

# Examination of the Development of the Deutogynes of *Calepitrimerus vitis* Nalepa in the Vine-growing Region of Szekszárd, Hungary (Acari: Eriophyidae)

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The first winter-forms (deutogyne) of the eriophyid mite *Calepitrimerus vitis* appear in the vineyards of Szekszárd at the beginning of August and then the mites continuously take refuge in their hibernation shelters until end of October. Most winter-forms move to the buds during September. There is no connection between the moving period length and the yearly infection. In spite of the low mite population in the years with weak infestation (1999, 2001) the movement lasts the same late, until end of October. Ratio of the mites taking refuge in hibernation shelters is the best at the beginning of the moving period in August and it is decreasing continuously until October. Considering the directions of movement to the hibernation shelters, 74.7% of the mites seek for the hibernation shelters moved down and 25.3% of the mites moved up. A new method is described, useful for practical purposes in an effort to evaluate the number of mites moving towards their hibernation shelters.

Keywords: *Calepitrimerus vitis*, eriophyid mite.

The eriophyid mite *Calepitrimerus vitis* Nalepa was detected in vineyards of Szekszárd first in 1979 and it has been observed in all grape plantations since 1982. The control of the pest is not effective and so it is important to collect information on its biology. In case of mite infection leaves curl and growth of the shoots and leaves is retarded. High level of infestation in spring may cause as much as an 85% decrease in the weight of the grapes at harvest time (Pérez-Marín, 1992). There are not found data in Hungary for the exact observation of the eriophyid mite movement to hibernate. It can be obtained essential data with the exact observation of the movement for the development of integrated and biological pest management programmes.

## Materials and Methods

For the study of the movement to hibernate was observed in the period of 1999–2001. The trial was carried out in Chardonnay grape variety, in vineyards of Baranya-valley, wine-growing region of Szekszárd. Method of the vine-stock cultivation

was umbrella. The observations were carried out parallel with a blue adhesive tape method and bud examination. Movement of the mite was observed with the blue adhesive tape method. Parallel with this buds were examined with a washing-out technique for determination the number of hibernated individuals.

The blue adhesive tapes were placed out first at the middle of June onto the canes. Adhesive tapes were placed out altogether on 10 stocks at the same time in the vineyards. The stocks were picked at random from the vineyards. Tapes were collected continuously from the beginning of July until end of October every four weeks (on 7 July, on 4 August, on 1 September, on 29 September and on 27 October). Ten tapes were collected at each time. After the first and the further collection (except the last collecting) another 10 stock were chosen and put tapes on them. Selections of the stocks were important because of the earlier trapping the number of the individuals could have been decreased and this can influence result of the examination.

The mites stuck in the tapes, were examined with a stereomicroscope. A new method was applied for the evaluation. Other evaluating methods have been used before, for example stereomicroscopic observation of entire surface or one margin of the tapes, but these are laborious and/or relatively inefficient.

On the collected tapes parallel with the direction of mites movement in entire length 5 mm representative stripe was indicated. This was required due to the exact count, because the caught individual number sometimes was high enough on the entire surface of the tapes. In order to separate of the direction of movement, the marked out stripe was divided in half across. So it was counted separate the moving of the mites from up to down and from down to up. All mites stuck in the stripe were counted. Catching results of the collected tapes at each time was given in number of the caught individuals on the 5 cm wide stripe (total individuals on 10 tapes in 5 mm stripes).

Parallel with this the buds were examined with a washing-out technique and continuously observed number of the hibernated individuals. Rhythm of seeking for hiding place is followable with the continuously observation of the moving specimens number, direction of the movement and number of the mites in the buds.

Buds examinations were performed continuously from the beginning of July until end of October every four weeks. Dates of the bud examinations were the same as the date of the blue adhesive tapes examinations (on 7 July, on 4 August, on 1 September, on 29 September and on 27 October).

Bud samples were collected from the same stocks than the blue adhesive tapes. Ten vine-shoots were collected from 10 stocks. On the vine-shoot the first 10 buds from below with the bark were washed out. Average was counted from the total washed out individuals, which showed average number of the hibernated mites in buds.

The used washing-out technique in the study was the following: the buds were separated into small pieces one by one with a laboratorial scalpel. First the bud scales were shelled gently then the whole buds were cut up in a 300 ml glass pouring out 100 ml tap water. A shaking machine was applied for a half an hour. After shaking the solution was tinted with "Azúr II. eozin" microscopically colour. The tinted solution was sieved through

a two-phase vacuum sieving. The size of first sieving-tissue is 300  $\mu$ m, the second is 40  $\mu$ m, and the latter is a changeable sieving disc. The two sieving surface occupy a "one under another" position in a plastic sieving-box fitting in a vacuum tube. In the first sieving phase the rough dirt and leaf pieces are separated, in the second phase the mites are caught.

The blue background is optimal for observing mites under microscope. The mites were observed and counted under binocular microscope at  $\times 50$  magnifications. One sample contained 10 buds and 2 cm long bark. Average was counted from the results of the samples. At all examination time, numbers of the new hibernated individuals were determined in that way the number of the hibernated mites was compared to the previous individual number. Difference of the two values provided the number of the new individuals.

## Result and Discussion

### *Results of the blue adhesive tapes examinations*

The blue tapes did not catch any individuals at the first collection in 1999. The first some individuals were found on the tapes at the beginning of August. In this time altogether 14 individuals were counted on 10 tapes in 5 mm stripes. Since the examination dates are far from each other, the caught individuals do not belong to the collection date so much, rather the previous period. So catching of the tapes collected on 4 August indicated the number of the mites, which were stuck from 7 July until 4 August. The tapes collected at the beginning of September hardly show any increase, altogether 58 individuals were counted on the tapes. Altogether 86 individuals were found on the tapes collected at the end of September. Only low number of catchings was observed at the end of October. Altogether 103 mites were on the tapes. Altogether 261 mites were observed on the 50 tapes in 1999. The most intensive period of movement was from the beginning of September till end of October.

At the first collection in 2000 the blue tapes did not catch any mite. The first individuals were observed on the tapes collected at the beginning of August. In this time altogether 107 individuals were counted on 10 tapes in 5 mm stripes. At the beginning of September the number of catchings was a little bit higher, altogether 338 individuals were counted on the tapes. At the end of September the catching was suddenly higher, altogether 2591 individuals were found. The results of the catching were the same high at the end of October. Altogether 2715 mites were counted on the tapes. Altogether 2715 mites were observed on the 50 tapes in 2000. The most intensive period of movement was from the beginning of September till end of October.

At the first collection in 2001 similar to the previous two years, the blue tapes did not catch any mite. The first some individuals were observed on the tapes collected at the beginning of August. Altogether 8 individuals were counted. The tapes collected at the beginning of September hardly shown increase, altogether 23 individuals were counted on the tapes. At the end of September the catching was a little bit higher, altogether 52 individuals were counted on the tapes. At the end of October number of the moving indi-

viduals were the same low altogether 73 individuals were found. Altogether 156 mites were observed on the 50 tapes in 2001. The most intensive period of movement was from the beginning of September till end of October.

#### Results of the bud examination

No individuals were found in the examined bud samples on 7 July in 1999. The first individuals were found in the bud of the vine-shoot samples collected at the beginning of August. Appearing of the new individuals is shown in *Fig. 1*. The new individuals appeared in the buds continuously in a higher and higher numbers from the beginning of August until end of September. During October number of the hibernated individuals decreased significantly. At the beginning of August 22.4% of the mites were already in the buds. At the beginning of September another 23% moved to hibernate. At the end of September further 46% moved to hibernate. By the end of September 91.4% of the individuals were already in the buds. From the end of September until end of October continued the hibernation of the new individuals, but their numbers decreased. In this period the new hibernation individuals were 8.6% of the total individuals. The individuals found in the examined samples at the end of September were moved to hibernate from the beginning of September until end of September, so the “hibernation peak” was in September.

No individuals were found in the examined bud samples on 7 July in 2000. The first individuals were found in the bud of the vine-shoot samples collected at the beginning of August. Appearance of the new individuals is shown in *Fig. 1*. The new individuals appeared in the buds continuously in a higher and higher numbers from the beginning

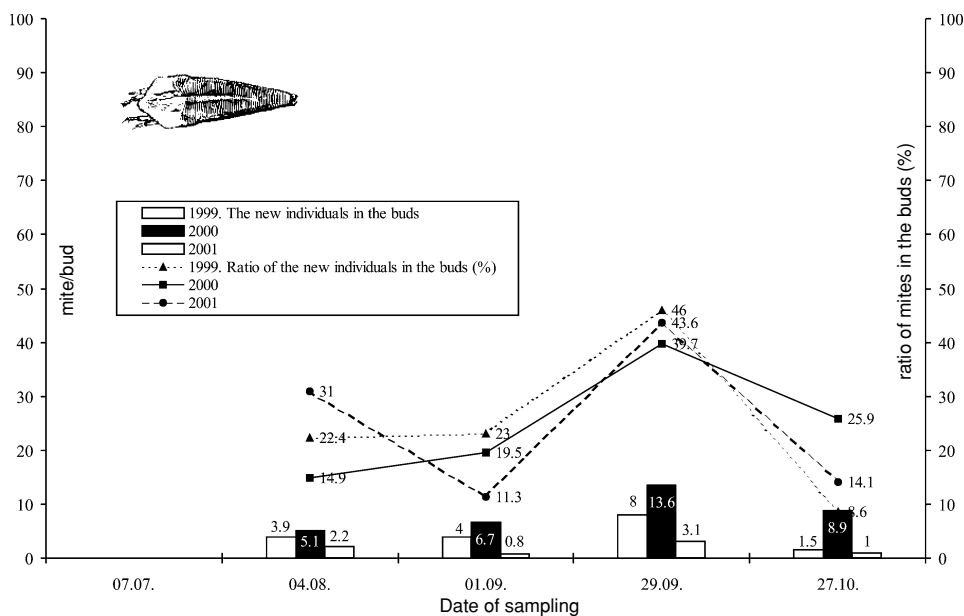


Fig. 1. The number and ratio (%) of the new individuals (1999–2001)

of August until end of September. From the end of September until end of October number of the individuals decreased. At the beginning of August 14.9% of the mites were already in the buds. At the beginning of September another 19.5% moved to hibernate. At the end of September further 39.7% moved to hibernate. From the end of September until end of October continued the hibernation of the new individuals, but their numbers decreased. In this period the new hibernation individuals were 25.9% of the total individuals. This value was higher than the number of the individuals at the beginning of August or at the beginning of September. This year the taking refuge in hibernation shelters lasted late; it was still in large number at the end of October. At the end of October number of the new hibernation individuals exceeded even the individuals number at the beginning of August and at the beginning of September. From the beginning of September until end of October 85.1% of the total hibernation individuals were in the buds. During the year the most hibernation individuals (39.7%) were in the samples at the end of September. "Hibernation peak" was in September.

No individuals were found in the examined bud samples similar to the previous 2 years on 7 July in 2001. The first individuals were found in the bud of the vine-shoot samples collected at the beginning of August. Appearing of the new individuals is shown in Fig. 1. The new individuals appeared in the buds continuously from the beginning of August. This year at the beginning of August 31% of the mites were already in the buds. This is a high rate compared to the previous two years. At the beginning of September another 11.3% moved to hibernate. While in the previous years the new individuals appeared in the buds continuously in a higher and higher numbers from the beginning of August until end of September, at the beginning of September in 2001 temporary decrease was observed in the number of individuals. Numbers of the hibernated individuals were less by 20% at the beginning of September than at the beginning of August. At the end of September further 43.6% of the mites moved to hibernate. This rate already met the previous year's experience. From the end of September until end of October continued the hibernation of the new individuals, but their numbers decreased. In this period the new hibernation individuals were 14.1% of the total individuals. This year the hibernation began early, in spite of this it still lasted at the end of October. Numbers of the new hibernated individuals were higher at the end of October than at the beginning of September. From the beginning of August until end of September 85.9% of the total hibernation individuals were in the buds. During the year the most hibernation individuals (43.6%) were in the samples at the end of September. "Hibernation peak" was in September.

#### *About of movement to hibernation in general*

The first winter-forms (deutogyne) of the eriophyid mite *Calepitrimerus vitis* Nalepa appear in the vineyards of Szekszárd at the beginning of August and then the mites continuously move to the winter place until end of October.

The first appearance of deutogynes in summer appears to depend not only on the environmental conditions such as morphological and physiological modifications of the foliage (Kreiter and Planas, 1987) but also depend on the number of mites. In those years

when the mite density is high, deutogynes appear sooner than when the population levels are lower. It was observed by Carmona (1978) and he attributed it to a reduction of the foliage in the heavily infested vineyards. A large number of mites feeding on the same leaf accelerate the process of tissue hardening. This makes mite feeding difficult and is responsible for deutogyne development in eriophyid mites, as noted by Keifer (1975).

This symptom was not observed in the vineyards of Szekszárd. Independently of the year the first winter-forms appeared at the beginning of August in all the three years. Length of the movement did not show any relation to the infestations. In spite of low number of the mites, the movement lasted the same late (at the end of October) even in the years with weak infestation (1999, 2001).

On the basis of the three years average, the connection between the numbers of the moving individuals and numbers of the new hibernated individuals in the buds are shown in Fig. 2. On the basis of catching of the blue adhesive tapes, the movement lasted late, the tapes caught the most individuals at the end of October. The movement towards hibernation shelters lasted in all the three years late but numbers of the hibernated individuals did not increase proportionally with the increase of movement. The most new hibernated individuals were in the samples at the end of September (8.3 in average). Movement was on the top at the end of October but in average only 3.8 new hibernated individuals was observed in the buds. From the total 2729 moved individuals at the end of September (8.3 in average), the hibernated individuals were in a much higher rate in the buds than from

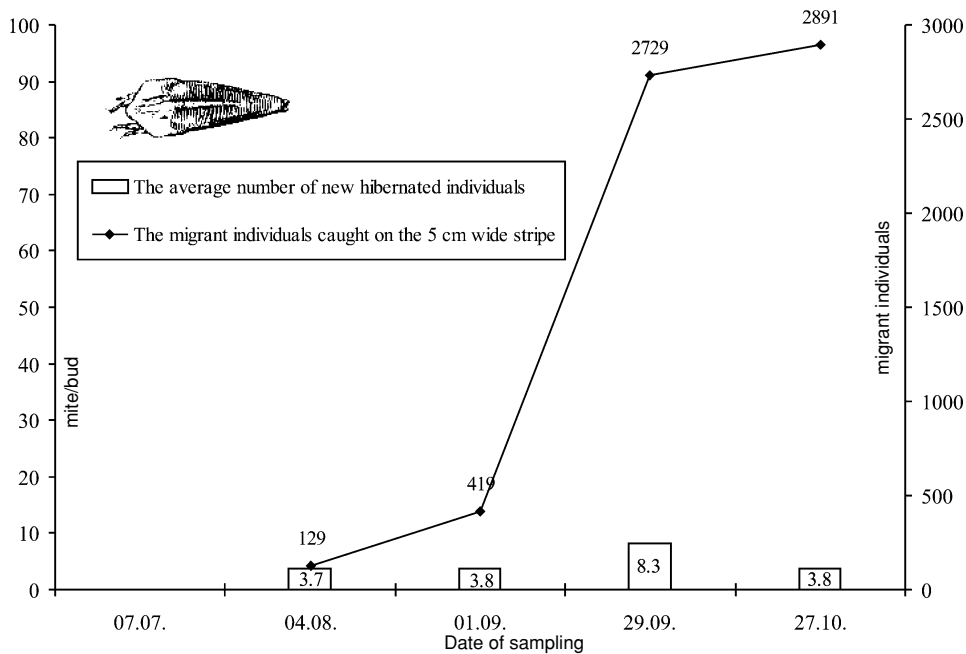


Fig. 2. The numbers of the migrant and the new hibernated individuals on the basis of three years average (1999–2001)

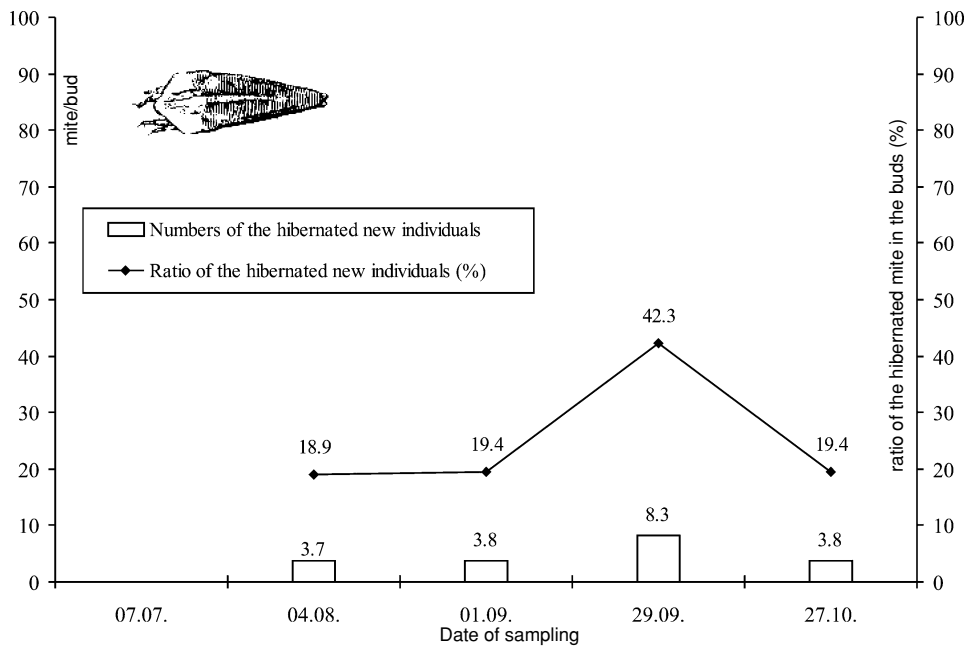


Fig. 3. The numbers of the hibernated new individuals on the basis of three years average (1999–2001)

the total 2891 moved individuals at the end of October (3.8 in average). In spite of the higher number of the moved individual at the end of October, the number of the new mites hibernated in the buds were more than twice less than at the end of September. From the large number of the moved individuals at the end of October, only few mites were able to find shelter for hibernation. Inverse of this was observed at the beginning of September. In that time number of the hibernated new individuals were 3.8 mites/bud of the total migrated 419 individuals. This value was the same as that of the individual number observed at the end of October. The same connection can be observed at the beginning of August provided even higher hibernating efficiency. Average number of the hibernated new individuals of the total caught 129 moved mites was 3.7 mites/bud. Efficiency of the hibernation is the best at the beginning period of the movement and it decreases continuously until end of October. Early, in August the significant proportion of the mites' population are still able to shelter to hibernate. Later on increasingly large portion of the population moves for hibernation but/and gradually less number is able to reach the buds. First of all due to the unfavourable weather conditions in late autumn only some individuals can move in the buds.

Numbers of the hibernated new individuals are shown in *Fig. 3*. On the basis of the three-year average, the most new individuals (42.3%) were in the samples at the end of September. "The hibernation peak" was in September.

Considering the directions of movement to the hibernation shelters, on the basis of the three-year average, 74.7% of the mites seek for the hibernation shelters moving down and 25.3% of the mites moving up.

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