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Research Article

STUDIES ON THE IMPACT OF MEDICINAL PLANTS IN RELATION TO MALARIA VECTOR CONTROL AGAINST ANOPHELES STEPHENSI

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ABSTRACT

Objective: The present study phytochemical screening and mosquitocidal activity of three different medicinal plants, Sesamumindicum, Pungamiapinnata, and Crotonbonplandionumextracts. The methanol extract of leaf samples were used for the phytochemical analysis to find out the phytochemical constituents in the plants. The main objective of the research work was check the presence or absence of the phytochemical chemicals in all the selected medicinal plants. **Methods:** Phytochemical analysis of these plants confirm the presence of various phytochemicals like alkaloids, flavonoids, saponins, steroids, tannins, terpenoids, tri-terpenoids, anthraquinones, amino acid, phenol, glycosides, carbohydrate, protein and phytosteroids. Twenty five early third instar larvae of An. stephensiwere exposed to various concentrations (50-250ppm) and the 24 h LC50 values of the S.indicum, P. pinnata, and C.bonplandionumextract was determined by probit analysis.The repellent activity of three medicinal plant extracts at concentration of 1.0, 2.0 and 4.0 mg/cm2 tested against adult female mosquitoes. **Results:** The highest larvicidal activity of S. indicum methanol extract with LC50/LC95 values were 108.55/230.57 ppm, followed by P. pinnata were 143.59/305.52 ppm, andC. bonplandionum were 154.51/319.01 ppm, respectively. Further, maximum repellent activity of methanol extract showing 100% protection up to 160 min was tested against An. stephensi. **Conclusion:** However, much scope for further systematic research in screening Tamilnadu medicinal plants for these phytochemicals and assessing their potential in protecting against different types of mosquito diseases.

Keywords: Sesamumindicum, Pungamiapinnata, and Crotonbonplandionum, phytochemical, mosquitocidal

INTRODUCTION

Anopheles stephensi is the most important vector of malaria fever in urban district of India and other West Asian countries [1]. Malaria afflicts 36% of the world human population [2]. It's death rates among children in Africa have been decreased by an expected 58% since 2000 [3]. As per the most recent evaluations from WHO, there were 214 million new instances of malaria worldwide in 2015 and there were an expected 4, 38, 000 malaria passing [4]. These problems have pointed the need for the development of new strategies for selective mosquito control. Commonly, phytochemical are profitable due to their eco-safety, target-specificity, non development of resistance, reduced number of application, higher acceptability and suitability of rural areas. The plant-borne extract may be source of another agent for control of mosquitoes [5]. Since ancient times, people have been exploring the nature particularly plants in search of new drug [6,7]. This has resulted in the use of large number of medicinal plants with curative properties to treat various diseases [8,9]. In India, almost 95% of the prescriptions were plant based in the traditional systems of Unani, Ayurveda, Homeopathy and Siddha [10]. Plant synthesizes a wide variety of chemical compounds, which can be sorted by their chemical class, biosynthetic origin and functional groups into primary & secondary metabolites. In medicines, uses today are definitely not the same as those that were used in ancient times or even in the recent past. Several modifications, improvement, sophistication and newer discoveries have continuously contributed to the type, quality, presentation and concept of medicinal preparation. In the development of human knowledge for therapeutic use, scientists endeavored to isolate different chemical constituents from plants, subjected them to biological and pharmacological tests and then used them to prepare modern medicines[11,12]. The beneficial medicinal effects of plant materials typically result from the combinations of secondary products present in the plant. But among the 250,000 – 500,000 plant species only a small percentage has been investigated phytochemically [13].This research would be helpful to foster research aimed at the screening of phytochemical compounds and protect plant-borne mosquito activities.

MATERIAL AND METHODS

Plants assortment

Fully developed leaves of S.indicum, P.pinnataandC. Bonplandionum were collected from different areas of Nagapattinam district (11º 26'N to 11°92'N latitude and 82º 13'E to 83° 35'E longitude) in Tamil Nadu, India, and washed methodically, blotted and shade dried. It had been real by plant taxonomer from the Department of Botany, Annamalai University. Further, a voucher example is that the stored at the herbarium of plant Phytochemistry division, Department of Zoology, Annamalai University, Tamil Nadu, India.

Extraction

The leaves were washed many times with water to remove all the unwanted impurities. Then, the leaves were shade-dried at room temperature and kept in a hot air oven for 50 ºC for half an hour. After that, the material was ground by using an electric blender. 500 g of powdered plant material was packed inside a Soxhlet apparatus, and successive extraction was carried out using as solvents methanol for 72 h. The solvent was evaporated under vacuum in a rotary evaporator (Heidolph, Germany), and the dried extracts were stored at four ºC until further phytochemical analysis.

Phytochemical screening

Following the methods by Kokate[14] and Sathish Kumar [15] we screened the bioactive chemical constituents detecting the presence of secondary metabolites such as saponins,alkaloids,flavonoids, steroids, tannins, terpenoids, tri-terpenoids, anthraquinones, amino

acid, phenol, glycosides, carbohydrate, protein and phytosteroids in the different extract of S. indicum, P.pinnataand C. bonplandionum.

Larvicidal activity

Standard WHO protocol with slight modifications was adopted for the study [16]. From the stock solution, the concentration of 50 to250 ppm was prepared. Early third instar larvae were initiated in 250 ml plastic cups containing 200 ml of water with each concentration. A control was prepared by the adding of acetone to water. Mortality was evidenced after 24 hours. For each experiment, five replicates were maintained at a time. The observed percentage mortality was corrected by Abbott's Formula [17].

Repellent activity

The minutes of protection in admiration to measurement method was utilized [18]. Three-day-old blood- starved female An. stephensimosquito (100) is unbroken during a net cage (45cm × 30cm × 45cm). The volunteer had no contact with lotion, perfumes or perfumed soaps on the day of the assay. The arms of a volunteer, solely 25 cm^2 dorsal facet of the skin on every arms were exposed and therefore the remaining space lined by rubber gloves. The crude extracts were applied at 1.0, 2.0 and 4.0 mg/cm^2 singly within the exposed area of the fore arm. The time of the check enthusiastic about whether or not are the target mosquitoes day biters. An. stephensi is testing throughout the getting dark from 20:00 to 4:00. The management and treated arm were introduced at the same time into the experimental cages; the mosquitoes were activated. Every test concentration was continual five times. The volunteer conducted their check of every concentration by inserting the treated and management arm into a similar cage for one full minute for each 5 minutes. The mosquitoes that landed on the hand were recorded so agitated off before imbibing any blood; creating out a five minutes protection. The proportion of repellency was calculated by the subsequent formula.

$$\% \text{ Repellency} = [(Ta-Tb)/Ta] \times 100$$

Where Ta is the number is that the variety of mosquitoes within the management group and Tb is that the number of mosquitoes within the treated group.

Statistical analysis

Larvicidal data were subjected to probit analysis[19] to calculate the LC_{50}, LC_{90} utilizing statistical package of social science (SPSS) rendition 16.0 for Windows. The significance level was set at $P<0.05$.

RESULTS AND DISCUSSION

Phytochemical screening

The present research involved the collection, identification, extraction, phytochemical test, larvicide and ovicides actions of extracts derived from commonly occurring native plants growing in Nagapattinamdistrict in Tamilnadu. The plants species except S. indicum contain flavonoids, saponins, steroids, tannins, triterpenoids, amino acid, phenol, glycosides, and protein. P. pinnata was obtained alkaloids, saponins, steroids, tannins, anthraquinones, phenol, glycosides, protein and phytosteroids, and E. variegata was found to be alkaloids, flavonoids, saponins, steroids, tannins, triterpenoids, anthraquinones, phenol, protein and phytosteroides (Table 1).In the previous study phytochemical screening of some important medicinal plants was confirm the presence of different phytochemicals like saponins, terpenoids, steroids, anthocyaanins, coumarins, fatty acids, tannins, leucoanthocyanins and emodins.The studied bioactive compounds have a broad range of biological activity [6]. For example, phytochemicals such as saponins have anti-inflammatory effects[20]. Glycosides are known to lower blood pressure[21], and tannins exhibit antioxidant. Antimicrobial and antiviral was effects[22]. The plant extracts were alkaloids that have been reported to exert analgesic, antispasmodic and antibacterial activity[23]. Plant cells produce two types of metabolites. Primary metabolites are involved directly in growth and metabolism (carbohydrates, lipids and proteins). Most natural products are compounds derived from primary metabolites such as amino acids, carbohydrates and fatty acids and are generally categorized as secondary metabolites. Secondary metabolites are considered products of primary metabolism and are generally not involved in the metabolic activity (alkaloids, phenolics, essential oils, terpenes, sterols, flavonoids, lignins and tannins, etc.)[24].

Larvicidal activity

The investigated that, larvicidal activity of methanol, ethyl acetate, chloroform and hexane extracts from three medicinal plants, such as S. indicum, P. pinnata, and C. bonplandionum. The highest LC_{50} values were 108.55, 125.18, 150.58 and 164.63 ppm, for methanol, ethyl acetate, chloroform and hexane extracts of S. indicum against An. stephensi (Table 2). Followed by, P. pinnataextracts were 143.59, 156.73, 179.44 and 193.07 ppm, respectively (Table 3), and C. bonplandionumextracts were 154.51, 168.50, 1187.37 and 209.38 ppm, respectively (Table 4). The present investigation is comparable with some of the other reports [25, 26, 27, 28, 29]. Similarly, Baranitharanet al.[9] have been noticed that LC_{50} and LC_{90} values of 85.44 and 159.73 mg/L, from citronella component from Melissa officinaliswere tested against An. stephensi. In the same way, highest larvicidal activity (LC_{50} values) were 136.75, 140.56, 144.90 and 149.89 mg/L for Ageratinaadenophora ethyl acetate extract with I, II, III, IV instar larvae of Cx.quinquefasciatus[30]. Further, Dhanasekaranet al.[31] reported that LC_{50} values (82.86 ppm) of Gnetumula were tested for laboratory against An. stephensi.Deepaet al. [32] has been that the LC_{50} and LC_{90} values (Larvicidal activity) of Menthapiperita oil tested against Cx. quinquefasciatus were 47.16 and 92.65 ppm, followed by Citrus limon were 51.12 and 98.18 ppm, than Rosmarinusofficinalis were 55.75 and 105.57 ppm. The larvicidal activity of Gymnemasylvestre(acetone, chloroform and methanol) extracts against Cx. tritaeniorhynchus with LC_{50} values were 34.756, 31.351 and 28.577 mg/ml, respectively [33].

Repellent activity

Present results revealed that methanol extract of S. indicum showed highest repellent action up to 120, 160 and 200 minutes at 1.0, 2.0 and 4.0 mg/cm^2 against An.stephensi. Further, P. pinnata methanol extract provided complete 100% protection up to 80, 120 and 160 minutes at 1.0, 2.0 and 4.0 mg/cm^2. C. bonplandionum methanol extract, the complete protection up to 40, 80 and 120 minutes at 1.0, 2.0 and 4.0 mg/cm^2 (Fig. 1). The present results comparable with the methanol extract of Ficusracemosa, highest repellent activity was provided 100% protection up to 160 and 200 minutes at 3.0 mg/cm^2 against Ae. aegypti[34].Mukandiwaet al.[35] have been revealed that repellent was dose-dependent, with the Clausenaanisata acetone extract (15%) having 93% repellence and the hexane fraction (7.5%) 67% repellency against Ae. aegypti.Krishnappa and Elumalai[36] reported that repellent efficacy was determined against An. stephensi at two different concentrations 1.5 and 3.0 mg/cm^2 for Cassia auriculata.

CONCLUSION

The selected three medicinal plant, methanol extract are the source of the primary screening and mosquitocidal activity against An. stephensi. The medicinal plant primary screened for phytochemical constituents appeared to have the provide to act as a source of useful drugs and also to development the health status of the consumers as an outcome of the presence of various compounds that are important for good health.

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