

Innovative Farming

-An International Journal of Agriculture

ARTHROPODS: THE NEW ALTERNATIVE MEDICINE FOR 21st CENTURY

<u>Mini</u> <u>Review</u> <u>Article</u>

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ABSTRACT

KEY WORDS

Arthropod, Medicinal property, Therapy, Beneficial

ARTICLE INFO Received on: 29.05.2016 Revised on: 06.07.2016 Accepted on: 08.07.2016

Insects are the largest and dominant group of living organisms due to its ability of adaptiveness to the ever changing ecological conditions. Besides their harmful effects as pests, insects have also contributed to the mankind through their beneficial uses. Insect resources have been used by human beings for a long time now, as food, medicine and chemical material also. Insects with their medicinal properties and their products can be used to treat many different diseases either directly or indirectly. Many species of insects have played important role in mysticism and magic inherent in many traditions as well as in the treatment of variety of illness. They also impart an important role in tribal therapies and thus paying the way towards modern therapies too. Modern scientific use of insects in medicine consists of Maggot Therapy, Apitherapy, Leech Therapy (Non Insect), Blister Beetle and Spanish Fly, Ant sutures, Psychoactive Scorpions (Non Insect), insect enzymes as medicine. Venomes present in bees, ants and wasps comprise of mixture of potential compounds such as melittin, apamine, mast cell degranulation peptide (MCD), the active amines histamine, serotonin. Presence of this molecule in honey have enabled it for treating a range of ailments from arthritis, skin diseases, multiple sclerosis, cancer, infections and pain. Thus, traditional knowledge coupled with identifying more and more such useful insects related to therapeutic and other medicinal uses to device strategies to preserve and tap the rich knowledge in a more sustainable way for benefit of mankind.

Introduction

Arthropods are the largest group of living organisms. It has been estimated that more than one million species of insects have been described, comprising about 70% of all organisms (Gullan and Cranston, 2005). Since ancient times in Mexico, China, India and in so many countries, many species of insects along with a large number of plant species have been recognized as processing curative properties. They are termed as "medicinal insects" (De Asis, 1982; Meza, 1979; Sahagun, 1980). Many species have played important role in mysticism and magic inherent in many cultures as well as in the treatment of variety of illness. For their healing art, medicinal insects and their uses has persisted in many rural areas today. These medicinal insects are said to be useful as diuretics, analgesics, anaesthetics, aphrodiasiacs. In South Korea, 17 insect species and their products are widely used for ailments like gonorrhoea, hearing problems, diabetes, impotence, lung disease, stroke and arthritis.(Pemberton, 1999). In China, presently about 140 sp of medicinal insects have been identified and even mass generated for production of medicine. (Tyagi, 2003) 11 sp of insects used as medicine to cure various ailments in Tamilnadu was reported (Ranjith singh *et al.*, 2004). Many larvae are crushed live, or extracts or eaten roasted or tonics for various diseases.

Ethnoentomology

The word derives from 'Ethno'-study of people; 'Entomology' – study of insects. The study of the relationship between insects and people. The focus of ethnoentomology is how insects have been or are being used in human societies around the world. It includes insects used for food, rituals and medicine.

Importance of studying the medicinal insects

Insects have proven as sources of drugs for modern medicine since they have immunological, analgesic, antibacterial, diuretic, anesthetic and anti rheumatic properties. Insect by-products are also very important both as folk medicines and potential modern drugs. It has no side effects and also no resistance problem was found for any diseases. The medicinal use of insects can be a main source for future discovery of new drugs for preparation of medical services and drugs or as a model system in genetic studies.

- Entomotharapy can be studied under two ways
- 1. Traditional and historical use of insects in Medicine

2. Modern or scientific use of insects in Medicine.

There are some medicinal insects listed in below based on their uses.

ARTHROPODS	PARTS USED AS MEDICINE
1. Honeybee,Lac and Scale insects	1.Live for therapy 2. Products as medicine
2.Cockroach	1.Products and as live
3.Centipedes	1.Whole insects, and products
4.Earwig	1.Products from insect body
5.Blister beetle	1.Products from insects
6.Tree ant, African Black Ant	1.Ant hill and extracts
7.Mole cricket	1.Products
8.Silkworm	1.Extracts of larvae and silk
9.Blowflies	1.Live insects
10.Drosophilla	1.Live and as model
11.Grasshopper	1.Live insects
12.Jatropha leafminer	1.Live smashes of larvae
13.Cicada	1.Extracts and broth
14.Termites	1.Live insects and their termitorium

Honey bee and it's potential

Honey is a sweet liquid made by bees using nectar from flowers. Bees first convert the nectar into honey by a process of regurgitation and evaporation, then store it as primary food source in wax honeycombs inside beehives. Benefits of consuming honey have been documented in early Greek, Roman, Vedic and Islamic texts. Healing qualities of honeyhave been referred by philosophers and scientists all the way back to ancient times, such as Aristotle (384-322 BC) and Aristoxenous (320 BC). Recent researches confirms that bee products promote healthy immune system, improve circulation, decrease inflammation, making them appropriate for use with patients suffering everything from migraine headaches to erectile dysfunction. One tablespoon of honey (21 gm approx) contains 64 calories,17.3 gm carbohydrate,0gm fat, 0gm protein (USDA Nutrient database). It also comprise of glucose, fructose and minerals such as irons, Ca, Phosphate, Sodium chloride, Potassium, Magnesium.

Apitherapy

Apitherapy is the medical use of honeybee and bee products such as honey, pollen, propolis, royal jelly and bee venom against disease and disorders

Benefits of Honey

• Preventing gastroesophageal reflux.

- Shortens the duration of bacterial Diarrhea in infants and young childrens.
- Able to help heal burns.
- Minimizes seasonal allergies. Also beats cough medicine.
- High cholesterol, Poor circulation.
- Heals wounds and scars
- Prevent inflammation of ovaries and Fallopian tubes.
- Prevent HIV. (Washington university school of medicine report, 2013)

Other constituents of honey and their uses Bees wax

- Contains Vitamin A
- Cell development & skin epithelium antiseptic property
- Body lotions, coating for pills-facilitates ingestion

Pollen

- Contains vitamins (A, B1, B2, B6, C, E), amino acids, and Ca, Fe, K, P, and Na.
- Skin diseases, health restorative, ulcers etc.

Royal Jelly

• Used to treat anemia, gastrointestinal ulcers, arteriosclerosis, hypo- and hypertension, and inhibition of sexual limitations.

• Cell regeneration & bone marrow production and balance the endocrine system.

Use of Propolis

- For fighting infections.
- Boosting the immune system.
- Healing genital herpes and cold sores.
- Helping the mouth heal after dental surgery.
- As a treatment for allergies as an antioxidant.
- In cancer treatment and cancer prevention.
- Most importantly prevent hair fall and stimulate new growth
- Useful for arthritis, measles in eyes and gastric ulcers.(Banerjee et al. 2003)

Bee used as therapy

It also termed as Apipuncture. Bee therapy is useful in arthrosis and arthritis, inflammation of blood vessels, asthma and allergies, urticana, psoriasis, wounds and scars, inflammation of ovaries and fallopian tubes, addiction. Apipuncture is the therapy by means of bee sting. One of the major peptides in bee venom, called <u>Mellitin</u>. Mellitin used to treat inflammation in sufferers of rheumatoid arthritis and multiple sclerosis. It blocks the expression of inflammatory genes, thus reducing swelling and pain. It is administered by direct insect sting or intramuscular injections.

Lac and it's use in medicine

LAC / SELLAC : Laccifer lacca.

Family: Coccidae

Lac is the scarlet resinous secretion of a number of species of lac insect, of which the most commonly cultivated species is *Kerria lacca*.

Medical use

- Used in folk medicine as a hepatoprotective and anti-obesity drug.
- Dentists used shellac as binding agents for dentures, restorations and mouldings as a constituent in "artificial calculus" for training purposes in dental work.
- Also used as an ingredient in <u>hair spray</u>.
- Used against <u>mushroom toxin</u> in mice.
- Used for medications for skin allergies.

Products from scale insects - Carmine

The pigment is produced from scale insects._It is also called crimson lake, cochineal, natural red 4. It is a pigment of a bright-red color obtained content carminic acid

Medical use

- As a food dye in many products such as juices, ice cream, yogurt, and candy for good digestion.
- Prevent skin disorder when applied.
- Also used in cosmetic products like eye shadow and lipstick

Grasshoppers as medicine purposes

- The CNS of them are very closely resembles humans, so they are used for trials before human for many psycho-active drugs tests.
- They are also used as pain relievers, especially for migraines or violent headache.
- The South Indian tribes roast the winged stage of termite in earthen pot and consume as medicine for remedial measure to treat asthma. (Wisland *et al.*, 2007)

Jatropha leaf miner

Jatropha Leaf Miner are harvested, boiled, and mashed into a paste - induce lactation, reduce fever and sooth gastrointestinal tracts (Anonymous, 2013)

Silworm extracts

Extracts are traditionally equivalent to tylenol"-the universal pain reliever dietary supplements for patients with heart disease. The silkworm (*Bombyx mori*) immatures and boiled pupae were eaten to treat apoplexy, bronchitis, pneumonia, convulsions, hemorrhages, and frequent urination. (Annetty turk, 2012). Antibiotic loaded silk hydrogels are used for prevention and treatment of infection (Prichard *et al.*, 2012). Silk protein matrices are useful for making thermostabilisation of vaccines (Sheng *et al.*, 2013). Electrically stimulated silk films used for enhancement of neural growth (Hronik-Tupaj *et al.*, 2013)

Centipedes having useful toxins

It contains 2 toxic ingredients that resembles bee venom histamine like substances and haemolytic protein. It is effective against esophagal cancer skin cancer, nasopharyngeal cancer, cervical cancer, liver cancer. It is helpful for dissipating toxins and wash away free radicals and used by herbalists. A large number of clinical cases shows that the pairing of centipede and scorpion is good for health treatment of hemiplegic paralysis caused by stroke. Centipede powder capsule can be used in treatment of intractable migraine.

Cicada and their use

Used for treatment of fever and associated seizures, Skin rashes, such as eye disorders as conjunctivitis, and blurred vision. Due to antipyretic effect, they are used to treat high fever, associated with common cold or influenza. Western news media reported in April 2003 that Chinese were using combination of cicada and Silkworm droppings to treat the fever associated with SARs. (SEVERE ACUTE RESPIRATORY SYNDROME). Very effective in relieving itchy rashes or skin eruption that occur in early stages of measles and chicken pox. Used to treat hearing problems in korea as folk medicine.

Termites

Two novel antimicrobial peptides, "termicin", "spinigrerin" from *P. spiniger having*cysteine rich antifungal peptide, having antimicrobial properties.

(Lamberty *et al.* 2001) Ayurveda practioners apply a compound of termite sandand mustard oil around the patient thigh for curing "OORU STHAMBAM" disease. Winged termite and the tarmitorium is used for ulcer, better health, body pain, rheumatics, anemia from peoples of kerala. The South Indian tribes roast the winged stage of termite in earthen pot and consume as medicine for remedial measure to treat asthma and as a cheap source of animal protein. (Wisland *et al.*, 2005)

Insects are also useful for aging research

Insects used in aging research are:

- Fruit fly (Drosophilla melanogaster)
- Ant (Formicidae)
- Wasp (Hymenoptera)
- Bees (Apis)

Drosophilla can be used as a model in aging research because:

- It shares many of the same gene as human.
- Life cycle is so short.
- Similar brain process.
- Genome fully sequenced.
- Ease of culture.

Thus an ideal organism to study aging as the gene that regulate a fly's lifespan have been found to closely parallel to those in human.

Earwig,cockroaches and mole crickets

Elizabethan doctors used powdered earwigs mixed with rabbit urine as deafness remedies. They are thought to cure stokes, tetanus and indigestion. Powdered cockroaches are sold as a cure of pleurisy and pericarditis. They were often placed into jars beside the bed of measles suffers and it is claimed that when cockroaches died, the illness would be transferred from sick child to the insects (Donley, 2014). Paste of Mole crickets (*Gryllotalpa gryllotalpa*) is spread over the affected area for sprains.

Ants and their venoms

The ant venom is capable to cure arthritis without any allergic and even any mild side effects. Genuinely skilled herbalists mix ant extract with ginseng and other mild stimulants that reinforce the action of vasodilators in China and Africa. The extract of these insects are used in herbal medicine. Some tree ants (Neyyurumbu) hills are used for curing scabies disease in kerala,India.(Wisland *et al.*, 2007)

Ant sutures can be used for stitching of wounds

Species used for that are *Dorylus grobodoi* and *E. Burchelli*. The larger breeds of ants have soldiers with very large pincers. The ants were held over edges of the wounds. When the pincers were clumped tight,the thorax and abdomen would be pinched off leav ing behind the head with the wounds closed at that point. Practice Started In India During 3000BC first and then spreaded (Shawn Donley, 2014). They secrete cantharidan,a powerful protein blocker in human body, thus among immunologists, it is highly valued as it prevent viral infection and prevent viral reproduction.

Blister beetle and it's utility

Cantharidin - A defensive chemical produced by blister beetles to ward off predator attacks by reflex bleeding. Beetles contain up to 1% cantharidin by weight. This was accepted by the <u>FDA</u> in 2004 as treatment for warts, skin problems. Inhibit ovarian cancer cell, urogenital tract and kidney infections and act as sex stimulant. Discoveries found that cantharidan reacts with "hostile cells" (a genetic material) and therefore useful in treatment of cancerous tumors most resistant to radiation and chemotherapy.

Blow flies and their uses

They are the first to colonise dead bodies, they generally start their colonies within hours. After a person's decease and develop on decaying flesh. Useful for finding of PMI. (POST MORTEM INTERVAL). Used against diabetic foot wound healing, Bed sores, leg ulcers in USA, Israel, Europe. In 1931, at John Hopkins, Professor William Baer published properly about the scientific study of maggots first in wound care.

Mechanism

In this therapy live, disinfected fly larvae introduced into non-healing or soft tissue wounds of a human or other animal for the purpose of selectively cleaning out only the necrotic tissue within a wound in order to promote wound healing.

Production procedure

Eggs are surface sterilized and placed on a food source (horse meat normally). 2 day old larvae inoculated into wound larvae flushed out with saline in 3 or 4 days and younger larvae added as necessary.

History

The U.S. FDA allowed the production of *Phaenicia sericata* larvae. Marketed under the brand name Medical Maggots (TM). In February, 2006, the British National Health Service (NHS) permitted doctors to prescribe maggot. First maggot therapy was used in World war I for the wound repairing of soldiers in battle field. The use of *L.sericata* larvae are leagalised to prescribe officially by U.S Food and Drug.

Details of maggot therapy Mechanism

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Species used in maggot therapies are

Family Calliphoridae - the BLOW FLIES Family Sarcophagidae - the FLESH FLIES The commonly found/used species - *Phormia regina*, *Lucillia sericata*

Maggot therapy can be divided into 3 processes.

1) debridement of wound (Chambers *et al.*, 2003)

2)wound healing (Bexfield *et al.*, 2010)

3) disinfection of wounds. (Andersen et al., 2010)

Insect anticoagulants and enzymes are another aspect in medicinal industry

The anticoagulants in salivary glands of blood sucking ticks and Hemipteran, Dipteran, Siphonapteran and Anopluran have tremendous potential for development of new anticoagulants and immune modulating medicines. Extracts of salivary glands of horse flies have been used for centuries in Eastern medicine as anticlotting agents. In leeches, recombinant derivatives of hirudin have been made available commecially in Europe and the USA.

Serrapeptase

It is an enzyme produced by serratia bacteria living on silkworms. Used in treating arterial plaque, migraine, back pain, sore throat, asthama etc.

Mechanism

Breaks down the insoluble protein 'fibrinogen' (glycoprotein helps in formation of blood clots). Inhibiting the release of pain-inducing.

Leech therapy

Hirudotherapy is a medical treatment that uses leeches. It is discovered by J. B. Haycraft in 1884. Approved as a medical therapy by the U.S. Food and Drug Administration (FDA). At first, leeches were used for headache, gangrene and imbalances of the blood flow.

Today used Effectively for

- Reddness and Swelling (inflammation).
- Improving blood circulation.
- Venous obstruction & in plastic surgery.(Graetz *et al.*, 2011)

Procedure and dose of this therapy

Used for conditions where blood clots is a problem. Leeches secrete a natural blood thinner (Hirudin) that

helps keep the blood flowing and improves survival of the tissue. It injects an anti-clotting chemical that can keep blood leaking from the wound for hours.

Dosing

For skin grafts and similar conditions: 2-5 leeches are applied until they fall off after about 15-20 minutes. The process is then repeated if area is large. In Afghanistan and India people used to smoke dried scorpions or use scorpion stings to get high when heroin is not available.

Psycoactive scorpion (non-insect)

The 'scorpion sting craze' increased in India due to decreasing availability of drugs and alcohol to youth.

USE

Venom used for preparation of Cancer medicine. For preparation medicine for alcohol addict person. Evidence of use for preparation of anesthesia.

Venom Ingredients:

Buthotoxin (Katsutoxin), Hydroxylamin, Lecithin, Cholesterol, Stearinsaure, Palmitinsaure, Trimethylamin, Betain, Taurin

Conclusion

Our world is gifted with a rich faunal diversity. Exploring more possibilities and feasibility of Ethnoentomology is the need of the hour. Popularisation of this field is of atmost importantce all around the globe. In India, motivation and facilities must be provided to scientists to study and work on ethnoentomology. Instead of killing lots of insects regularly, it is better to collect, use and explore them in medicinal researches. With more people joining the field, will lead to more development paving the way for further research. So by using modern scientific techniques with the cooperation of traditional claims would probably go a long way leading to the discovery of more new drugs from insects.

References

- Andersen A.S, D. Sandvang, K.M. Schnorr. 2010. A novel approach to the antimicrobial activity of maggot debridement therapy. *Journal of Antimicrobial Chemotherapy*, **65**(8): 1646–1654.
- Anonymous. 2013. Insects Used as Medicine Around the World.www.livingrichlyonabudget.com.
- Banerjee, P., K.N. Sahoo, T.K. Biswas, S.K. Basu, J. Chatterjee, A.K. Hui, N.C. Chakrarborthy and P.K. Debnath. 2003. Bees make medicine for mankind. *Indian journal Traditional Knowledge*, 2: 22-26.
- **Bexfield, A.E., C. Bond, Morgan. 2010.** Amino acid derivatives from *Lucilia sericata* excretions/secretions may contribute to the beneficial effects of maggot therapy via increased

angiogenesis. *British Journal of Dermatology*, **162**(3): 554–562.

- Chambers, L., S. Woodrow, A.P. Brown. 2003. Degradation of extracellular matrix components by defined proteinases from the greenbottle larva *Lucilia sericata* used for the clinical debridement of non-healing wounds. *British Journal of Dermatology*, **148**(1):14–23.
- Cherniack, E.P. 2010. Bugs as drugs, part 1: insects. The "new"alternative medicine for the 21st century? *Alternative Medicine Review*, **15**(2): 124–135.
- Dra Julietia, Ramos Elorduy De Conconi. 1988. The utilization of insects in the empirical medicine of ancient. *Mexicans J. Elhnobiol.*, 8(2): 195-202.
- Graetz, T.J., B.R. Tellor, J.R. Smith and M.S. Avidan. 2011. Desirudin: a review of the pharmacology and clinical application for the prevention of deep vein thrombosis. *Expert Review of Cardiovascular Therapy*, 9(9): 1101– 1109.
- Gullan, P.J. and P.S. Cranston. 2005. The insects: an outline of entomology. Blackwell publishing Ltd, Oxford.
- Hronik-Tupaj, M., W.K. Raja, M. Tang-Schomer, F.G. Omenetto and D.L. Kaplan. 2013. Neural responses to electrical stimulation on patterned silk films. *Journal of Biomedical Materials Research A*, 101(9): 2559–2572.
- Meza, C. 1979. La Utilization de los insectos en la farmacopea Mexicana Tesis Prof.Fac.de Ciencias UNAM. pp. 67.
- Numata, K.B., H.A. Subhramaniam, A. Currie and D.L. Kaplan. 2010. Gene delivery mediated by recombinant silk proteins containing cationic and cell binding motifs. *Journal of Controlled Release*, 146(1): 136-143.
- Paul, E., M.D. Cerniack. 2010. Bugs as drugs, Part 1:Insects,The "New" alternative Medicine for the

21st Century. *Atlernative Medicine Review*, **15**(2): 124-135.

- **Pemberton, R.W. 1999.** Insects and other arthropods used as drugs used as drugs in korean traditional medicine. Journal Ethnopharmacology, 65(3): 207-216.
- Ratcliffe, N.A., C.B. Mello, E.S. Garcia, T.M. Butt, and P. Azambuja. 2011. Insect natural products and processes: newtreatments for human disease. *Insect Biochemistry and Molecular Biology*, 41(10): 747–769.
- Singh, R. and C. Padmalatha. 2004. Ethnoentomological practices in Tirunelveli district, Indian Journal of Traditional Knowledge, 3: 442-446.
- Tyagi, B.K. 2003. A handbook of medically important insects and other arthropods. Scientific Publishers,India,Jodhpur), pp. 269.
- Wilsanand, V.P. Varghese and P. Rajitha. 2007. Therapeutics of insects and insect products in South Indian traditional medicine. *Indian Journal of Traditional Knowledge*, **6**(4): 563-568.

http://www.ncbi.nlm.nih.gov/pubmed/20806997

en.wikipedia.org/wiki/Ethnoentomology

www.youtube.com

www.altmedrev.com/publications/15/2/124

www.entomon.net/use-of-insects-in-medicine-

<u>agriculture.shtmlhttp://www.amazingleeches.com</u> /leeches-in-non-surgical-

therapy.htmlhttp://darkshadowghosttours.blogspo t.in/2014/08/using-insects-for-medical-

healing.html

http://honey_ Health Benefits and Uses In Medicine -Medical News Today.html

How to cite this article?

Pritha Ghosh and N.S. Satpute. 2016. Arthropods: the new alternative medicine for 21^{st} century. *Innovative Farming*, **1**(3): 79-84.