PREDATOR PREY INTERACTION BETWEEN PREDATORS AND PHYTOPHAGOUS MITES

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C O N T E N T S

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I. INTRODUCTION

Plant parasitic mites generally play a very important role as most of them are very serious pests of fruit trees, truck crops, field crops and ornamental plants. They cause a great damage to host plants by feeding and sucking the plant sap, and ultimately affect the yield of these plants.

Chemical control of mite pests is well established and practiced in spite of the disadvantages of this control method. One of these defects is the toxic effect of the pesticides on the natural enemies of the mites, which in nature, tend to keep the pest population below the economic level of each crop.

Biological control, which means in its practical sense the adaptation and manipulation of the most important predators and parasites against the mite pests, is highly recommended by several workers. As an important example is the control of Panonychus ulmi (Koch) on apples in Germany and England by Typhlodromus pyri (Scheut.) (Dosse, 1960 and Collyer, 1964); on plum in Poland by several phytoseiids

(Niemczyk and Wiackowski, 1965); on apples in the Netherlands by *Amblyseius potentillae* (Garman) van de Vrie and Kropczynska, 1965); on peaches in Canada by *Typhlodromus caudiglans* Schuster (Putman and Herne, 1966).

To obtain a good natural control by predators, it is important to study the interactions between predators and its prey species, under different densities, to determine the most efficient predator prey ratio. In Egypt, many acarine predators were recorded among which the stigmaeid *Agistemus exsertus* Gonzalez (Zaher and Elbadry, 1961) and the phytoseiid *Amblyseius gossipi* Elbadry (Elbadry et al., 1968) are the most important on vegetation.

The present work was aimed to study the interactions between the above-mentioned predators and its prey, *Tetranychus arabicus* Attiah at different densities in a simple ecosystem. It is hoped that the results of the present study will contribute to the general knowledge of mite and predator ecology, as well as to provide a background of information to aid in efficient utilization of predators in the control of mites.

II. REVIEW OF LITERATURE

1. Feeding behaviour of predatory mites :

Herbert (1959) found that the female of Typhlodromus pyri (Scheuten) fed on all stages of Tetranychus telarius (L.), Panonychus ulmi (Koch), and Bryobia arborea (M. and A.). Chant (1961) indicated that Phytoseiulus persimilis (A.H.) quickly reduced its prey, Tetranychus telarius to a very low level on bean plants in a controlled greenhouse experiment. Zaher and Elbadry (1961) reared the predatory mite Agistemus exsertus Gonzalez on the eggs and larvae of the common red spider mite Tetranychus cinnabarinus Bois. They found that this predator preferred to feed on prey eggs than other stages. During the predator life span, number of prey eggs or larvae attacked by female predator exceeded that attacked by male. The former preyed on 430.6 eggs or 149.8 larvae, while the latter consumed about 137.7 eggs or 47.2 larvae, when the life span of female was 31.3 days, and of male was 23.6 days.

Bravenboer and Dosse (1962) reported that Phytoseiulus riegeli Dosse was very effective on glasshouse crops. The effectiveness was due to the shorter life-cycle of the predator than the prey and the great predator searching capacity. Elbadry and Elbanhawy (1968b), stated that the female Amblyseius gossipi Elbadry when fed on Tetranychus cinnabarinus (Bois.) reproduced at a similar rate to corn and date pollen feeders (2.1 eggs/female/day). They showed that the capability of females A. gossipi to prolong their survival for 9.7 days by feeding on plant tissue only would definitely enable such predators to exist in the field at unfavourable conditions of lack of prey. This added another excellent attribute to this important natural enemy. Elbadry et al. (1968) found that adult predator A. gossipi fed readily in both adults and immatures of Oligonychus mangiferus (Rahman), Tetranychus cinnabarinus and Eutetranychus orientalis (Klein). They noticed that eggs of T. cinnabarinus were fed upon but were not a satisfactory food for development. They reported that living prey mites were essential for the predator to complete its development.

Abo Elghar et al. (1969) showed that A. exsertus developed and reproduced successfully on pollen of Phoenix dactylifera, Zea Mays and Ricinus communis. The average developmental periods from larva, to adult were 9.5, 9 and 10.5 days at 28-30 °C, respectively. Mites reared on T. cinnabarinus developed faster (6.6 days). They also found that the average number of eggs laid per female/day was 3.15, 1.92 and 1.44 for mites feeding on pollen of dates, corn and caster bean, respectively whereas females preyed on tetranychid mite prey laid 2.36 eggs/day. Feeding on castor bean pollen increased the reproductive capacity of A. exsertus than all other tested food substances. Pollen of Gossypium barbadense was unfavourable for A. exsertus to develop or reproduce. Afify et al. (1969) studied the effectiveness of A. exsertus as an egg predator of T. cinnabarinus. They found that its effectiveness increased as the predator advanced in age. The daily rate of food consumption was directly proportional with temperature, and females were more effective than males specially at the adult stage. Elbadry et al. (1969b) studied the life history of A. exsertus and concluded that it was a facultative predaceous mite as it developed and reproduced successfully on either T. cinnabarinus or E. orientalis. However, tetranychid eggs favoured the full expression of the reproductive potential of this predator. Wafa et al. (1969) studied the feeding range of the predator mite A. exsertus. They reared it on different types of animal diets including eggs and immatures of T. cinnabarinus, eggs of E. orientalis and Prodenia litura, pollen grains of date palm and cotton, and leaves of sweet potato. They found that this predator could survive and reproduce on eggs and immatures of T. cinnabarinus but slowly developed on eggs of E. orientalis. The date palm pollen grains were more suitable for development and reproduction than others. Zaher et al. (1969) reported that Phytoseius plumifer could develop and reproduce when fed on the different stages of the red spider mite T. cinnabarinus. Zaher and Shehata (1971) showed that T. pyri fed on the different developmental stages of T. cinnabarinus. Shehata (1973) reported that Phytoseiulus persimilis (A.H.) fed on the various stages of Tetranychus urticae (Koch) at different densities both separately and mixed. Reproduction was higher with adults as diet, followed by immatures and then eggs. If the mixed diet was offered, P. persimilis preferred adults then immatures while very few eggs, were consumed.

McMurtry and Scriven (1975) in their studies to determine the optimum amount and stage of Tetranychus pacificus

(McGregor) needed for production of the predator Phytoseiulus persimilis under insectary condition found that, a diet which started with 2 mg. of prey eggs/10 females predator, fed 3 times a week and doubled the amount of food each week, produced an average of 9.7 active stages of predator/mg. of prey after 35 days. A 50% reduction in the amount of prey resulted in less than half the number of predators being produced and fewer predators per mg. of prey eggs. A diet of all stages of prey (with 50% eggs)produced somewhat fewer predators compared to prey eggs as food, and adult stages of prey were unsatisfactory for rearing the predator.

2. Population ecology of phytophagous and predatory mites:

Zaher and Elbadry (1962) observed that A. exsertus was dominant in Giza region. Its seasonal incidence showed that its population generally reached the peak during August and September. Putman and Herne (1964) showed that Typhlodromus caudiglans (Schuster) was an important factor in maintaining Panonychus ulmi at low density levels. The predator increased very rapidly but appeared to reach an upper limit of density fixed by intrinsic factor possibly cannibalism. Under this condition T. caudiglans could not bring P. ulmi to endemic densities in one season. Hussey et al. (1965) studied the interaction between Tetranychus urticae and Phytoseiulus riegeli on cucumbers. They reported that when the predator was introduced at a low prey population, elimination of the prey occurred before injury.

Van de Vrie and Kropozynska (1965) studied the influence of the predatory mite Typhlodromus potentilae Grman on P. ulmi. Glasshouse experiments showed that the development of high densities of P. ulmi on apple could be prevented by T. potentillae.

Oatman (1970) reported that the combining action of P. persimilis and native predators resulted in an early reduction in the spider mite Tetranychus urticae (Koch) in the release areas. Sandness and McMurtry -(1970) studied the form of the functional response curve of Amblyseius largoensis (Muma), Amblyseius concordis (Chant), and Typhlodromus floridanus (Mama) to increase in density of the prey, Oligonychus punicae (Hirst) and when the density of prey was high, it was followed by increase of consumption by predators.

Croft (1972) studied the effect of prey stage distribution as a factor influencing the numerical response of *T. occidentalis* and *Tetranychus mcdanieli* (McGregor) and *Tetranychus pacificus*. He concluded that at low and intermediate densities, prey stage distribution was optimally and generally favourable for the numerical increase of predators. During short periods early in the seasons prey generations were synchronized and as prey densities became high or overwintering conditions approached, the stage distribution became less favorable for the numerical increase of predators. They also concluded that from an applied biological control consideration, the effects of unfavorable stage distribution would most often occur at high densities. Effective control interactions which have occurred long before these destructive prey levels were attained. For mass release programs, the most favorable period for predator release would be shortly after a minimum prey density was attained to sustain a numerical increase of predators. Not only would pest density be reduced, but a highly favorable prey stage distribution would be available to the released predators.