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POPULATION DYNAMICS OF SOME PHYTOPHAGOUS MITES AND THEIR PREDATORS ON GOLDENROD *SOLIDAGO ALTISSIMA* L. I. SEASONAL TRENDS IN POPULATION NUMBERS AND SPATIAL DISTRIBUTIONS[1]

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I. INTRODUCTION

Goldenrod (*Solidago altissima* L.), native to North America, has recently spread over Japan. It is now one of the most noticeable, naturalized plants in the country and forms a pure stand over wide areas such as abandoned fields or basins of rivers which are close to urban areas.

Preliminary field survey which started in late 1975 demonstrated that there are very few phytophagous insects which utilize this newly-introduced plant as their food resource over generations, though there are some which eat this plant only temporarily (TAKAFUJI, 1978). With mites, however, three species of similar groups occur at comparatively high densities over generations and in addition several species of predacious mites are observed to feed on these phytophagous mites.

A group of these mite species is thought to provide interesting materials for analyzing relationships between the species at the same trophic levels and also between those at different ones, together with the population dynamics of each of the species. It will be also interesting to see over years some possible changes in the community structure of insects and mites on goldenrod; it is likely that more native species may adapt to this new plant in the near future, as it has been often the case that there are very few natural enemies for introduced plants for a time after introduction, whereas there are many in their native lands (see eg. ANDRES and GOEDEN, 1971; HARRIS, 1973).

This is the first report of the study, in which some seasonal trends in population numbers and spatial distribution patterns are described on those phytophagous mites and their predators on goldenrod.

II. MATERIALS AND METHODS

The study area

Field survey was carried out at a pure stand of goldenrods at a basin of Uji

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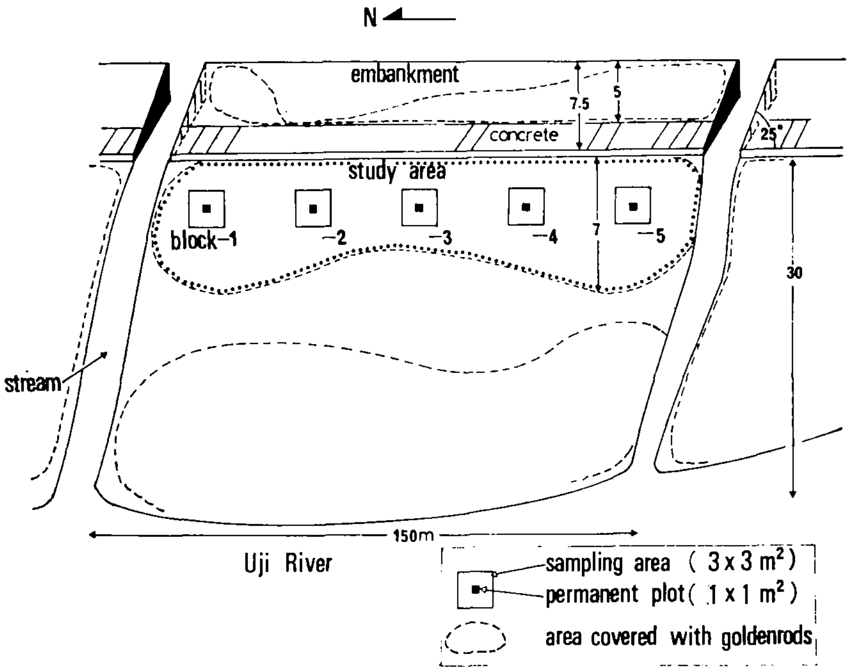

Fig. 1. A map of the study area showing the distribution of goldenrod *Solidago altissima*. Ten plants were sampled from each of five 3×3-sq. m areas, within which a 1×1-sq. m permanent plot was delimited to record the change in the density of goldenrods.

River in the south of Kyoto City. The study area (Fig. 1), which extends below an enbankment along the river, was about 150 meters long and 6 meters wide and it was separated by small streams at its northern and southern ends. Beyond the streams, there were also areas covered with goldenrods.

Five permanent plots of 1×1-sq. m were delimited at intervals of about 30 meters along the study area to record changes in the density of the plants (Fig. 1).

The plants in this area received no artificial disturbance such as mowing or herbicide spray.

The goldenrods

The plants vegetatively propagate through rhizomes though they also propagate by seeds which are produced in late autumn. New shoots (rosettes) begin to emerge on the ground in early December when parent plants wither. The number of new shoots continue to increase till March, but then some small ones are eliminated in a density-dependent manner during spring, but thereafter the density of plants remains constant (Fig. 2).

The density of the host plants varied among the five areas; it was higher in Blocks 4 & 5 than in other three blocks, and the plants were also bigger, the number of leaves per plant larger in those blocks (Fig. 2).

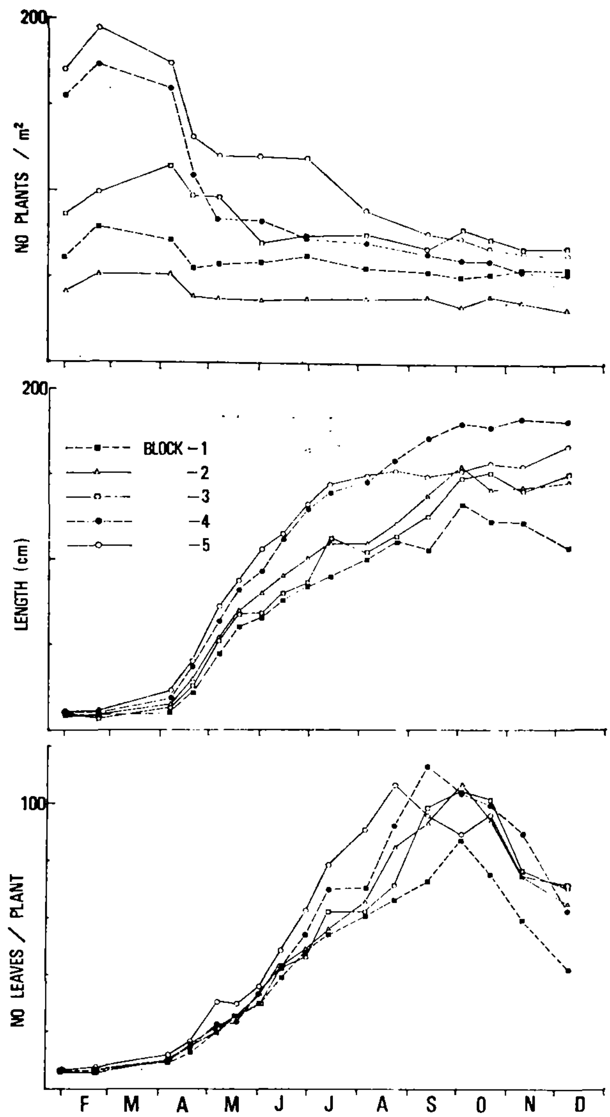

Fig. 2. Seasonal change in the density of goldenrods (upper figure), that in plant height (middle figure) and that in the number of leaves per plant (bottom figure), at each of the five blocks in the study area. The densities were investigated in the permanent plots, and the plant height and the number of leaves were determined from 10 plants which were sampled in each sampling area.

Sampling

Ten plants were sampled from each of five 3×3-sq. m areas, within which there was a permanent plot (Fig. 1). The plants were preserved with vinyl bags in a large icebox immediately after they were sampled.

Fifteen leaves were sampled from each plant at regular intervals to study the stages and the numbers of all the mite and insect species on them by a stereoscopic microscope, but if the number of leaves was less than 15, all the leaves were studied.

Sampling was carried out at intervals of 12 to 20 days.

III. Mite and Insect Fauna on Goldenrods

Table 1 shows a list of mite species associated with goldenrods in the study area. Among them, three species of phytophagous mites repeated their generations on goldenrods throughout the year: the species were *Brevipalpus obovatus*, *Tetranychus desertorum* and an unidentified mite of the family Tydeidae. Other non-predacious species occurred only sporadically at very low levels.

Table 1. List of mite species inhabiting goldenrod *Solidago altissima* L. in the basin of the Uji River near Kyoto*.

Family Name	No. of Species	Species Name
Tenuipalpidae	1	*Brevipalpus obovatus* Donnadieu
Tetranychidae	1	*Tetranychus desertorum* Banks
Tydeidae	1 (+1?)	
Phytoseiidae	3	*Phytoseius nipponicus* Ehara *Phytoseius capitatus* Ehara *Amblyseius deleoni* Muma et Denmark
Stigmaeidae	1	*Agistemus exsertus* González-Rodriguez
Bdellidae	1	
Acaridae	1	*Tyrophagus sp.*
Otocepheidae	1	

* The mite species were identified by Dr. S. Ehara of Tottori Univ., Japan.

Four species of predacious mites were observed throughout the year except when they were overwintering outside the plants. They were three species of phytoseiid mites (*Phytoseius nipponicus*, *P. capitatus* and *Amblyseius deleoni* and a stigmaeid mite *Agistemus exsertus*. Laboratory observations showed that these predators eat all the three phytophagous mites. But it was extremely infrequent that they ate the tydeid as this tydeid mite walked very rapidly. It was also confirmed that they ate *B. obovatus* and *T. desertorum* by the colored intestines of the predators collected in the fields, as the body color of the prey was clear red.

With the tydeid mite, it was not observed that the species ate other mite species, although there are some reports (Fleshner & Arakawa, 1953; Baker, 1965) that some tydeids feed on eriophid mites.

With regard to phytophagous insects, more than 10 species were observed to feed on goldenrods (Takafuji, 1978). Among them, a phytophagous thrip occurred at comparatively high levels on fresh leaves throughout the year. Also a moth, *Plusia albostrata* B. occasionally occurred at outbreak levels on new shoots which emerged in early autumn when parent plants were artificially mowed. Except these two species, others were very rare.

With predacious insects, only one species, a cecidomyiid, *Feltiella sp.* was observed, whose lavae mainly fed on. *T. desertorum.*

IV. Seasonal Changes in Population Numbers

Phytophagous mites

Eighty percent of the overwintering population of *B. obovatus* was adults (Fig. 5) and they began oviposition in early March, though the population density per plant did not increase until April or May because the oviposition rate was low and the number of newly emerged plants increased during early spring. After the age distribution became almost stable in June (Fig. 5), the population showed an almost exponential increase reaching a peak in October when the goldenrods began to deteriorate (Fig. 3A). Thus, there was only one peak in the population density of this species. The peak density in 1977 was 1700 per plant or 20 per leaf, being about 15 times greater compared with that in 1976, although the initial overwintering density

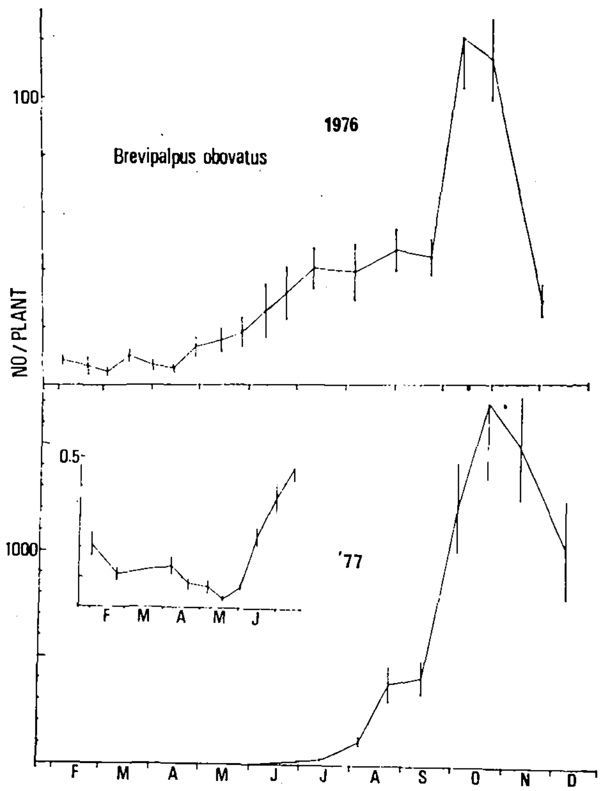

Fig. 3A. Population trends of a phytophagous mite *Brevipalpus obovatus*. The figures show the seasonal changes in the average number of mites per plant (±S. E.). At each census time, 50 plants were sampled from the five sampling areas. The number of individuals includes all the stages.

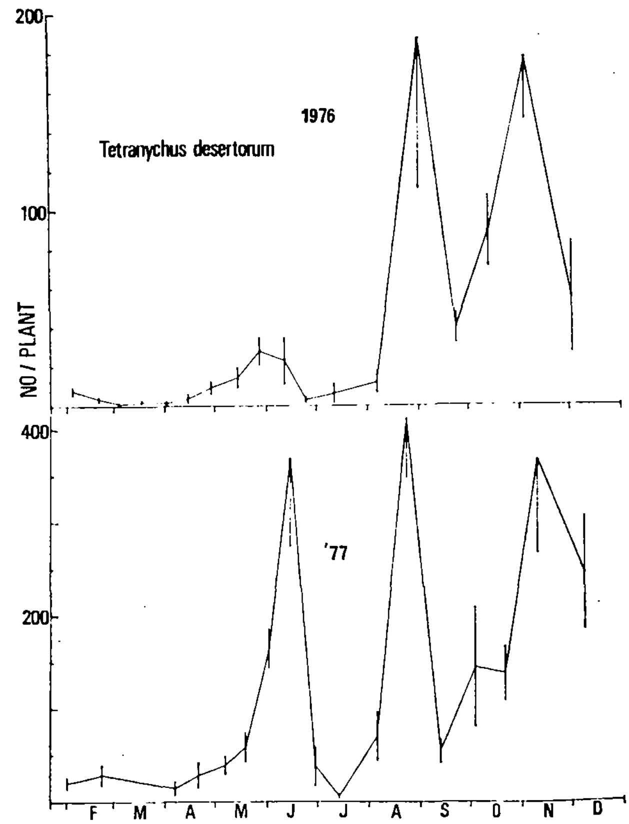

Fig. 3B. Population trends of a phytophagous mite *Tetranychus desertorum*. See Fig. 3A for more details.

in the former was only one fiftieth in the latter. Therefore, the rate of population increase of *B. obovatus* throughout the year was nearly 300 times greater in 1977 than in 1976.

Overwintering population of *T. desertorum* was composed of all stages, though the proportion of egg stage was higher compared with that in the remainder of the season (Fig. 5). The population of this species showed three, distinct oscillations in both years (Fig. 3B): peak density occurred in middle June, at the end of August and in early November. The overwintering density was only about 2.5 times as large in 1977 as in 1976, but the density in the first peak was nearly 13 times greater in the former, whereas in the other two peaks the densities were only twice greater in 1977 (Fig. 3B).

With the tydeid mite, its population trends varied greatly between the two years, though there seemed to be two peaks throughout the year; in 1976 the population density was greater in autumn, whereas in 1977 it was much higher in early summer (Fig. 3C).

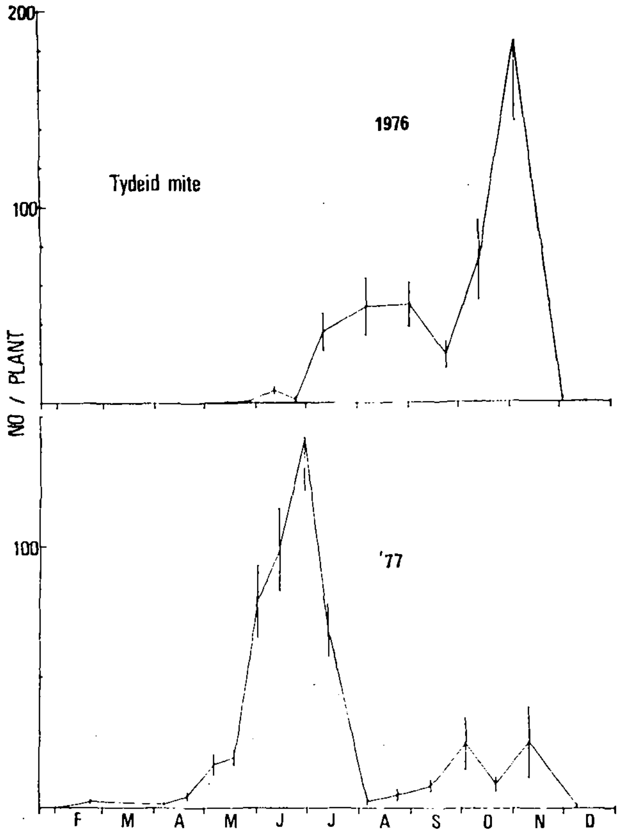

Fig. 3C. Population trends of a tydeid mite (Tydeidae). See Fig. 3A for more details.

Predators

There were two species of predacious mites of the genus *Phytoseius*. However, the numbers of the two species were grouped together, simply because it was practically impossible to distinguish between the eggs or younger immatures of the two, although *P. nipponicus* was more dominant than *P. capitatus* in terms of the number of adult females.

Overwintered adult females of *Phytoseius* started to emerge on plants in April and soon began oviposition (Fig. 5). In 1976, the population reached a peak in early June repeating two generations (Figs. 5 & 4A) and then gradually kept to decline until December, whereas in 1977 there was another peak in autumn (Fig. 4A). Adults ceased oviposition in early October, leaving plants to enter hibernation.

There were two peaks in the population density of *A. deleoni*, one in early summer and the other in middle autumn (Fig. 4B). Although *A. deleoni* has much larger oviposition rate than have the two species of *Phyoseius*, its population density remained relatively low throughout the year. However, the ralative ratio of the

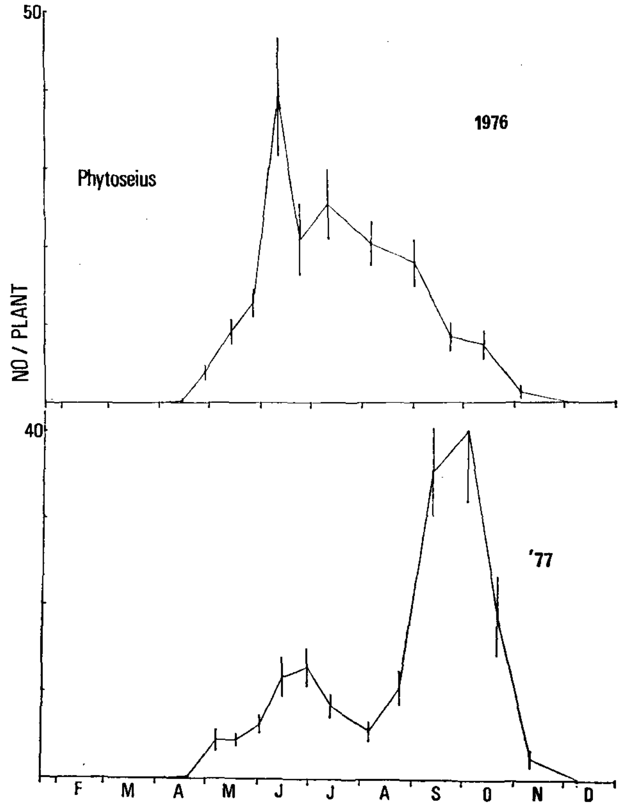

Fig. 4A. Population trends of two species of predacious mites of the genus *Phytoseius* (*P. nipponicus* and *P. capitatus*). The numbers of individuals of the two species were grouped together. See Fig. 3A for more details.

number of *A. deleoni* to that of *Phytoseius* in early summer increased over the two years.

With *A. exsertus*, there seemed to be two peaks, but autumn peak density was much larger than another peak in early summer (Fig. 4C). The population density in 1977 was nearly five times greater than that in 1976. Both adults and immatures were observed to overwinter on plants during winter season (Fig. 5), whereas the three species of phytoseiid mites overwintered outside plants.

The only insect predator, *Feltiella sp.* was comparatively rare; the highest density throughout the year was around one individual per plant on the average. The larval plus pupal density showed three, very distinct oscillations throughout the year (Fig. 4D).

V. Seasonal Changes in Spatial Distribution

(i) Degree of Aggregation in the Distributuon on Leaves

Prey

The degree of aggregation ($\overset{*}{m}/m$) (see Iwao, 1968) of *B. obovatus* became larger

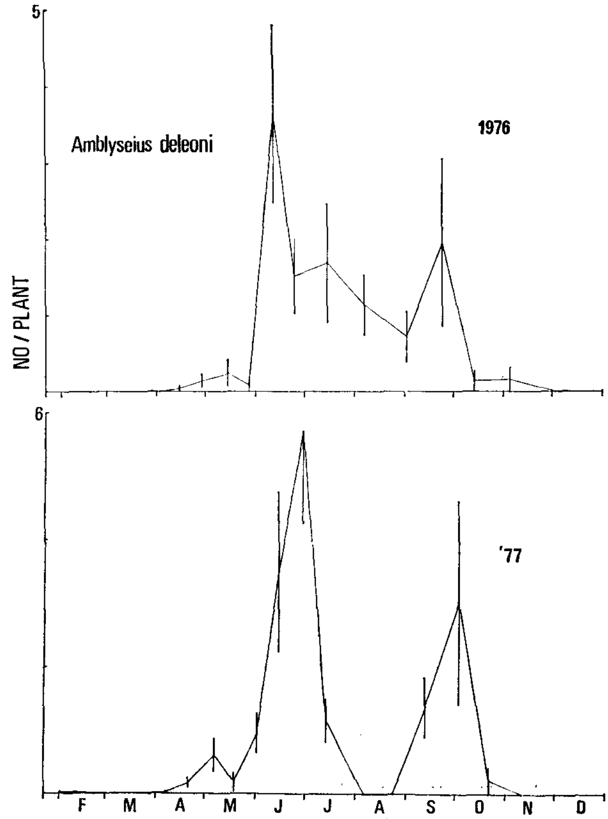

Fig. 4B. Population trends of a predacious mite *Amblyseius deleoni*. See Fig. 3A for more details.

during early spring (Fig. 6A, top). This was probably because in this season population increase and dispersal of this species were very small and in addition the numbers of leaves and newly-emerged plants increased. After that period, the degree of aggregation continued to decline till June, and thereafter it remained relatively constant.

The degree of aggregation of *T. desertorum*, which forms a colony covered with its own webbing, was greater than that of *B. obovatus* and in addition it showed very drastic changes (Fig. 6A, middle): it ranged between 5 and 94. There was a negative correlation between the change in the degree of aggregation and that in population density; as population density increased, the degree of aggregation rapidly declined, but if the population density began to decrease, then it drastically increased (cf. Fig. 3B).

With the tydeid mite, there also was an inverse relationship between the changes in the degree of aggregation and in population density, but the degree did not change so greatly as *T. desertorum* (Fig. 6A, bottom).

Predators

The degree of aggregation with *Phytoseius* was much lower compared with that

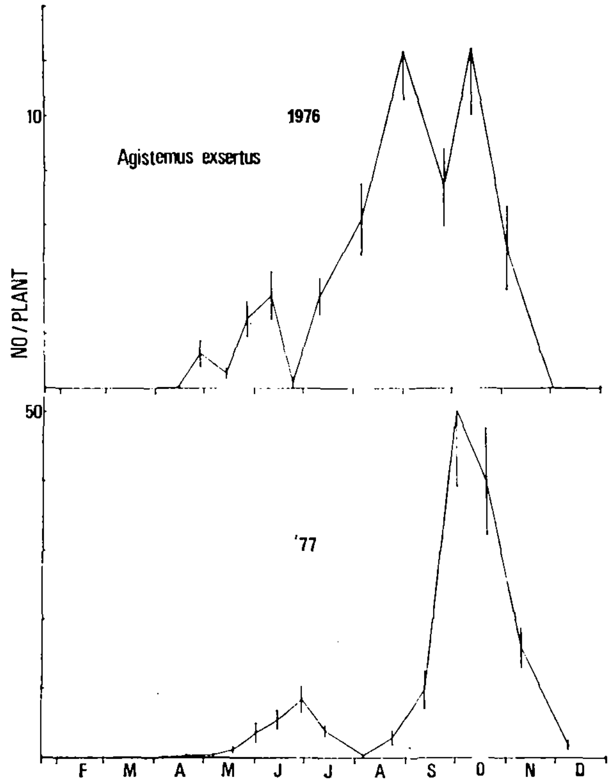

Fig. 4C. Population trends of a predacious mite *Agistemus exsertus*. See Fig. 3A for more details.

of each of the prey species; it remained rather constant around the value of 3, except in late autumn when its population density heavily declined (Fig. 6B, top). This will be because the two species of *Phytoseius* have low reproductive capacities (only less than 1 egg/day/♀), and they never aggregated to areas of high density of the prey species because they were easily trapped by the webbing of *T. desertorum*.

The activity of *A. deleoni*, however, was never hindered by the webbing of *T. desertorum* and it tended to aggregate where the prey mite was abundant and its eggs were also laid at areas of high prey density. This seemed to result in a higher degree of aggregation of this species compared with that of *Phytoseius* (Fig. 6B, middle).

With *A. exsertus*, there was a clear, inverse relationship between the changes in its population density and in the degree of aggregation, and its distribution was more aggregated compared with that of *Phytoseius* (Fig. 6B, bottom).

(ii) Vertical Distribution within a Plant

As goldenrods grew, fresh leaves were produced on the top of the plants, while leaves in the lower part became deteriorated and some fell on the ground. The vertical distributions of the mites (Fig. 7), therefore, were partly influenced by the

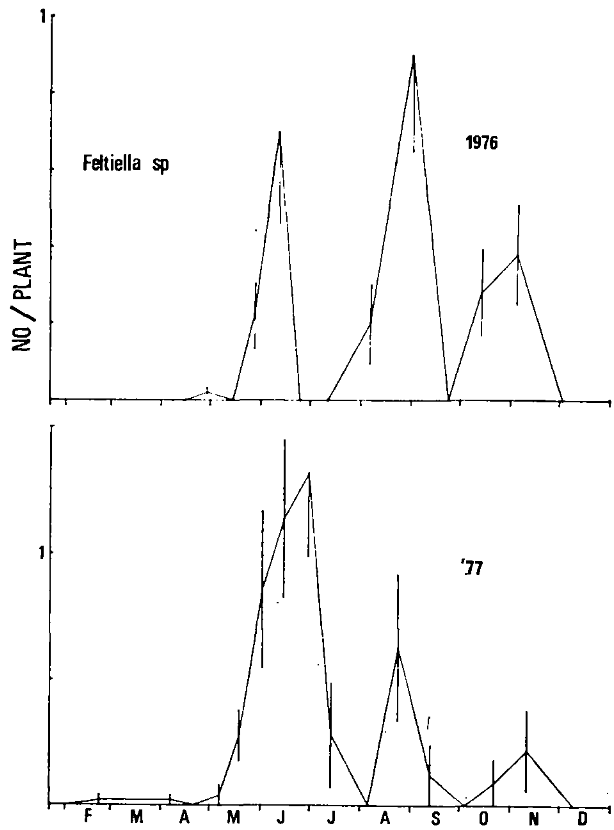

Fig. 4D. Population trends of the larvae of a predacious cecidomyiid *Feltiella sp.* See Fig. 3A for more detaiis.

freshness of the leaves which became inferior from the top to the bottom of the plant.

Prey

Most of the individuals of *B. obovatus* were distributed on the old leaves in the lower or middle part of the plants (Fig. 7, top left). Although some moved up to newer leaves during early summer, the proportion of the individual found on the upper leaves remained generally around 10%.

The vertical distribution of *T. desertorum* showed a drastic change during a period of April to June (Fig. 7, middle left). In spring when most leaves on a plant were still fresh, the mites remained on the lower leaves. However, as plants grew, the proportion found on the lower leaves sharply decreased, showing that the majority of the individuals of the increasing popuation moved to fresh leaves. After June, more than 70% was distributed on the fresh leaves close to the top of the plants.

Thus, in spring the two species coexisted on the lower leaves but after June there was a considerable habitat segregation in the two, although there was some overlapping between their distributions mainly on the middle leaves. This habitat

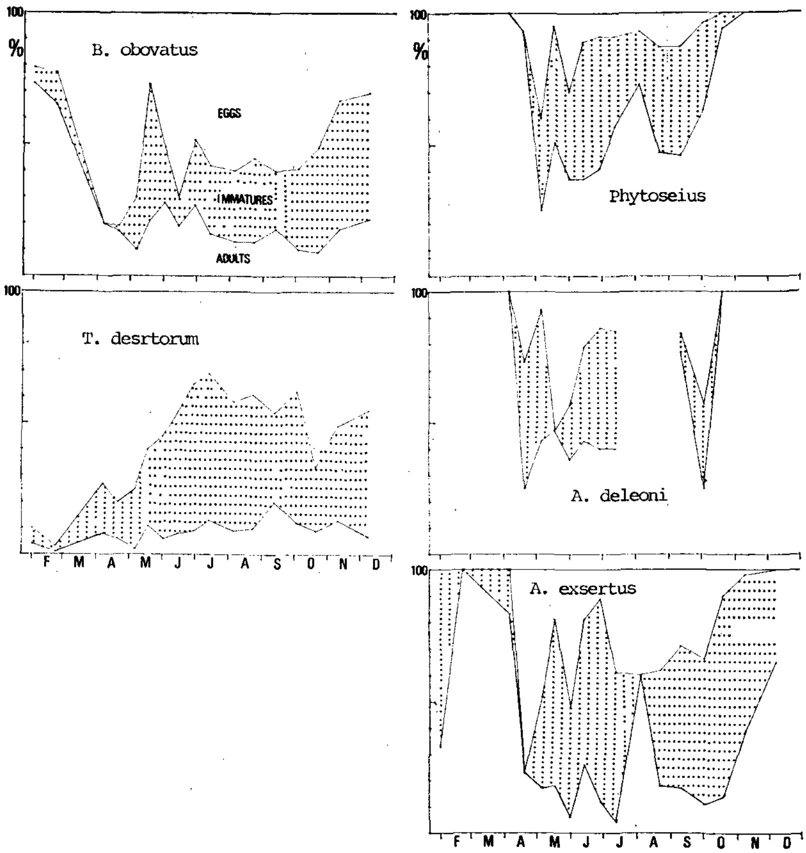

Fig. 5. Seasonal changes in the age distributions of two species of phytophagous mites (left figures) and their predators (right figures). The figures show the proportions of the numbers of eggs, immatures and adults to the total numbers from 50 plants sampled at each census time.

segregation primarily will result from their difference in preference to the conditions of leaves. However, in July and October when the population density of *T. desertorum* heavily declined, *B. obovadus* tended to expand its distribution upward, which implied that there might be some competitive relationship between the two species, as the activity of *B. obovatus* seemed to be hindered by the webbing of *T. desertorum.*

With the tydeid mite, most were found on the lower and middle leaves and particularly in autumn the majority was on old leaves (Fig. 7, bottom left).

Predators

About 80 to 90% of the individuals of *Phytoseius* was distributed in the lower and middle parts of the plants, and only 10 to 20% was on the new leaves where *T. desertorum* was most numerous (Fig. 7, top right). In autumn, the proportion in the lower part became larger, showing that they were leaving plants for hibernation.

The vertical distribution of *A. deleoni* greatly changed during a short period, but

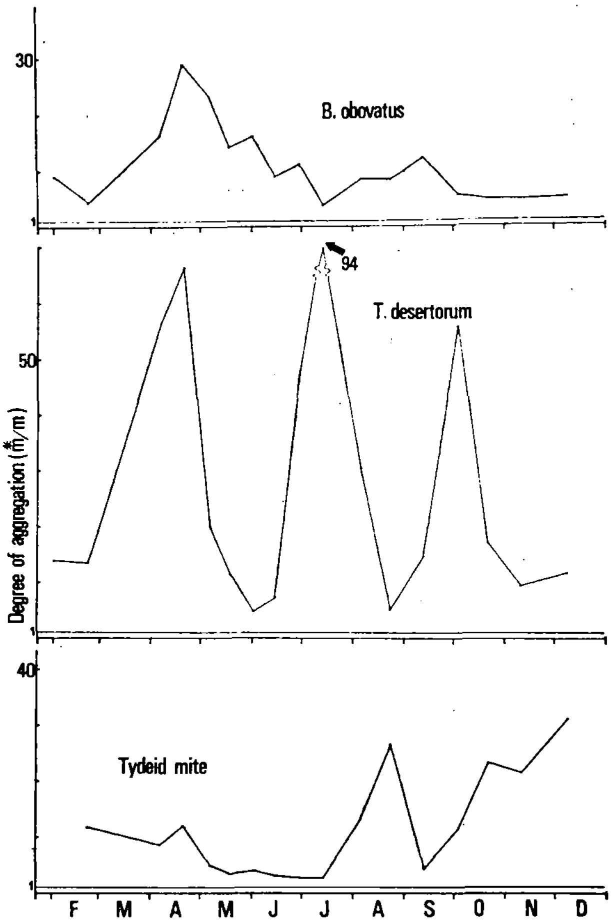

Fig. 6A. Seasonal changes in the degrees of aggregation ($\overset{*}{m}/m$;see IWAO, 1968) in the distributions of the numbers of individuals (all stages combined) in three species of phytophagous mites on the leaves of goldenrods. Each value was calculated based on the data from 50 plants sampled from the five census areas.

when its population density was increasing, it tended to distribute itself more on the upper leaves where *T. desertorum* was most abundant (Fig. 7, middle right).

With *A. exsertus*, it was most numerous on the lower leaves, but the distribution of this species tended to change slightly in accordance with that of *T. desertorum* (Fig. 7, bottom right).

VI. DISCUSSION

Two of the dominant phytophagous mites, *B. obovatus* and *T. desertorum*, exhibit very different, seasonal population trends. The initial population increase of *B. obovatus* in spring and early summer is very small but thereafter the population shows an exponential increase until host plants become deteriorated simply because of the aging

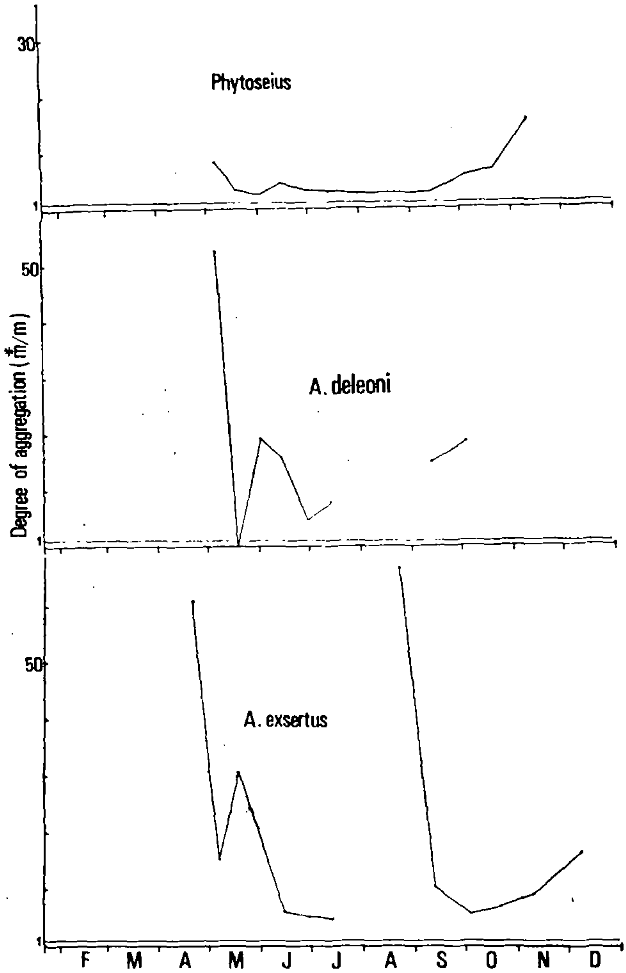

Fig. 6B. Seasonal changes in the degrees of aggregation ($\overset{*}{m}/m$) in the distributions of the numbers of individuals in four species of predacious mites on the leaves of goldenrods. For more details, see Fig. 6A.

of the plants themselves. Both of the peak and overwintering densities exceedingly varied between the two years.

The population trend of *T. desertorum*, on the other hand, is characterized by the repetition of a rapid exponential increase followed by a sudden crash, but the differences in the peak and overwintering densities between the two years are much smaller compared to those of *B. obovatus.*

The marked differences in the population trends of the two species are mainly attributed to their inherent, ecological and behavioral differences. The reproductive potential of *T. desertorum* is much greater than that of *B. obovatus* : the former develops to adults twice faster and its daily oviposition rate during the first 10 days' oviposition period is more than four times greater, although the total oviposition of

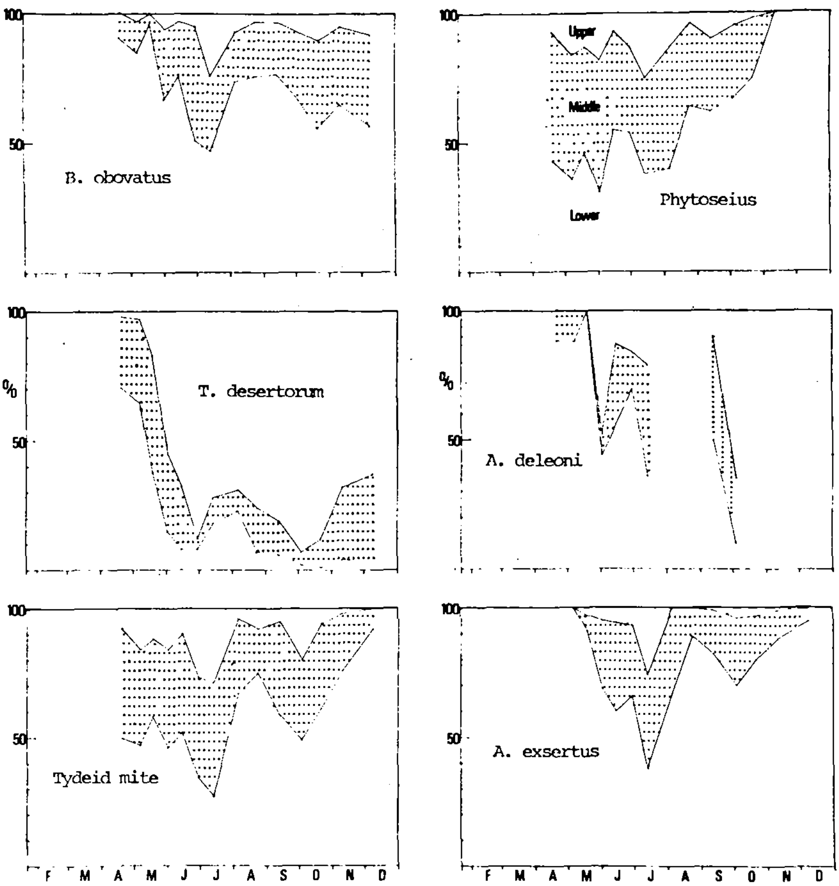

Fig. 7. Seasonal changes in the vertical distributions on goldenrods, of three species of phytophagous mites (left figures) and their predators (right figures). The figures show the proportions of the numbers of individuals (all stages combined) on the upper, middle and lower leaves of 50 plants sampled at each census time. Five leaves were sampled from each of the upper, middle and lower parts on each plant.

T. desertorum throughout the entire oviposition period is only twice greater (see NICKEL, 1960 for *T. desertorum* and MORISHITA, 1954 for *B. obovatus* respectively).

With regard to their behavioral aspects, *T. desertorum* concentrates on fresh, upper leaves within its profuse webbing, which at very high densities becomes a continuous sheet, leading to the dispersal of the individuals suffering from food shortage and this then results in a crash of the population. On the contrary, *B. obovatus*, which is much smaller in body size and much more sluggish in activity than *T. desertorum*, tends to be distributed on the lower leaves and tolerates deteriorated conditions of food resources without producing any noticeable webbing.

The population trend exhibited by *T. desertorum* is common to some species of tetranychid mites such as *Panonychus citri* (M.) (NISHINO, 1976) on citrus and

T. kanazawai K. (OSAKABE, 1967) on tea in Japan, and *T. mcdanieli* M. (HOYT, 1969) on apple in Washington, although the number of peaks, the period of peak occurrence and the population levels at the peaks vary between species, areas and years. The seasonal trend of *T. desertorum* is most similar to that of *T. kanzawai*, except that the latter generally lacks the peak in mid-summer.

The rapid exponential increase of *T. desertorum* observed in the present study shows that the predators of this species are ineffective in holding the prey population at low densities. It is observed that all the species of predator found on goldenrods more or less respond to changes in the density of *T. desertorum* with a time lag, but there is no such response to the increase of the population of *B. obovatus* or that of the tydeid mite, which shows that *T. desertorum* is the main food resource for the predators. However, there are some differences in the manner they respond to changes in the density of *T. desertorum*. For example, *Feltiella sp.* responds most clearly to the three oscillations of the population of *T. desertorum*, confirming the laboratory observation that the predator is very intensively dependent on this prey as its food. This predator has the highest capacity for prey consumption (per individual/day) of all the predators on goldenrods and its single larva may eradicate several colonies of the prey, but its abundance is very small and therefore its effect on the prey population is very limited.

The response of *Phytoseius*, which are the most dominant predators, to the density of *T. desertorum* is unclear; although in 1977 there were delayed increases in response to the increase of *T. desertorum*, but in 1976 the number of the predators continuously decreased after summer. Also in 1977, when the prey population crashed in June and August, the abundance of *Phytoseius* decreased only slightly. These suggest that they never intensively depend on *T. desertorum*, but maintain their populations eating also *B. obovatus* and possibly other resources such as plant juices from goldenrods. This seems to be supported by a discrepancy between the spatial distributions of *Phytoseius* and *T. desertorum* as the activity of the predators is hindered by the webbing of the prey.

The other two species of predacious mites respond to changes in the density of *T. desertorum*, suggesting that they depend on this prey more intensively than *Phytoseius*. However, *A. exsertus* generally feeds on only eggs of the prey, and its capacity for prey consumption (only 4 to 6 eggs/day/♀) and that for dispersal are small. In addition, there is a considerable discrepancy between the vertical distributions of the two.

With *A. deleoni*, it has much higher oviposition rate (2 to 4 eggs/day), compard with that of *Phytoseius*, and this predator can attack all the stages of *T. desertorum* even within the heavy webbing of the prey. However, for unknown reasons the abundance of this predator remains very low and is not able to become a dominant species, showing that its potential capacity for population increase observed in laboratory conditions is not achieved in the field.

Although much more studies are obviously needed for conclusions, these population behaviors of the predators suggest that they are neither effective in holding the populations of the prey at low levels nor is predation the main factor responsible for the rapid decrease of the population density of *T. desertorum*. The drastic decline of this prey will be attributed to the mortality due to resource shortage which locally occurs on leaves where the prey aggregate, including the mortality in the process of dispersal from damaged leaves, though also the heavy rainfall during the period from middle June to middle July when it is the rainy season at this area and that by a typhoon in September will be largely responsible for the crash of *T. desertorum* population.

NISHINO (1976) observed an increased dispersal in the population of *P. citri* when it reached a high level and he also attributes the drastic decline of the prey population to dispersal, although there is no data for natural enemies. Also in the study of population dynamics of *T. kanzawai* on tea (OSAKABE, *l. c.*) where the fauna of its natural enemies is very similar to that on goldenrods except that a predacious thrip is one of the dominant predators on tea, there is no indication that predators play an important role in suppressing the prey population.

These observations on the role of predators in the present study support the view by CHANT (1959) or ANDERSON and MORGAN (1958) that certain species of phytoseiid mites maintain their populations without exerting any substancial influence on the natural populations of tetranychid mites. However, there are a few species of phytoseiids such as *Metaseiulus occidentilis* (N) or *Typhlodromus occidentalis* (N) which have been demonstrated to be effective in stabilizing natural, tetranychid populations (eg. HOYT, 1969; FLAHERTY and HUFFAKER, 1970; FLAHERTY and HOY, 1971), whereas also in some other species there seems to be some circumstancial evidences which imply their effectiveness in the field (see HUFFAKER, *et al.*, 1970). These effective predators are characterized by their relatively high reproductive capacity and by the ability to concentrate on prey colonies, feeding primarily on tetranychid mites when they are abundant.

However, even for these species to be more stable in their regulatory effects, it is important that the predators have some alternate prey such as tydeid mites (FLAHERTY and HOY, *l. c.*) or eriophid mites (HOYT, *l. c.*) which occur at relatively high densities: the preators can maintain or increase their populations before the main prey species begin to increase, thereby increasing the initial number of predators relative to that of the prey at early stages in their interactions. Also in the case of predacious coccinellids (*Stethorus*) which are the most imortant predators for the population of *T. urticae* on apple in Australia, READSHAW (1975) shows that only when the initial ratio of the number of *Stethorus* which immigrate from other areas to that of the prey is above a certain level, they successfully hold the prey population below the level at which leaf damage is noticeable.

The present study suggests that the lack of predators with a high reproductive potential which is actually achieved in the field may result in the unstable, seasonal trends of the prey populations. The fauna including both phytophagous and predacious species and the dominancy among them, however, may shift as the history of the interactions between the mites or insects on goldenrod is still very short.

SUMMARY

(1) At the basin of the Uji River near Kyoto, three species of phytophagous mites occur on goldenrod *Solidago altissima* L. which recently has spread over Japan. They were *Brevipalpus obovatus* D., *Tetranychus desertorum* B. and a tydeid mite. Four species of predacious mites (*Phytoseius nipponicus* E., *P. capitatus* E., *Amblyseius deleoni* M.-D. and *Agistemus exsertus* (G.-R.) and a cecidomyiid *Feltiella sp.* were observed to eat those phytophagous mites.

(2) The population of *B. obovatus* showed an exponential increase until late autumn when the goldenrods withered, whereas the seasonal population trend of *T. desertorum* was characterized by a rapid, exponential increase followed by a drastic decline, showing three oscillations throughout the year. With the tydeid, its population density of 1976 was highest in autumn but in 1977 it was much higher in early summer.

(3) The vertical distribution of *B. obovatus* on goldenrod showed the majority of the individuals was on the lower and middle leaves. But with *T. desertorum* it showed an upward movement from the lower leaves during spring and thereafter the majority aggregated to the fresh, upper leaves.

(4) Population densities of all the predators changed with changes in the density of *T. desertorum* but not to changes in the density of the other two prey, showing *T. desertorum* was the main prey for the predators. *Feltiella sp.* and *A. deleoni* were more intensively dependent on *T. desertorum* than the other predators, attacking all the stages of the prey, but their abuudances were low. Although *Phytoseius* and *A. exsertus* were more dominant, there were considerable discrepancies between the vertical distributions of *T. desertorum* and these predators and they failed to attack the prey within its webbing. These suggested the predators would be ineffective in regulating the populations of the prey species.

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セイタカアワダチソウ群落における数種草食性ダニと捕食性天敵の個体群動態 I. 季節消長

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(1) 京都府宇治川河川敷のセイタカアワダチソウ群落には3種の草食性ダニが常時発生しており，またそれらの捕食性天敵も数種みられる。

(2) 草食性ダニのうち，増殖力の低いチャノヒメハダニ *Brevipalpus obovatus* D. は春から寄生植物が自然枯死する秋までゆるやかな指数的増加を示した。一方，増殖率の高いアシノワハハダニ *Tetranychus desertorum* B. の個体群は3回の激しい振動を繰り返した。

(3) これら2種の草食性ダニの植物内の垂直分布には顕著な違いがあり，前者は中・下部の古葉にとどまる傾向があるのに対し後者は春以降，先端部に近い新鮮葉に集中して増殖・分散を繰り返した。

(4) 5種の捕食性天敵はいずれもこれら草食性ダニや不規則に発生するコハリダニの一種を餌としているが，それらの個体群はアシノワハダニの個体群密度により強く反応して変動し，このダニに主な餌として依存しているようである。しかしその依存の程度は種によって異なり，優占種である2種の *Phytoseius* 属の捕性カブリダニは依存度が比較的低く，アシノワハダニが激減してもあまりその個体数は減らなかった。一方，ニセラーゴカブリダニ *Amblyseius deleoni* M.-D.，コブモチナガヒシダニ *Agistemus exsertus* G.-R.，および捕食性タマバエ *Feltiella sp.* では依存度が高く，特にニセラーゴカブリダニはハダニのコロニーに集中して捕食・増殖した。しかし他の捕食性ダニにくらべて捕食・増殖力ともに高い本種の個体数は全体として低いレベルにとどまった。これらの5種の捕食性天敵はいずれも個体数レベルが低いかまたは高くてもアシノワハダニ個体群との空間分布にずれがあるためにその個体数制御の主な要因になっていないようである。