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Entomotherapy- a renewed healing technique

Penuballi Swathi* and Haseena Bhaskar
Department of Agricultural Entomology,
College of Agriculture, Kerala Agricultural University, Thrissur-680656, India
****Corresponding author: swathipenuballi108@gmail*.com**

Healing of human ailments by using medicines prepared from different insects or insect derived by products is called as Entomotherapy. The ancient Mayan, Egyptian and Brazilian societies have long since understood the powerful biochemical properties of insects. In traditional medicine, different insects are used as live, cooked, ground, in infusions, in plasters and as ointments, both in curative and preventive medicines (Shrivastava and Prakash, 2015).

The discovery of antimicrobial peptides (AMP's) in insects and animals during 1980's, has led to the development of promising alternative sources of today's antibiotics (Nguyen *et al*., 2011). The anticancer, antimicrobial and antiviral properties of peptides isolated from insects have been widely documented (Chernysh *et al*., 2002). Nearly 64 different arthropod species from 14 orders are used medicinally across five continents. Lepidoptera, Coleoptera, Orthoptera, Hemiptera, Hymenoptera and Diptera feature most prominently in entomotherapy in human therapeutic practices. Insects can be either directly used as live insects in human treatments or indirectly as their products.

Live, medical grade fly larvae of the blowfly, *Lucilia sericata* are used in maggot debridement therapy (MDT) for fast and effective treatment of non-healing wounds. Maggots remove dead or decaying tissue, their secretions promote faster wound healing and reduce spread of infection through blood. Recently lucifensin, a novel larval defensin isolated from *Lucilia sericata* (Calliphoridae) has been identified as one of the antibacterial agents of medicinal maggots involved in MDT. The maggots can be applied on wound surface either by directly releasing onto the wound and then retaining within a special dressing system, or as biobag dressing, where the maggots are sealed within a dressing of finely woven net pouch containing foam (Pickles and Pritchard, 2017).

Insect products in human medicine are honey bee products such as honey, propolis, royal jelly and bee venom (apitherapy) as well as cantharidin, venom, silk and anticoagulants. Honey is a powerful antimicrobial agent with a wide range of effects. Many commercial firms have registered medical grade honey by enhancing certain antibacterial components like hydrogen peroxide and methyl glyoxyl contents. Two popular sources of medical

grade honey commercially exploited around the world are Manuka honey and Revamil honey. Propolis is proven to be a safe immune-stimulant and a potent vaccine adjuvant, as it induces an earlier immune response and provides a longer protection period. Royal jelly has a hepatoprotective effect by stimulating liver tissue regeneration. The antimicrobial, antiviral, anti-inflammatory and anti-cancer activity of bee venom may be attributed to its main component, melittin.

Fig. 1. Applying maggots on the wound surface

(Source: https://www.sciencephoto.com/contributor/lmu/)

Cantharidin, a terpenoid extracted from the blister beetles, *Mylabris cichorii* and *Epicauta hirticornis* acts as a vesicant (Moed *et al.,* 2001). Huan *et al*. (2012) reported that cantharidin promotes secondary necrosis and COX-2 over-expression in human bladder carcinoma cells and stimulate cystitis through c-Fos and COX-2 overexpression in rat. Recently, analogues of solenopsin, an alkaloid present in the venom of fire ants of the genus *Solenopsis* have been explored for the treatment of human psoriasis.

Silk fibroin hydrogels developed from the silk proteins of Bombycidae and Saturniidae prevents infection during wound healing process (Nguyen *et al.,* 2011). Blood sucking arthropod saliva possess wide range of bioactive compounds with therapeutic qualities. The most potent vasodilator known to science, maxidilian was found in the saliva of biting sand flies. The salivary anticoagulant, anopheline isolated from *Anopheles* sp. possess distinct thrombin inhibition mechanism which has implications for the design of novel anti thrombotics to combat immune response during organ transplantation (Figueiredo *et al.,* 2012)

Fig. 2. Blister beetle (family: Meloidae)

(Source: https://www.thailandnatureproject.com/mylabris-cichorii)

Insects provide inexhaustible resources for pharmacological research, representing a feasible substitution to many medicinal drugs. Hence it is imperative that insect diversity be conserved so as to identify new sources of pharmacological exploration in the coming years.

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