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Data Visualization Techniques on Partially Purified Plant Extracts against Aedes aegypti (Culicidae: Diptera)

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Abstract— Discovering patterns from the large database can be extracted by means of various methods and techniques. The data set can be more understandable if it is presented in the form graphical representation rather than presenting as numerical data. Partially purified extracts of the different plant species were evaluated for the egg hatchability, larvicidal and pupicidal activity of mosquito, Aedes aegypti under the room temperature in the laboratory. Dosage value as expressed in ppm was 1 to 100 for Aedes aegypti and their value are stored in database. A relationship was observed between partially purified the plant extract doses and percentage mortality. The percentage of egg hatchability, larval and pupal mortality was found to be increased with increase in the dosage. Based on the probit analysis, the L_C50 value of egg, instars and pupae hence assumed

Keywords— Data mining, Visualization, Aedes aegypti, ppm, partial purification, L_C50

I. INTRODUCTION

Knowledge Discovery in Databases is not a new technique but rather a multi-disciplinary field of research; machine learning, statistics, database technology, expert systems and data visualization all made a contribution [1]. Data visualization is the process by which textual or numerical data are converted into meaningful images [2].

Mosquitoes are vector for various disease including malaria, yellow fever, filariasis Japanese encephalitis and chikungunya. Among these mosquito borne diseases dengue fever dengue hemorrhagic fever, yellow fever and chikungunya are endemic in Southeast Asia and Africa [3]. It is transmitted by *Aedes aegypti* (Linn.). One of the methods available for controlling the mosquitoes is use of synthetic insecticides. Mosquitoes develop genetic resistance to synthetic insecticides [4] and even to biopesticides such as *Bacillus sphaericus* [5]. Also synthetic insecticides adversely affect the environment by contaminating air, water, and soil. There is a urgent need to find alternatives to the synthetic insecticides which is more potent and low-cost. Plants are rich source of alternative agents for control of mosquitoes, because they possess bioactive chemicals, which act against limited number of species including specific target-insects and are eco-friendly [6].

Traditionally plant based products have been used in human communities for many centuries for managing insects. Several secondary metabolites present in plants serve as a defense mechanism against insect attacks. These bioactive chemical may act as insecticides, antifeedants, moulting hormones, oviposition deterrents, repellents, juvenile hormone mimics, growth inhibitors, antimoulting hormones as well as attractants. Plant based pesticides are less toxic, delay the development of resistance because of its new structure and easily biodegradable [7]. For the present study, the data mining of plant species were screened against egg hatchability, larval and pupal mortality of the mosquito *Aedes aegypti*.

II. METHODOLOGY

In this study ten plants species were taken such as *Tridax procumbens, Annona squamosa, Tagetes erecta, Acorus calamus, Casearia esculenta, Ricinus communis, Pongamia pinnata, Vitex negundo, Lantana camara, Ageratum conyzoides* and their partially purified extracts have been tested against *Aedes aegypti* with various dosage (ppm). Reading was taken at regular intervals and are stored in the database. In case, if we want retrieve a particular data based on some criteria it will be a difficult task. Hence Data Mining as an analytic process designed to explore large amounts of (typically business or market related) data in search for consistent patterns and/or systematic relationships between variables, and then to validate the findings by applying the detected patterns to new subsets of data.

III. PARTIAL PURIFICATION OF PLANTS EXTRACT

Different parts of the plants were taken based on the effect of crude extracts tested to purify on silica gel column. Sufficient quantity of powdered plant materials were dissolved in 60% acetone and extracted for 8 hrs. Clear supernatant was air dried concentrated and dissolved in acetone. Column was packed with silica gel (60x120 mesh) and washed with 1% acetone several times. Sample was centrifuged at 5000 rpm for 2 minutes. The clear supernatant was applied over the column eluted with 1% acetone. Fractions collected 3 ml per minute and were air dried and used for bioassay.

To obtain the different concentration of test medium for crude 1 to 10 gm of stock powder and for silica gel fractions 1 mg of dried powder was dispersed in 100 ml of 0.02% acetone. The effect of crude and silica gel fractions on the developmental was noticed for a period of 24 hrs [8].

IV. INFORMATION AND SCIENTIFIC VISUALIZATION

Visualization techniques are useful methods for pattern discovering in data sets. An elementary technique that can be of great value is the so called scatter diagram. In this technique information is displayed in a Cartesian space with two attributes. It is a class of graphic techniques used to visualize the contents of a database [1].Knowledge Discovery in Databases is 'the non-trivial extraction of implicit, previously unknown and potentially useful knowledge from data'. So the knowledge must be new, not obvious and one must be able to use it [1].Data mining algorithms can figure out hidden data patterns as well. As an alternative to mechanical data mining algorithms, visual exploration has proven as an effective tool in data mining and knowledge discovery [9]. Data structural features can be effectively recognized by data seekers using data visualization [10].

Data visualization is accepted as the new name of this discipline which consisted of two existing sub-areas: information visualization and scientific visualization [11]. The study of scientific visualization was officially launched through a research recommendation made by the National Science Foundation (NSF) in 1987 [12]. Approximately the same time, the emerging data warehouse and data mining [13] paved the way for information visualization to apply on high dimensional business datasets. In general, the variables in a typical scientific visualization task are continuous and are about volumes, surfaces, etc. Information visualization tasks are apropos of categorical variables and the recognition of patterns, clusters, trends, outliers, and gaps [14]. A typical data mining task in a business data warehouse context is more related to information visualization.

Table: 1 Effect of extracts of ten plants species against the developmental stages of the mosquito, *Aedes aegypti*

Stages	**LC50 (ppm)**									
	Tridax procumbens	***Ricinus communis***	***Tagetes erecta***	***Lantana camara***	***Ageratum conyzoides***	***Annona squamosa***	***Pongamia pinnata***	***Vitex negundo***	***Acorus calamus***	***Casearia esculenta***
Egg	50.46	72.27	25.74	82.53	82.73	38.49	72.65	88.46	58.94	39.83
I Instar	4.57	18.68	4.15	19.65	24.17	3.38	22.38	16.18	7.86	7.35
II Instar	7.25	31.19	4.93	26.16	31.54	7.24	26.73	24.27	23.84	15.54
III Instar	7.93	35.18	10.21	38.46	47.28	10.21	36.87	29.16	32.37	23.76
IV Instar	25.26	47.05	23.22	43.64	61.47	18.28	48.35	43.64	32.43	41.09
Pupa	29.18	82.43	48.17	83.56	82.25	29.18	78.94	83.56	53.59	51.45

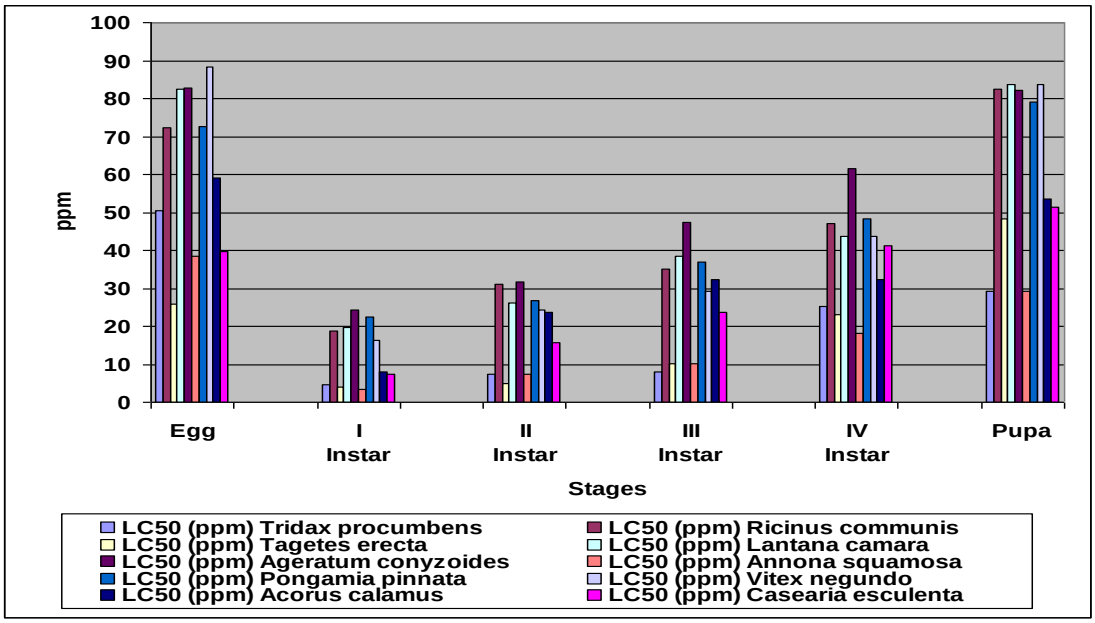

Fig 1. Effect of extracts of ten plants species against the developmental stages of the mosquito, *Aedes aegypti*

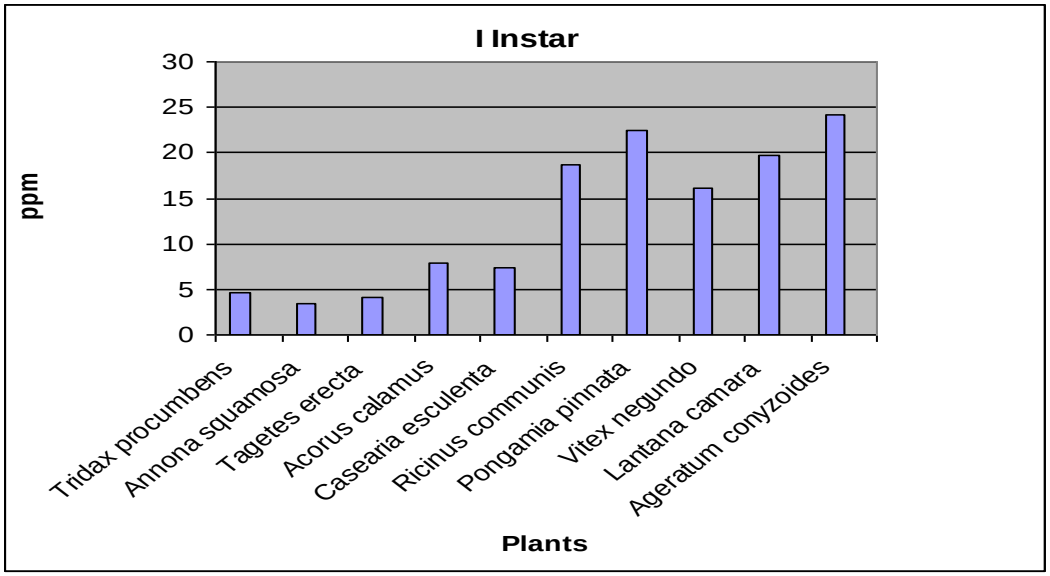

Fig 2. Records with lowest ppm which shows highest mortality rate among 10 plants. (plant wise)

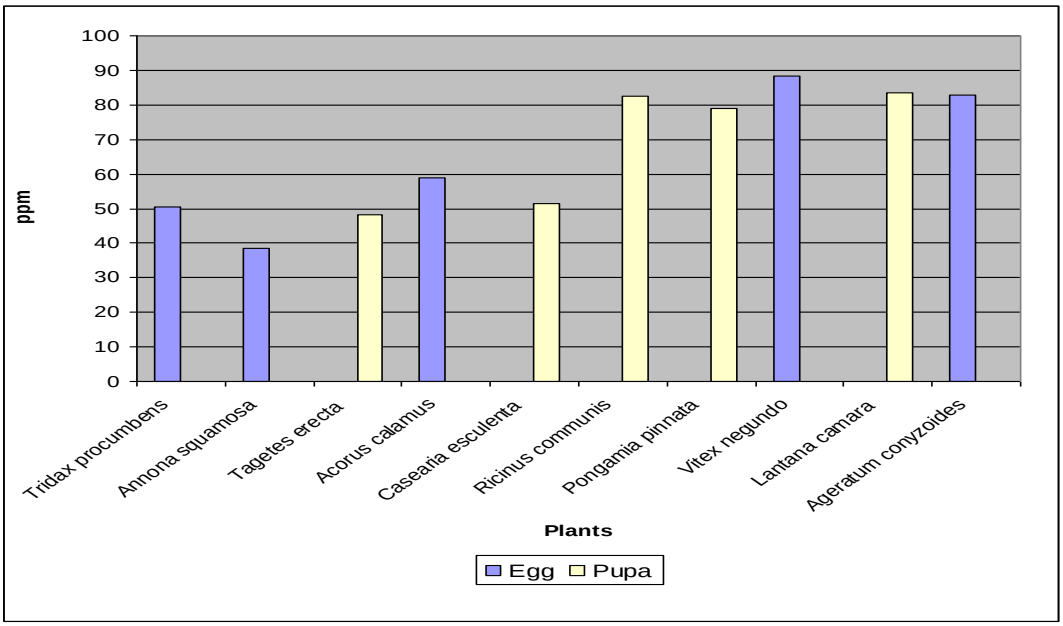

Fig 3. Records with highest ppm which shows highest mortality rate among 10 plants. (plant wise)

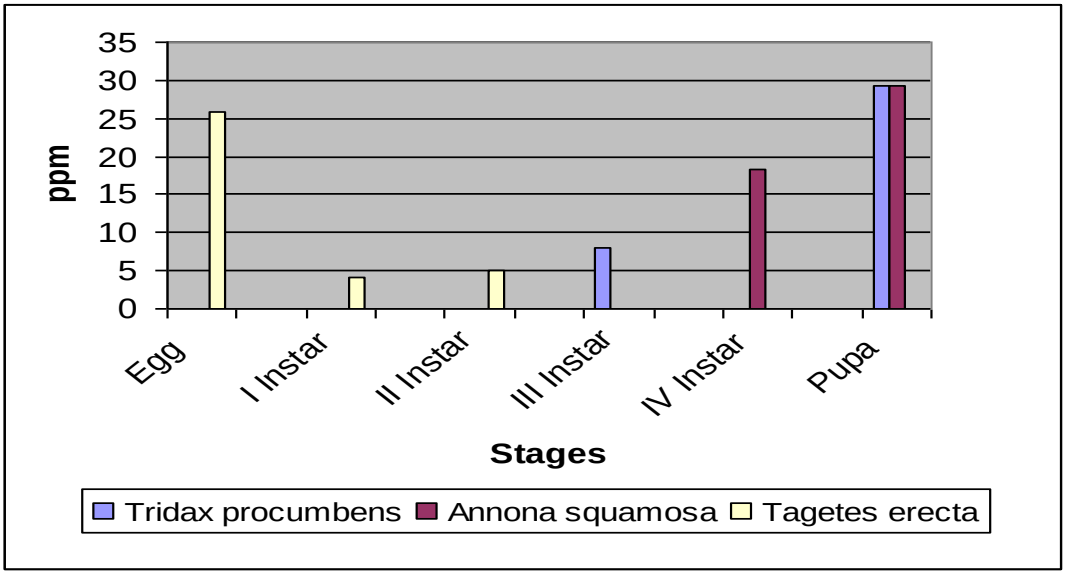

Fig 4.Records with lowest ppm which shows highest mortality rate among 10 plants. (stage wise)

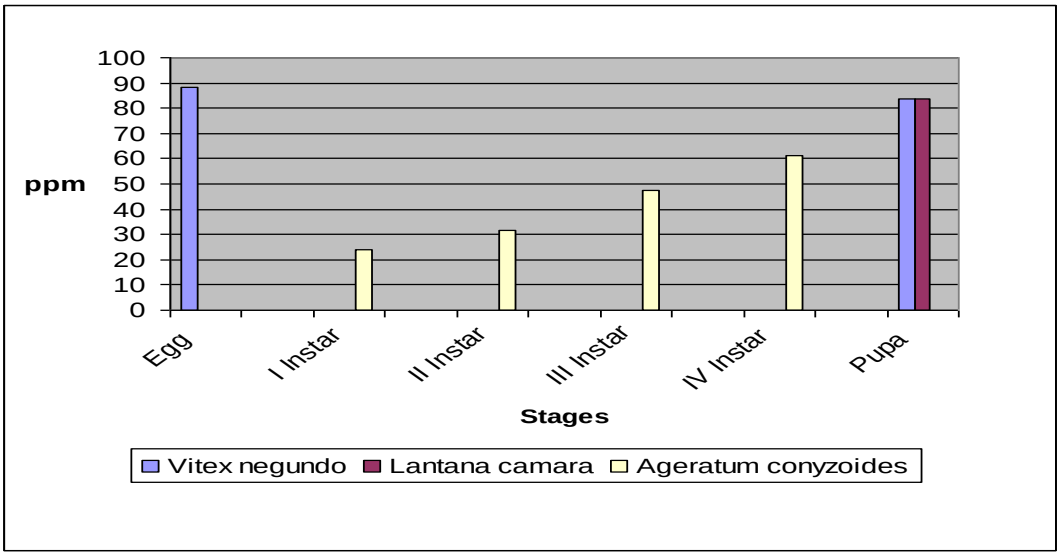

Fig 5. Records with highest ppm which shows highest mortality rate among 10 plants. (stage wise)

By looking at these graphs the viewer is in many ways looking at all of the data in the database for a particular predictor or data column. By looking at the graph it is also possible to build an intuition about other important factors. Such as the mortality rate with maximum and minimum ppm.

V. CONCLUSION

Data mining and bioinformatics are fast growing research area today. It is important to examine what are the important research issues in life science and develop new data mining methods for scalable and effective analysis. Data Mining deals with discovering hidden knowledge, unexpected patterns. It is currently regarded as the key element of a much more involved process called knowledge discovery. This paper aims to provide essential insights and guidelines to help you make the right decisions. Thus the visualization techniques can help us by giving a feeling for the structure of data set. Hence it is a better way to explore data set.

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