Green Chemistry -

A major challenge of agriculture is pest and fungal control safely for humans, pest, fish and beneficial insects. In current agricultural practices, the control of pests is often accomplished by means of the excessive use of agrochemicals, which can result in environmental pollution and the development of resistant pests. In this context, PreVasive's BigShot series of bio-pesticides and fungicides offer a better alternative to synthetic pesticides, enabling safer control of pest populations.

Attention is increasingly being paid to the use of natural compounds (such as essential oils) as a promising option to replace agrochemicals in agricultural pest control. These odoriferous substances are extracted from various aromatic plants, which are rich sources of biologically active secondary metabolites such as alkaloids, phenolics, and terpenoids (Esmaeili and Asgari, 2015), using extraction methods employing aqueous or organic solvents, or steam distillation. Their mechanisms of action are multi-modal, especially because the effect is due to a combination of compounds designed in nature by the plants (de Oliveira, 2011; Esmaeili and Asgari, 2015).

The oils extracted for BigShot Maxim EOS from organically cultivated (Thymus vulgaris L.) thyme oil, Cymbopogon, variously known as lemongrass, including geraniol, borneol and citronellol and contain several hundred additional secondary metabolites used by the plant for defense.

These natural organic plant oils contain at least 150 biologically active compounds. Among them, the major constituents are triterpenes known as limonoids. Other components present include meliantriol, nimbin, nimbidin, nimbinin, nimbolides, fatty acids (oleic, stearic, and palmitic), and salannin.
Among the botanical insecticides currently marketed the oils in PreVasive pest and mosquito control products are non-toxic to humans and shows very low toxicity to beneficial organisms, and is therefore, effective for the control of many pests. Target insect species include the following: family Culicidae, Aedes sanadensis , aedes aegypti, Aedes albopictus, Culex genera Culiseta genera, Culiseta genera, Psorophora genera , Aedes sanadensis, Aedes sollicitans, Aedes vexans, Anopheles – A genus of mosquitoes with more than 430 species – Anopheles stephensi (Lucantoni et al., 2006), A. culicifacies (Chandramohan et al., 2016), Ceraeochrysa claveri (Scudeler et al., 2013, 2014; Scudeler and dos Santos, 2013), Cnaphalocrocis medinalis (Senthil Nathan et al., 2006), Diaphorina citri (Weathersbee and McKenzie, 2005), Helicoverpa armigera (Ahmad et al., 2015), Mamestra brassicae (Seljåsen and Meadow, 2006), Nilaparvata lugens Stal (Senthil-Nathan et al., 2009), Pieris brassicae (Hasan and Shafiq Ansari, 2011), and Spodoptera frugiperda (Tavares et al., 2010). Arachnid targets include Hyalomma anatolicum excavatum (Abdel-Shafy and Zayed, 2002) and Sarcoptes scabie var. cuniculi larvae (Xu et al., 2010).

These oils are considered contact insecticides, presenting systemic and translaminar activity (Cox, 2002). They have broad spectrums of action, inhibiting feeding, affecting hormone function in juvenile stages, reducing ecdysone, deregulating growth, altering development and reproduction, suppressing fertility, sterilizing, repelling oviposition, and disrupting molting processes, feeding inhibitor and more (Brahmachari, 2004). as a feeding inhibitor, it stimulates cells involved in feeding inhibition, causing weakness and pest death (Brahmachari, 2004).

The limonoids present in the oils inhibit ecdysone 20-monooxygenase, the enzyme responsible for catalyzing the final step in conversion of ecdysone to the active hormone, 20-hydroxyecdysone, which controls the insect metamorphosis process. However, these effects are probably secondary to the action in blocking microtubule formation in actively dividing cells (Morgan, 2009). Moreover, the oils can inhibit the release of prothoracicotropic hormone and allatotropins from the brain-corpus cardiacum complex, resulting in problems of fertility and fecundity (Mulla and Su, 1999). Meliantriol and salannin also act to inhibit the feeding of insects, while nimbin and nimbidin mainly present antiviral activity (EMBRAPA, 2008). The limonoids also interfere in mitosis, in the same way as colchicine, and has direct histopathological effects on insect gut epithelial cells, muscles, and fatty tissues,

resulting in restricted movement and decreased flight activity (Wilps et al., 1992; Mordue (Luntz) and Blackwell, 1993; Qiao et al., 2014).

Several studies have described the action of the BigShot EOs in specific groups of insects. Among the major insect groups, which has shown action against (i) Lepidoptera: antifeeding effect and increased larvae mortality (Mancebo et al., 2002; Michereff-Filho et al., 2008; Tavares et al., 2010); (ii) Hemiptera: early death of nymphs in due to inhibition of development and ecdysis defects (Weathersbee and McKenzie, 2005; Senthil Nathan et al., 2006; Formentini et al., 2016); (iii) Hymenoptera: food intake decrease, reduced larval and pupal development, larvae death during the molting process (Li et al., 2003); (iv) Neuroptera: severe damage in the midgut cells of larvae, injury and cell death during the replacement of midgut epithelium, and changes in cocoons, with increased porosity and decreased wall thickness affecting pupation (Scudeler et al., 2013, 2014; Scudeler and dos Santos, 2013). In another class, the Arachnida, exposure of the Ixodidae group to EOs oil decreased egg hatching and caused malformation, deformities, and death of larvae and adults (Abdel-Shafy and Zayed, 2002).

Products derived from these oils contribute to sustainable development and the resolution of pest control problems in agriculture (Lokanadhan et al., 2012). These products benefit from the natural properties of EOS as a powerful insect growth regulator (IGR) that also affects many other organisms (such as nematodes and fungi) and can act as a plant fertilizer (Brahmachari, 2004). BigShot Mosquito pro and BigShot Maxim are Anti Fungal and AntiViral,

The BigShot Pests management system employs these specific plant extracts for pest management and to supply nutrients to plants Scientific research has shown that these extracts are safe for workers, with no handling risks, and can be used throughout the entire crop production cycle and as pest repellents such as mosquito Control practices as a pupacide, larvicide and adulticide with 15 to 45 day environmental residuals on surfaces.

As a biofertilizer, with the organic and inorganic compounds present in the plant material acting to improve soil quality and enhance the quality and quantity of crops.

Nitrogen is one of the main nutrients required by plants for their development, and urea is the main source of nitrogen fertilizer used worldwide to supply the nitrogen demand of crops. The control of urea hydrolysis and nitrification is one of the principal strategies employed to avoid nitrogen losses in agriculture (Ni et al., 2014). EOS a constituent of BigShot has demonstrated activity as a nitrification inhibitor, helping to slow the bacterial activity that is responsible for denitrification, hence decreasing the loss of urea from the soil (Musalia et al., 2000; Mohanty et al., 2008).

Due to their compositional complexity, Botanical oil-based products can act as antifeedants, growth regulators, sterilants, anti-oviposition agents, and repellents (Gonzalez-Coloma et al., 2013). Other factors that have stimulated the use of EO-based products for pest control in agriculture are ecological and toxicological aspects with non-toxic properties to beneficial insects, humans, pets, fish and the environment. Additionally, BigS hot contains a **plant-based** glycerin to aid in plant nutrients and provide efficacy for limited surface persistence safe and friendly to beneficial insects.