technical, medical, and social sciences (including arts and humanities). It is owned by Elsevier and is available online by subscription. Research Xplore (www.researchxplore.com) is free open access database that indexes, abstracts, and provides full text for articles and papers on engineering, agriculture, health sciences, and social sciences.

Beside above mentioned databases covering broad area of researches and requires efforts to search specific information on topic of interest, now in the age of digitization, most of journals are being published electronically and also available online. None of the database as I, cited is of concise specific nature to deliver the information of particular subject interest. The RMBiblio is the specific bibliographic database having the scientific literature only on Rapeseed-Mustard disease research. Hope, this will help both the present and future researchers of rapeseed-mustard in identifying important area of research and to frame their research to meet the plant health challenges ahead.

**Materials and Methods**

The design of a bibliographic information system has

to take into account two possible requirements: the completeness of the data held in the database, and ease of use for the intended users. Information in the database has to be as comprehensive and detailed as possible to allow for all conceivable queries. System design and development usually proceeds through several phases of a software development life cycle (SDLC) that includes: feasibility study (problem identification); requirements analysis (users’ requirements); choosing the system design and architecture; testing; implementation and evaluation. To find out the requirements in this case, existing system was investigated, analyzed and evaluated to understand the current mode and methods of disseminating research information in order to identify existing problems discussion sessions were organized with potential users of the system, i.e. researchers and administrators at the directorate of Rapeseed-mustard Research, Bharatpur, India. After collecting the necessary information from the users, it is necessary to structure the information and define what will really facilitate their work. Figure 1 is depicted a Use case diagram of the system. Secondary data was obtained from published literature and internet which help to elicit information about research activities and other relevant research information. System architectural design was used

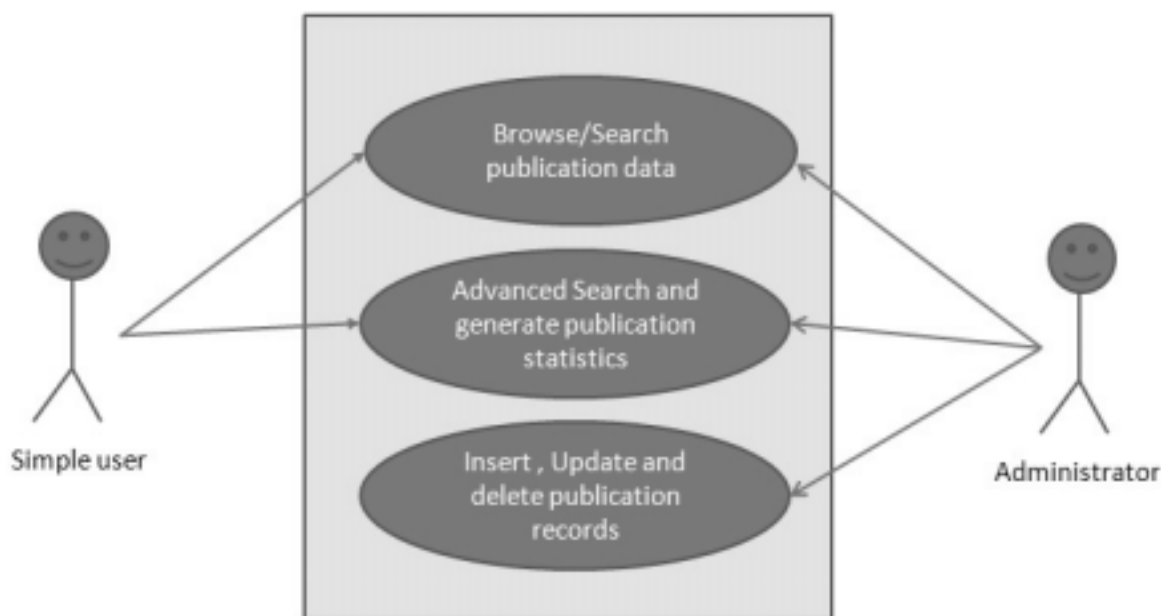


Figure 1. Use case diagram of the system

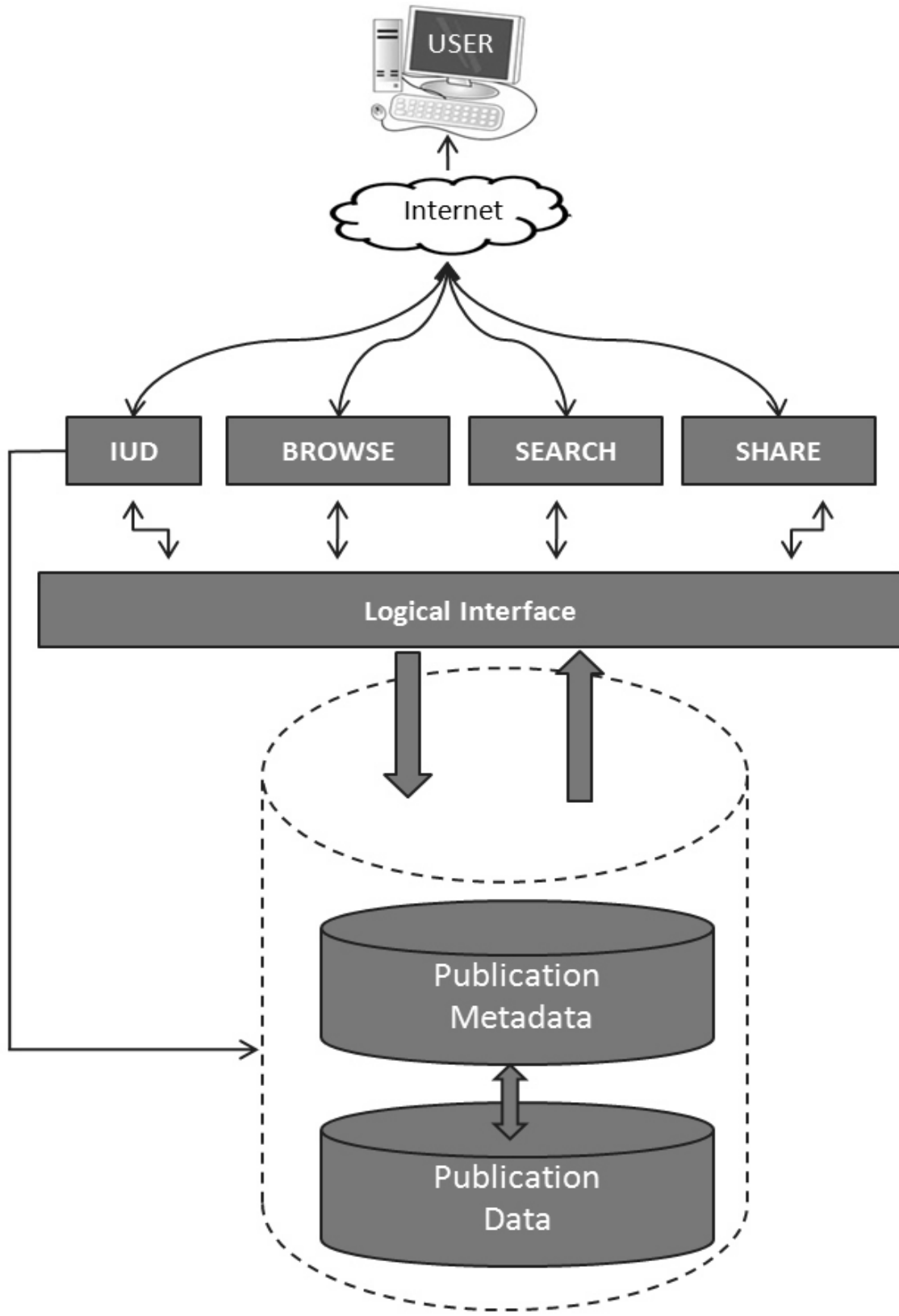


Figure 2. RMbiblio system design architecture

to transform the requirements statements from the requirements analysis phase into design specifications for construction. The system design is based on 3-tier architecture, separating data, logic and presentation tiers. This makes the application easier to maintain in the future, as well as to further upgrade with new features. The overall system architecture designed to develop an efficient research publication information system is shown in fig. 2. HTML, CSS, MySql and PHP was used in implementing this bibliographic information system. HTML, CSS, was used for development of user interface; PHP is the middleware and MySql for the backend (Oguntoyinbo *et al.*, 2013; Kumar *et al.*, 2008a; Kumar *et al.*, 2008b).

### Publication data & Metadata base

The publication information acquired through published material and internet. Number of articles may publish in a publication, all articles in this database distinguished in different categories. These include: research paper published in refereed journals, conference or seminar paper, research thesis, technical bulletin, report or manual, book or book chapter, news letter/ magazine and article on the internet. The data actually kept in an entry depends on the category of publication. Simplified diagrams of the structure of the publication database and the publication categories are presented in fig. 3a and 3b respectively. The concept of metadata of publications is used in the creation of the database. This will allow filtering and provide enhanced search

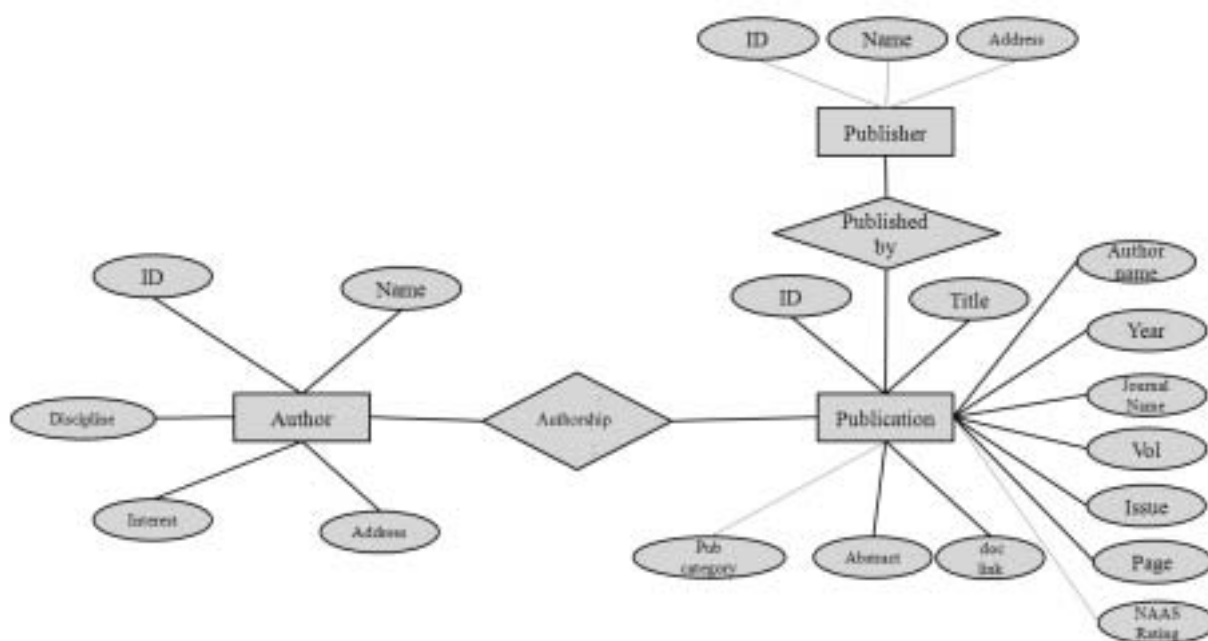


Figure 3a. E-R diagram



Figure 3b. Publication categories



<p><b>Metadata Schema categories</b></p>	<p><b>Metadata vocabulary terms</b></p>
<p>ID</p>	<p>DPUB1301</p>
<p>Publication category</p>	<p>Research Paper</p>
<p>Title</p>	<p>Design and implementation of web-based aphid (Lipaphis erysimi) forecast system for oilseed Brassicas</p>
<p>Author</p>	<p>VINOD KUMAR, AMRENDER KUMAR and CHIRANTAN CHATTOPADHYAY</p>
<p>Journal name</p>	<p>Indian Journal of Agricultural Sciences</p>
<p>Abstract</p>	<p>Oilseed Brassicas are major crops in India and world over. Keeping in view severe losses caused by aphid over. Keeping in view severe losses caused by aphid (Lipaphis erysimi) in these crops, efforts were initiated to devise user-friendly web-based software for forecasting their occurrence. Multiple stepwise regressions have been followed.....</p>
<p>Year of Publication</p>	<p>2012</p>
<p>Volume</p>	<p>87</p>
<p>Issue</p>	<p>7</p>
<p>Pages</p>	<p>618–622</p>
<p>NAAS Rating</p>	<p>6.6</p>
<p>Publisher name</p>	<p>ICAR, New Delhi</p>
<p>Doc_link</p>	<p>Doc/DPUB1301.pdf</p>

**Design and implementation of web-based aphid (Lipaphis erysimi) forecast system for oilseed Brassicas**

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**ABSTRACT**

Oilseed Brassicas are major crops in India and world over. Keeping in view severe losses caused by aphid (Lipaphis erysimi) in these crops, efforts were initiated to devise user-friendly web-based software for forecasting their occurrence. Multiple stepwise regressions have been followed for developing aphid prediction models in practice. Interpretation and use of these models was difficult for any person not having proper statistical knowledge. Further keeping in view the need of online software tool to help the plant researchers, extension personnel and farmers in forecasting of aphid infestations and timely application of control measures, the study was carried out. The paper introduces design and implementation of web-based forecast software for prediction of aphid in oilseed Brassica in India. The software uses statistical prediction models developed based on weather parameters as independent variables and crop age at time of first appearance of aphid as crop yield number of aphid and crop age at peak population as dependent variables, which were fitted by multiple stepwise regressions. The software has been developed by adopting algorithms, user-friendly open source technology. The system provides a prediction of insect aphid infestations well in advance of their actual arrival on the crop along with recommendations for next-best insecticide application.

**Key words:** Brassica, Forecast software, Lipaphis erysimi, Prediction model, Web-based system

Globally, India ranks third in production of oilseeds Brassica and contributes 14.9% of world production. In India, oilseed Brassica contribute 23.7% of acreage, 20.0% of production and play an important role in oilseeds economy (Chauhan and Jha 2011). Of the various insect-pests and diseases limiting rapeseed-mustard production, Lipaphis erysimi (Kull) continues to be an endemic problem in India (Jha 2011). It is favoured by low temperatures (8-18°C) coupled with 60-80% relative humidity and cloudy weather. Losses due to insect aphid infestation may reach upto 80% when conditions favour multiplication of the pest (Maddal et al. 1994) and are very difficult to manage. Insecticides are favourable. Yield losses due to insecticide application on oilseed Brassica could be replaid due to destructive insect-pests of rapeseed-mustard despite decades of research towards its management. Weather has a very important role to play in the appearance, multiplication and spread of the insect-pest. Considerable efforts have been directed towards developing aphid resistant cultivars. But due to absence of stable, desirable and diverse source of resistance to the insect aphid with a broad genetic base, systematic use of insecticides has been the most practical way to manage Lipaphis erysimi. However, due to high cost of chemicals as well as their hazardous effects, use of insecticides need to be only need-based. Although consumption of systemic insecticides on rapeseed-mustard crops in India is high (IASRI 2009), timing their application has been erratic. Crops requiring treatment have been left

Figure 4. Metadata and schema design

effectiveness within the database. Publication metadata elements provide standard information about the research publication. The most commonly used metadata formats is presented in fig. 4.

### **User interface and system implementation strategies**

A user-friendly interface for the system has been developed. The system has been designed to provide metadata-based filtering to facilitate browsing and searching. The major activities considered in designing the system are acquiring the new publications, searching for desired information, updating records and providing customized statistical reports of the publication database. The system supports formbased Boolean queries for browsing, searching and sharing of publications (Kumar *et al.*, 2008b). RMBiblio is implemented using the open source technology LAMP (Linux-Apache-MySQL-PHP). MySQL database was used for back end data storage, and required tables were created using PHPMyAdmin (graphical user interface for MySQL administration). The Apache web server was used for delivering content from the database server to end-users. PHP (recursive acronym for Hypertext Pre-processor or Personal Home Page) is an open source server-side scripting language used to develop the dynamic web application for displaying information accessed from a database. HTML (Hypertext Markup Language) and Java scripts are used in conjunction with PHP to give an aesthetically pleasing web interface for users. The interface was developed in the English language to provide global access to the system. The hardware specifications include highend servers and storage devices. The system operates in sharing mode on a server running Linux kernel 2.6.18-194 operating system, MySQL version 5.1.56, Apache 2.2.21 and PHP version 5.1.17.

### **Results and Discussion**

In RMBiblio, the bibliographic information on rapeseed-mustard disease is an interactive user-friendly system that allows users without any specialized training or knowledge of Structured Query Language (SQL) to perform record searches, insertions, updates and deletions conveniently. The users using the system are broadly

divided in two classes. The first one contains the users with administrative privileges, called 'Administrators' who have the responsibility of maintaining the whole system through the addition, deletion or modification of the publications records. The second class contains the 'Simple users' who have only read privileges. Read privileges have also been granted to all users. The application is benefit both class user 'Administrators' by making their job maintain and update database easier through the use of the system facilities. It is obvious however that a well maintained and up to date system will also benefit 'Simple users' cause they will be always be kept informed with fresh information. The system offers significant saving of digital space and requires lesser time for updating and management of digital research publication information. Figure 5 is depicted as a sample screen-shot of user interface.

### **IUD records operation**

The potential use of the system for maintaining publication data and researcher i.e. author evaluation purpose mandates that the record operations; INSERT, UPDATE and DELETE (IUD) must be performed in a secure manner. For secure transaction of records, the system operates in administrator and user mode. After login as administrator the insert, update and delete of records can be performed. Figure 5 shows a screen-shot of the interface for inserting and updating new records of publication to the database. To avoid typographic errors, the system provides a dropdown menu option for selecting different attributes.

### **Search features of the system**

This is the main feature of every bibliographic information system. The system provides a powerful facility to search the publications within the database. There are three primary methods of searching for publications (1) Browsing by publication categories, (2) Keyword based search, and (3) Advanced search based on different attributes (fig.5). Presentably, sophisticated and versatile searching facility has been implemented using MySql Full text search options, the rows returned are automatically sorted with the highest relevance first. Relevance values are nonnegative floating-point numbers. Zero



Figure 5. A samples screen-shot provides the user interface



relevance means no similarity. Relevance is computed based on the number of words in the row, the number of unique words in that row, the total number of words in the collection, and the number of documents (rows) that contain a particular word. A couple points about full-text searching in MySQL: Searches are not case sensitive; Short words are ignored, the default minimum length is 4 characters; Words called stopwords (the, have, some, etc) are ignored. Sometimes basic searching causes too many records to be retrieved. The advanced search option is designed for users who wish to specify exact search criteria to search the publication in database on user specified attributes. Figure 5 presented the most preferred advance search options provided by the system.

The present online bibliography database of rapeseed-mustard disease hosted on the website of DRMR contains 2604 scientific publications on all aspects of disease research progress (*Albugo* and *Sclerotinia* pathogens) in the world during the period of past 223 years from 1792 to 2014. (Saharan *et al.*, 2014; Sharma *et al.*, 2015). The database contains reference, abstract, full text link of open access articles.

### Conclusions

*RMbiblio* provides much needed exposure to rapeseed-mustard disease research published and acts an important resource to rapeseed-mustard information seekers. It is being updated on an ongoing and timely basis. Although a formal assessment of the system has not been done, informal feedback has included very positive reviews by rapeseed-mustard researchers, students and administrators in India due to effective management of references and the easy user interface. The system is receiving response from the rapeseed-mustard community both at national as well as international level. Further refinement and augmentation of the capabilities of the application in response to user feedback is important to enhance the quality of the software.

### References

Anonymous. 2014. Status paper on Oilseeds, Department of Agricultural & Cooperation, Ministry of Agriculture, Govt. of India ([http://nmoop.gov.in/Misc/Status\\_Paper.pdf](http://nmoop.gov.in/Misc/Status_Paper.pdf)).

- Chauhan JS, Singh KH, Kumar V . 2012. Compendium of rapeseed mustard varieties notified and breeder seed production scenario in India (2006-2012), AICRP-RM, Directorate of Rapeseed Mustard Research, Bharatpur, Rajasthan, India.
- Saharan GS, Verma PR, Meena PD, Hossein Borhan M and Dhiraj Singh 2014. Analysis of white rust research progress through bibliography. *J Oilseed Brassica* **5**: 42-115.
- Kumar Vinod, Lehri Sushma, Sharma AK and Kumar Arvind. 2008a. Design and implementation of agriculture research digital photo manager. *Computers and Electronics in Agriculture* **60**: 296-300.
- Kumar Vinod, Lehri Sushma, Sharma AK, Meena PD and Kumar Arvind. 2008b. Image based rapeseed-mustard disease expert system: an effective extension tool. *Indian Res J Extn Edu* **8**: 10-13.
- Ng KH and Peh WCG. 2010. Getting to know journal bibliographic databases, *Singapore Med J* **51**: 757-761.
- Oguntoyinbo OE and Oladejo BF. 2013. Developing a research output repository system Using web technology for Nigerian research Institutes, Computing, Information Systems, *Development Informatics & Allied Research* **4**: 59-64.
- Meena PD, Rathi AS, Vinod Kumar, Dhiraj Singh. 2013. Identification and management of rapeseed-mustard diseases. ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur, India p. 24.
- Sharma P, Verma PR, Meena PD, Vinod Kumar and Dhiraj Singh. 2015. Research progress analysis of sclerotinia rot (*Sclerotinia sclerotiorum*) of oilseed Brassicas through bibliography. *J Oilseed Brassica* **5**: 45-125.

