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A database on parasitoid of insect pests of crops in Manipur, India

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A B S T R A C T

A Parasitoid database consisting of 62 (sixty two) species records gathered by conducting a systematic survey of parasitoids on insect pests of crops in different localities of Manipur was developed by using MS-Access. The database is for academic purpose and it includes the taxonomic details of the parasitoid, host insect, host plant, morphological characters, geographical distribution, period of activity, parasitoid behavior and its biology etc. Image of the parasitoid species are also provided for helping in easy identification of the species.

Keywords: Database, insect-pest, parasitoids, Manipur

Introduction

Manipur, one of the seven states of the North eastern India, is located in the extreme north eastern border of the Indian Union between 23°.83' and 25°.68'N latitudes and 93°.03' and 94°.78' longitudes. The state has a total geographical area of 22,356sq.km. The topography of the state can be broadly divided into two natural regions, viz., the central plain or the Imphal valley and the hills surrounding the central plain, with an elevation varying from 130m to 2,995m above MSL. In Manipur, a year can be divided into four distinct seasons, viz., the cold season/winter (December to February), the hot dry season/spring-summer (March to April), the rainy season (May to September) and the retreating monsoon season (October to November). The average maximum temperature ranges approximately from 21°C to 31°C during summer and rainy seasons and from 12.60°C to 28°C during winter at different altitudes. Manipur has a mixture of tropical, subtropical and temperate types of climatic conditions with good vegetation and rich biodiversity.

The agro-ecology of this region harbours a good number of crops which are extensively grown throughout the year due to presence of favorable climatic conditions except in few months at particular places. However the problem of insect pests to the crops seems to be still on the increase .For the control of these insect pests, normally chemical pesticides are used extensively. World wide pesticide use has increased twelvefold since the early 1950s, and costs paid by the farmers in the United States for pesticides increased six fold between 1951 and 1976 (Eichers 1981). The consequence of these pesticides residues varies from none to serious. As farmers and the public at large gain increased knowledge of these problems, the demand for other forms of pest control, in particular biological control increases. Biological control is a population level process in which one species population lowers the number of another species by mechanisms such as predation, parasitism, pathogenicity, or competition. Among these biological processes, parasitism is achieved by the biological control agents such as parasitoids. Parasitoids are the agents used in biological control possess the potential to be effectively employed in the integrated pest management programme owing to their

parasitic nature, high reproductive potential resulting an easy mass multiplication and seasonal synchrony with their insect host. Most parasitoids attacking insects are in the orders Diptera and Hymenoptera; some are also found in the Strepsiptera and some belong to genera Coleoptera, Neuroptera and Lepidoptera (Van Driesche & Bellows 1998). In Manipur, since the crops are extensively grown throughout the year due to presence of favorable climatic conditions, to protect these crops from pests' devastation, people are solely depending on chemical pesticides, the side effects of which have come to fore so candidly that there is a serious concern for finding alternative methods of crop protection. The concept of integrated pest management has received a greater acceptance in the present scenario of environment degradation and food contamination. Hence, propagation of parasitoids as a means for controlling insect pest is necessary for providing a successful integrated pest management program. Here, we present a database, on Parasitoids, which provides integrated access to all the parasitoids of insect pests on economically important crops of Manipur. The Parasitoid database currently contains 62 parasitoid species which are found parasitizing different insects' pests infesting a large variety of economically important crops in Manipur. This database will enable certain improvement in the area of crop protection in the region. By using these potential parasitoids in the field after mass multiplication, it may certainly reduce the use of toxic insecticides for a safe environment. Mass multiplication of these parasitoids at farmer's level would provide self employment to a great extent and at the same time would promote the upliftment of local people.

Materials and Methods

Collection, rearing and preservation

Surveys for the collection of the parasitoids were conducted from January 2007 to December 2008 at different crop growing areas of Manipur throughout the year. The survey was conducted during different seasons from different localities varying in altitudes and seasons. Materials were collected in polythene bags tied with rubber bands and brought to the laboratory for rearing. Sample number, locality, date, host plant, host insect, habitat including colouration of mummies (in case of aphids) were noted in the field notebook. In the laboratory the collected materials along with the host plants were transferred to medium sized jars (250/500ml) translucent plastic containers or Petri dishes and numbered accordingly. The mouths of the jars were kept closed by muslin cloth tied with rubber belts. Those specimens collected at the larval stage were fed with the host plant till pupation. The containers were checked everyday in order to check fungal infection during rearing. After emergence of the adult parasitoid proper identification of the parasitoids as well as host insects and host plants were done. The unidentified specimens were then sent to other experts, viz., ZSI, Kolkata and Division of Entomology, IARI, New Delhi for identification. For preservation of the specimens, parasitoids were killed and preserved in 70% alcohol in homeopathic vials (4 cm x 0.5 cm), which were leveled. Some of them were preserved as dry specimens either by mounting on rectangular paper card or pinned with Asta insect pin of different size while the smaller specimens were mounted on microslides after processing. In order to study the minute taxonomic characters for specific identification, permanent mount of the specimens were prepared as per the established

norms of permanent slide preparation of whole insects (Singh 1987).

Database construction and features

The in-house standalone database was designed and developed using MS Access 2003 with written SQL queries and using different applications to make the database more user-friendly. The Parasitoid database includes primary data as well as secondary data collected from various literatures sources viz., final technical report on biodiversity of parasitoids funded by MOEF, New Delhi (Singh & Singh 2006), published thesis on parasitoids from Manipur University Library Google Scholar, etc. Parasitoid database altogether contains about 62 entries under the order Hymenoptera and Diptera. Detailed view of the database showing separate views is shown in Fig.1. The database can be accessed either by using scientific name, taxonomic status, morphological characters, host plant, host insect, period of activity, biology, etc. The database finds its utility in providing a successful integrated pest management program by propagating parasitoids as a means for controlling insect pest. This will help the farmers in minimizing the use of hazardous chemical insecticides for the control of insect pests in the fields.

Results and Discussion

The systematic survey on certain important crops viz., cereals, vegetables, fruits, spices, fiber and plantation crops revealed the occurrence of 62 (sixty two) species of parasitoids belonging to the families *Aphididae, Chalcidae, Ichneumonidae, Braconidae* etc. in different localities of Manipur varying in altitude and seasons (Table. 1). The host range of the parasitoids recorded in the database indicated that majority of the parasitoids so far entered are monophagous, few are oligophagous and some are polyphagous. The highly polyphagous species includes *Aphidius colemani, Campoletis chloridae* and *Lipolexis scutellaris*. The incidence of these parasitoids revealed that they are active almost throughout the year but its maximum activity was recorded from the month of January to March which represents the period of abundant growth of the crops harbouring different insect pests. Hence, a database on parasitoids is prepared for academic purpose which includes the taxonomic details of the parasitoid, host insect, host plant, morphological characters, geographical distribution, period of activity, parasitoid behavior etc.

Parasitoids are fascinating insects whose adult female lay their eggs in or on other insects and immature larvae develop by feeding on host bodies resulting in death of the host. Since parasitoid reproduction results in killing hosts, they can be used on a large scale to control insect pests attacking a wide variety of crops and these have ultimately stimulated research on biological control of insect pests. With regard to their ability to provide effective biological control they react to the population size of their host in a density dependent manner (Huffaker and Messenger 1964; Huffaker *et al.* 1984). A detailed study on the parasitoids of different insect pests attacking crops will help the farmers in the easy identification of its host insect, host plants, its period of activity etc. Subharani *et al.* (2007) studied the biodiversity of hymenopteran parasitoids of insect pests of crops in Manipur and reported 36 species of parasitoids species. A perusal of literatures revealed that a Universal Chalcidoid database is available in http://www.nhm.ac.uk/idsm /research/projects/chalcidoids and a predator

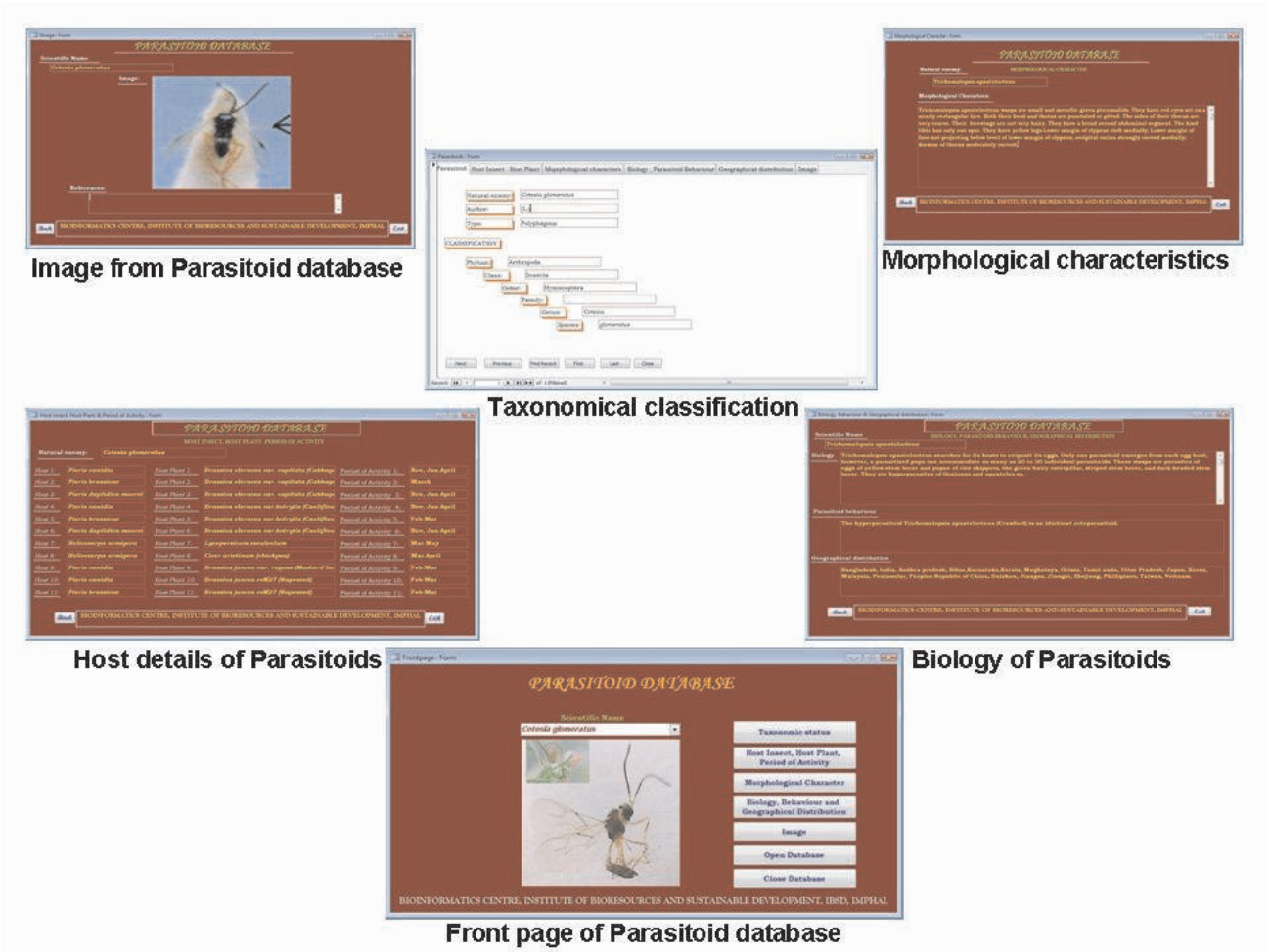

Fig 1. Parasitoid database screenshots displaying separate views of the database.

parasitoid database (PPRBASE) which is bibliography of research papers involving predacious or parasitic insects is available in the http://riss.narc.affrc.go.jp/ktsos/pprbase.htm. The parasitoid database thus developed provides a user friendly interface to the scientists, research scholars, students and the farmers of the region to retrieve information easily with less time and effort for their attempt to enhance the conservation and augmentation of the potential parasitoids.

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Table 1.
List of parasitoids attacking different insect pests on various host plants

Parasitoid	Host Insect	Host plant	Period of activity
Trichomalopsis apanteloctena, Crawford	*Scirpophaga incertulas*	*Oryza sativa*	Aug -Sept
Brachymeria excarinata, Gahan	*Pelopidas mathias mathias*	*Oryza sativa*	July -Sept
	Cnaphalocrocis medinalis	*Oryza sativa*	Aug -Oct
	Plut ella xylostella	*Brassica oleracea*	Feb- April
Cotesia sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	July -Sep
	Sylepta derogata	*Abelmoschous esculentus*	July -Sep
Psuedogonatopus nudus Perkins	*Nephotettix nigropictus*	*Oryza sativa*	Aug -Sep
Apanteles boaris Walk.	*Pelopidas mathias mathias*	*Oryza sativa*	July -Oct
Charops bicolor Szepligeti	*Pelopidas mathias mathias*	*Oryza sativa*	July -Oct
Rhysipolis sp.	*Pelopidas mathias mathias*	*Oryza sativa*	July -Oct
Halidaya luteicornis Walker	*Pelopidas sinensis*	*Oryza sativa*	July -Oct
Brachymeria sp.	*Pelopidas sinensis*	*Oryza sativa*	Aug -Oct
Drino sp.	*Pelopidas sinensis*	*Oryza sativa*	Aug -Oct
Pribaea orbata (Wiedemann)	*Pelopidas sinensis*	*Oryza sativa*	Aug -Oct
Bracon sp.	*Nymphula depunctalis*	*Oryza sativa*	July -Sept
Xant hopimpla flavolineata Cameron	*Cnaphalocrocis medinalis*	*Oryza sativa*	Aug -Oct
Elasmus sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	Aug -Oct
Bracon sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	Aug -Oct
Temelucha sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	Aug -Oct
Diadegme sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	Aug -Oct
Scenocharops sinui Sudheer& Narendran	*Cnaphalocrocis medinalis*	*Oryza sativa*	Aug -Oct
Campoleginae sp.	*Mocis frugalis*	*Oryza sativa*	Aug -Oct
Apanteles sp.	*Mocis frugalis*	*Oryza sativa*	Aug -Oct
Brachymeria coxodenta Joseph Narendran & Joy	*Mocis frugalis*	*Oryza sativa*	Aug -Oct
Campoletis chloridae Uchida	*Pieris canidia*	*Brassica oleracea var. capitata*	Jan -April
	Pieris daplidica moorei	*Brassica oleracea var. capitata*	Jan -April
	Helicoverpa armigera	*Cicer arietinum*	Mar - May
Platygaster oryzae, Cameron	*Orseolia oryzae*	*Oryza sativa*	Jun -Sept
Lysiphlebus (Adialytus) ambigues. Haliday	*Rhopalosiphum maidis*	*Zea mays*	Jul-Aug
Aphidius colemani Vireck	*Rhopalosiphum maidis*	*Zea mays*	October
	Lipaphis erysimi	*Brassica oleracea var. botrytis*	Dec -Mar
	Myzus persicae	*Solanum melongena*	January
Aphidius aulacorthi Stary	*Macrosiphum miscanthi*	*Tricticum aestivum*	March
	Myzus persicae	*Solanum melongena*	January
Aphidius giffuensis Ashmead	*Myzus persicae*	*Brassica oleracea var. botrytis*	January
	Aphis gossypii	*Capsicum frutescens*	January
Aphidius avenae Haliday	*Myzus persicae*	*Solanum melongena*	January
	Myzus persicae	*Carcia papaya*	March
	Aphis gossypii	*Capsicum frutescens*	January

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Parasitoid	Host Insect	Host plant	Period of activity
Aphidius hortensis Marshall	*Myzus persicae*	*Brassica oleracea var. capitata*	February
	Lipaphis erysimi	*Brassica juncea var.rugosa*	Jan. - Feb.
Aphidius matricarae Haliday	*Myzus persicae*	*Brassica oleracea var. capitata*	December
	Myzus persicae	*Brassica oleracea var. botrytis*	Jan - Mar
	Myzus persicae	*Brassica oleracea var.gongylodes* (Knol khol)	Jan - April
	Aphis gossypii	*Solanum tuberosum*	Jan-Feb
	Myzus persicae	*Solanum tuberosum*	Jan-Feb
	Acrytosiphon pisum	*Pisum sativum*	Feb-Mar
	Myzus persicae	*Pisum sativum*	Feb-Mar
	Myzus persicae	*Solanum melongena*	January
	Myzus persicae	*Carcia papaya*	March
Aphidius picipes (Nees)	*Hydaphis coriandri*	*Coriandrum sativum*	December
Aphidius similes, Stary & Carvar	*Myzus persicae*	*Lycopersicum esculentum*	Decem ber
Aphidius rhopalosiphi De Stefani - Perez	*Myzus numecola*	*Prunus amygdalus* (Almond)	February
Brachymeria bengalensis (Cameron)	*Pieris canidia*	*Brassica oleracea var. capitata*	Nov -Jan
	Pieris canidia	*Brassica oleracea var.botrytis*	Nov, Jan - April
	Pieris brassicae	*Brassica oleracea var.botrytis*	Mar -April
	Pieris canidia	*Brassica oleracea var.gongylodes* (Knol khol)	Nov, Jan -April
	Pieris brassicae	*Brassica oleracea var.gongylodes*	Feb-Mar
Brachymeria lasus (Walker)	*Pieris canidia*	*Brassica oleracea var. capitata*	Nov, Jan - April
	Pieris canidia	*Brassica oleracea var.botrytis*	Nov, Jan - April
	Pieris brassicae	*Brassica oleracea var.botrytis*	Mar -April
	Pieris canidia	*Brassica oleracea var.gongylodes* (Knol khol)	Nov, Jan -April
	Pieris brassicae	*Brassica oleracea var.gongylodes* (Knol khol)	Feb-Mar
Diaretiella rapae M' Intosh	*Lipaphis erysimi*	*Brassica oleracea var. capitata*	Jan - Mar
	Myzus persicae	*Brassica oleracea var.botrytis*	Jan - Mar
Diaretiella rapae M' Intosh	*Lipaphis erysimi*	*Brassica oleracea var.gongylodes* (Knol khol)	Jan - April
	Lipaphis erysimi	*Brassica juncea var. rugosa*	Jan-Feb
	Lipaphis erysimi	*Brassica juncea cv* M27	Jan - Mar
Ephedrus plagiator (Nees)	*Lipaphis erysimi*	*Brassica oleracea*	Jan - Mar
Diadegma semiclausum, Hellen	*Plutella xylostella*		Feb-April
Platylabus sp.	*Plutella xylostella*		Jan-April
Enicospilus sp.	*Helicoverpa armigera*	*Cicer arietinum*	Mar -April
Cercelia illota Curran	*Helicoverpa armigera*	*Cicer arietinum*	April
Voria sp.	*Helicoverpa armigera*	*Cicer arietinum*	April
Diadegma insularis Cresson	*Plutella xylostella*	*Brassica oleracea var.botrytis*	Feb-April
Apanteles cypris Nixon	*Cnaphalocrocis medinalis*	*Oryza sativa*	July-Sept
Trichomma cnaphalocrocis Uchida	*Cnaphalocrocis medinalis*	*Oryza sativa*	July-Sept
Cardiohiles philippensis Ashmead	*Cnaphalocrocis medinalis*	*Oryza sativa*	July-Sept
Bracon sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	July-Sept
Aulosaphes sp.	*Cnaphalocrocis medinalis*	*Oryza sativa*	July-Sept

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