Variation in the population distribution of two species of Tenuipalpid mites on their specific host medicinal plants

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ABSTRACT

The Tenuipalpid mites are referred to as false spider mites or flat mites and the genus Brevipalpus is recognized as the economically most important group of species of Tenuipalpidae. It is becoming increasingly evident that they are potentially serious plant pests especially with their involvement as vectors of plant viruses. The objective of the present work is to study the variation in the population distribution of two species of Tenuipalpid mites, viz. *Brevipalpus obovatus* and *Brevipalpus phoenicis* on their specific host medicinal plants. A survey was conducted on the Phytophagous Tenuipalpid mites associated with medicinally important plants, viz. *Ocimum sanctum, Ocimum gratissimum* and *Adhathoda vasica* grown in Malappuram district of Kerala during the period of September to December in the year 2011. Results of the present survey indicated that the medicinal plants *A. vasica* and *O. gratissimum* were infested by *B. phoenicis* and the *O. sanctum* was infested by *B. obovatus*. The paper discusses on the population distribution of these Tenuipalpid mites on their specific host plants through Per Leaf Counting Method. To study the population distribution the number of various life stages, viz. adults, nymphal stages and eggs were recorded. Results of the survey enabled to reveal that the distribution of mite population was high in *O. sanctum*, moderate/medium in *O. grattissimum* and low in *A. vasica*. Feeding by theses mites leads to the collapse of the inner leaf tissue, and subsequently devitalizes the plant. Damage is characterized by browning of the damaged leaf surface. Quite often, infestation of the mite leads to leaf deformation also.

Keywords: medicinal plants, phytophagous mites, per leaf counting method, *Brevipalpus obovatus*, *Brevipalpus phoenicis*

INTRODUCTION

Mites of the family Tetranychidae, Tenuipalpid and Eriophyidae constitute an important group of pests, damaging almost all economic crops. Recent studies in India have shown that Phytophagous mites became a potential threat to the medicinal plants [1,2]. Tenuipalpid mites or false spider mites are reddish in color, slow moving and not readily detected because of their small size and sluggish behavior, they are about 260 µm in length [3,4]. Two species of mites, *B. obovatus* and *B. phoenicis* are cosmopolitan and occur on many economically important plants in Asia, Africa, Australia, Europe, the Middle East, South America, and the United States [5]. *Brevipalpus* mites are found on many perennial plants and have relatively long life cycles compared with other phytophagous mite pests. These mites feed on fruit, stems, branches and leaves of plants. On the leaves they most commonly occur on lower surface near the midrib or veins [4,6]. The greatest concern with *Brevipalpus* species on the economically important plants in the world has been their association

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with the viral disease, leprosis [7]. Symptoms of leprosis have been reported to occur on fruit, leaves, shoots and large limbs. Lesions occur on both upper and lower leaf surfaces, especially along the margins. Scaly lesions called scaly bark grow on the twigs [8].

Brevipalpus mite population was primarily comprised of females and the reproduction generally occured through parthenogenesis [3]. The typical life cycle of *Brevipalpus* mite consists of four active stages (i.e., larva, protonymph, deutonymph and adult). Between each active stage is a quiescent developmental (chrysalis) stage that is sessile but physiologically active. Eggs and chrysalis stages of the mite remain attached to the leaf surfaces of the plant [9]. Eggs were elliptical, bright red in color and were sticky in nature [6]. Eggs are deposited in cracks, crevices, or other protected niches on leaf surfaces and tend to be deposited in clusters by more than one female [5]. Adults are morphologically different from the immature stages. The medicinal plants selected for the present study having many therapeutic value in the Ayurvedic treatment. The plant *A. vasica* is used as bronchodilator and antihistaminic [10]. *O. sanctum* used as antifertility, anticancer and antidiabetic [11] and *O. gratissimum* used as antibacterial and antidiabetic [12]. The present study indicates the variation in the population distribution of two species of Tenuipalpid mites on their specific host medicinal plants by recording the number of different life stages of the mites under study.

MATERIALS AND METHODS

A survey was carried out on the medicinal plants grown/cultivated in various localities, distributed in Malppuram district of Kerala during the period of September to December in the year 2011. Considering the medicinal importance and severity of Tenuipalpid mite infestation, three species of plants, viz. *A. vasica*, *O. gratissimum* and *O. sanctum* were selected for making subsequent collection of mites for the present study. The leaf samples of heavily infested leaves were collected for every 2 weeks, from randomly chosen plants. The mite infested leaf samples were kept in separate polythene bags for subsequent transportation to the laboratory. The number of different life stages, viz. egg, larva, nymphal and adults of Tenuipalpid mites on each host plant was noted by Per Leaf Counting method. The counting of eggs from the leaf surface was done by direct observation through a stemi DV_4 stereo zoom microscope. For counting movable life stages, viz. larva, nymphal and adults, the leaf samples of each plant were immersed for 5-7 min in a petriplate containing 70% alcohol solution. The leaves were slightly washed in this solution to remove the entire mite population from the leaf surface. The mites of each leaf sample in the petriplate were thoroughly examined under a stemi DV_4 stereo zoom microscope in the laboratory. The number of different life stages of mites per leaf were counted and recorded. All collected mites from specific host plants were mounted in Hoyer's medium on microscope slides for identification. Five features were considered for analysis: the number of eggs, larvae, nymphs, adult mites, and adult + nymphs. The damage symptoms induced by the feeding activity of the various life stages of the mite were thoroughly examined under the microscope and recorded.

RESULTS AND DISCUSSION

In the present study two species of Tenuipalpid mites *B. obovatus* and *B. pheonicis* were found to infesting the medicinal plants under study. The plant *O. sanctum* was infested by *B. obovatus* and *O. gartissimum* and *A. vasica* were infested by *B. pheonicis*. Results of the present study enabled to reveal that the population distribution of *B. obovatus* on *O. sanctum* was high when compared to *B. pheonicis* mites on *O. gartissimum* and *A. vasica* (Table 1). In order to study the population distribution of these two species of Tenuipalpid mites, their different life stages, viz. egg, larva, nymph, and adult were counted and recorded (Figure 1). Since total count of adults and nymphs

were important from the pest management point of view, the numbers of adult + nymph mites of Brevipalpus species under study were noted.

Table 1. Total number of mite stages recorded from their specific host plants during the period of survey.

Host plant	Mite species	Pest Mite-Life Stage Counts				
		Egg	Larva	Nymph	Adult	Adult + Nymph
O. sanctum	*B. obovatus*	673	321	1934	1627	3561
O. gartissimum	*B. pheonicis*	409	276	1315	1012	2327
A. vasica	*B. pheonicis*	113	87	826	619	1445

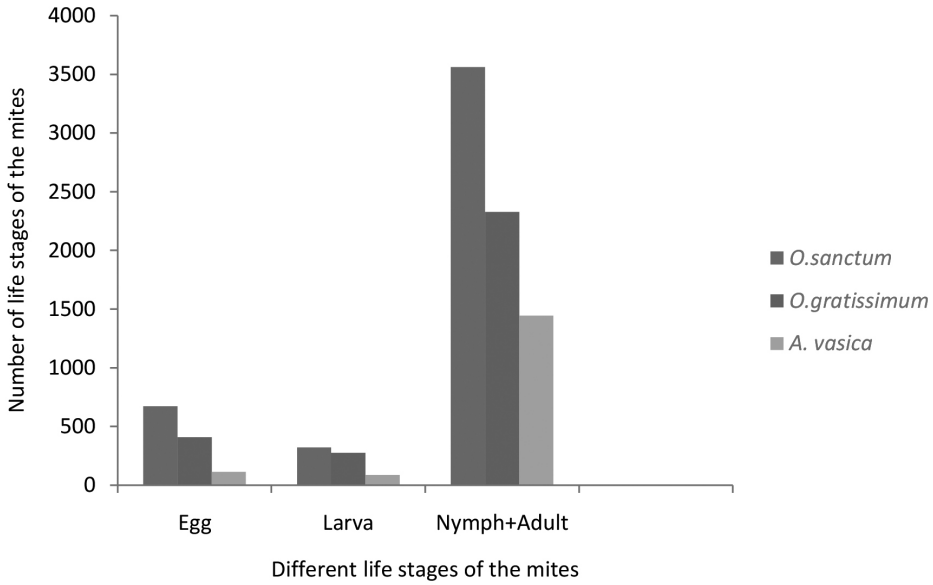

Figure 1. Total number of different life stages of the *Brevipalpus* mites on their specific host plants.

Results showed that the number of adult + nymph mites of *B. obovatus* on *O. sanctum* were high (3561) when compared to the *B. pheonicis* on *O. gartissimum* (2327) and *A. vasica* (1445) (Figure 2). By this data it was confirmed that the plant *O. sanctum* was heavily infested by the *B. obovatus*, where as the range/level of infestation on *O. gartissimum* and *A. vasica* were moderate/medium and low respectively. The plants showed symptoms of mite's presence/feeding in direct relation with the accumulation of mite stages on their host plants. Results of field studies enabled to record the infestation of *B. phoenicis* on almost all age groups of the leaves of plants under study, with preference to the middle aged leaves. The life stages of this species were mainly confined to the lower surface of leaves, closely opposed to the midrib. This observation was in support of earlier findings on the preferential distribution of mites on the leaves of other host plants [4,6]. The species is highly polyphagous, enjoying wide host range, infesting varied economic crops like fruit crops, plantation crops, condiments [5] and even medicinal plants [13]. Studies on biological parameters of this species on different hosts like guava and papaya [3], Indian tea [9,14], *Clerodendron siphonanthus* [15], Citrus [16], *Ocimum gratissimum* [13] clearly established that the development and reproduction of the species varied considerably in relation to the host plant on which it feeds.

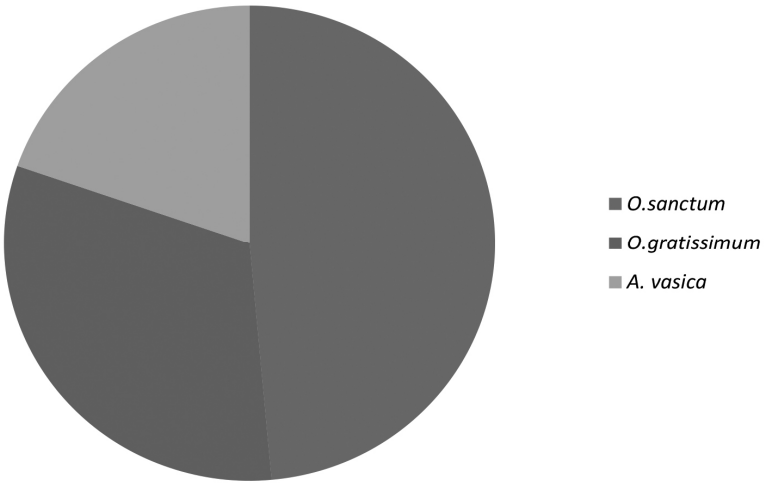

Figure 2. Total number of Adults+nymphs of *Brevipalpus* mites recorded from their specific host plants.

The population density of the mite was found to comprise entirely of female individuals, even after repeated observations carried out in the field. Apart from direct feeding injury, the species was known to transmit several dreadful phytopathogenic viruses like the citrus Leprosis Rhabdovirus [7,17] and the Coffee Ring Spot Virus [18]. Leaves that were too old [19] or too young [20] harbored comparatively lower population of adults. Brevipalpus mites inject toxic saliva into fruits, leaves, stems, and bud tissues of numerous plants. Feeding injury symptoms on selected plants include: chlorosis, blistering, bronzing, or necrotic areas on leaves [4]. Several mites in the genus *Brevipalpus* may transmit the citrus leprosies virus, but only *B. phoenicis* has been experimentally confirmed to transmit the virus. However, *B. obovatus* also as suspected transmitters.

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