Acta Biologica Szeged. *22* (1—4), pp. 87—95 (1976)

DATA ON SEASONAL DYNAMICS AND ENVIRONMENTAL CLAIMS OF EMPOASCA FABAE HARRIS (HOMOPTERA: CICADELLIDAE) ON CONDIMENT PAPRIKA

GY. GYŐRFFY

Department of Zoology, Attila József University, Szeged

(Received September 25, 1975)

Abstract

It was established by the author at the investigation in the years 1971—1973 that *Empoasca fabae* HARRIS is the predominant corrupting element of the food-plant community condiment paprika *(Capsicum annuum* L. convar. *longum)*. The activity optima of imagos at 50 per cent vapour content are 31.5 °C. From the end of June up to the end of the growing season of the plant, one generation develops entirely on the condiment paprika, completed earlier by imagos migrated from the weed ecotone. The population maxima are to be expected in the first week of september. The percentage of ♂-s changes between 25 and 55 per cent.

Among the pests of the condiment paprika *(Capsicum annuum* L. convar. *longum)* the members of the group Homoptera, Auchenorhyncha had but a part insignificant, if any, according to the literature so far. The plant-lice (SZELÉNYI, 1957) are regarded as a most important corrupting element (SZIRMAI, 1941; SZALAY—MARZSÓ, 1961; ANGELI, 1968; TÓTH, 1968). Leafhoppers are mainly mentioned, by comparatively few investigators, because of their virus-spreading property. Thus *e.g.* Stolbur's disease *(Chlorogenus australiensis* var. *stolbur)* is primarily spread by *Hyalesthes obsoletus* SIGN. (ANGELI, 1968; ALEKSIC, Z.—SUTIC-ALEKSIC, D., 1970).

There are several cultivated plant species that can be damaged by *Empoasca fabae* HARR., *viz.:* sugar beet (MOFFIT—REYNOLDS, 1972), medick (DECKER—KONSKOLEKAS—DYSART, 1971; NEWTON—HILL—ELGIN, 1970). On condiment paprika it has not been described, as yet. It was, however, proved by the investigations below that, apart from plant-lice, it was the second most important corrupting element. And if there are no plant-lice, it becomes predominant alone (GYŐRFFY, 1974).

Materials and Methods

The area investigated is: a condiment-paprika field, 23.6 ha, in the vicinity of Szeged. Its soil is meadow carbonate chernozem, already from the surface. The paprika was planted in 60 cm row space and 60 cm (or in some spaces smaller) stock space. In the years 1971—1973, the collection was carried out from stock to stock by means of grass nets, with the method of "100 plants" (SZALAY—MARZSÓ, 1969). On a single occasion, we generally collected from 5×20 plants. The matter was selected after ether anaesthesia. Temperature and relative vapour content were measured at any collection. The values of the mean daily temperature and humidity were, however, obtained from the meteorological station in the neighbourhood of the site of collection. Collections took place generally on one occasion a week, in the morning hours.

Before comparing the data of collection spontaneously, we held necessary to examine if these data may be regarded as exact informations or they were modified in conformity with some factors. We collected therefore all day on four occasions and on one occasion even at night. The change in the individual number of the Empoasca fabae HARR. imagos and larvae was studied separately. The larvae were, however, only divided into two groups, partly because of the uncertain separation, partly owing to the comparatively low individual number, making the evaluation dobious.

Results

Connection of activity and the possibility of collection with abiotic factors

The activity (collectibility) maxima of imagos are, according to the climogram (Fig. 1), at 31.5 °C and 50 per cent vapour content. Activity agrees with the possibility of collection only in a single area. Therefore both terms are used. The population optima were put by MOFFIT and REYNOLDS (1972) between 26.6 and 32 °C. The result obtained coincides with that essentially. Vapour content is not mentioned.

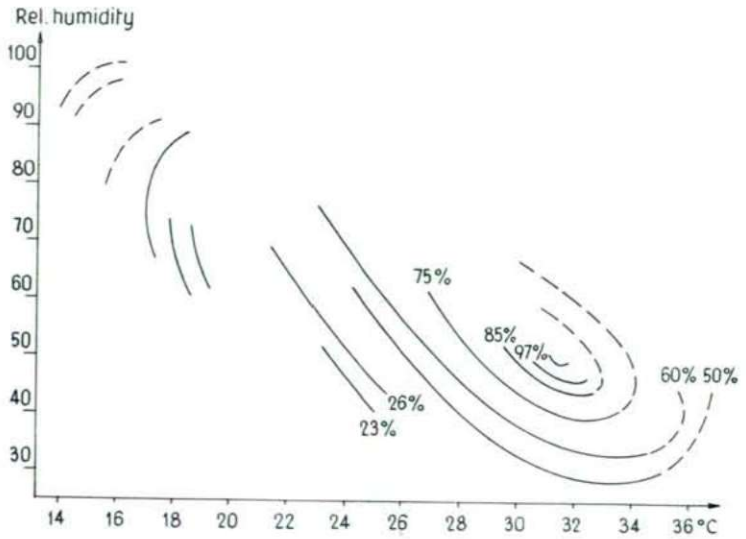

Fig. 1. Climogram of activity (collectibility) of the imagos of *Empoasca fabae* HARRIS. The dotted line means a supposed curve containing relatively few data.

At about 15 °C and 85 per cent vapour content the possibility of collection began rising again what cannot be explained with the increase in activity. We assume that at the changes of the abiotic factors in negative direction activity decreases and later on reaches the level of relative rest. Then there follows a phase that we have named "active holding on". This holding on is, however, of a more and more decreasing intensity till it gets to the point of growing numb. Meanwhile, however, the possibility of collection is increasing again because at using the grass-nets the possibility of shaking down the individuals is one of the decisive factors. This connection, of course,

does not hold good of the species drawing back under more unfavourable conditions into the soil or to other sites that can only be approached with difficulty. Empoasca fabae Harr. do not belong to the latter species, the explanation of the results achieved is therefore well-illustrated by the facts mentioned above (Fig. 2).

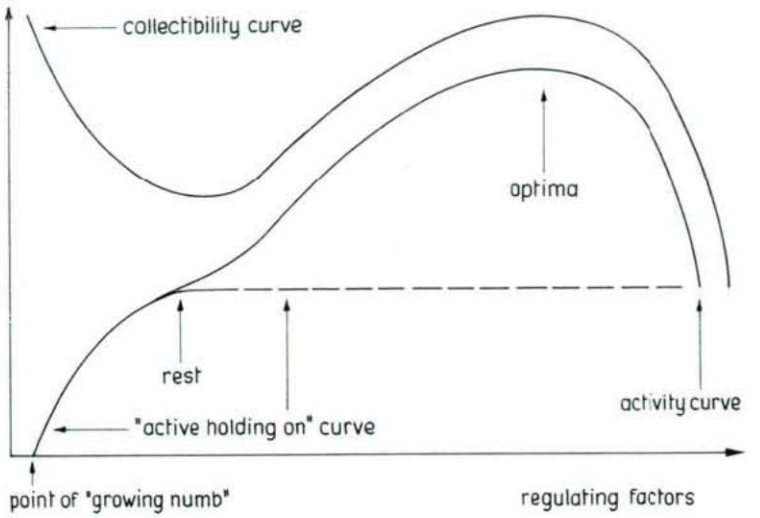

Fig. 2. Connection of collectibility, activity and "active holding on" generally with the regulating factors.

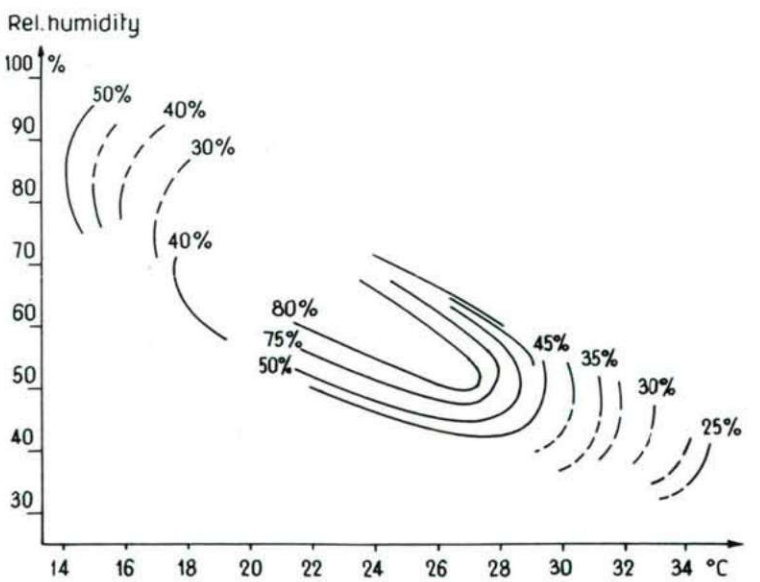

Fig. 3. Activity (collectibility) climogram of the larvae of *Empoasca fabae* HARRIS.

The temperature optima of the juvenile *Empoasca fabae* HARR. are lower, those of vapour content however higher (Fig. 3). The activity-intervals of larvae are much smaller, at least in respect of vapour content. It is no mere chance, therefore, that the majority of them generally dwell inside of the flowers. Rest comes about here, too, at about the same point as in case of the imago.

It turns out of all these that the data collected so far can only be accepted with reservation and their quantitative comparison may only be successful with a preliminary correction. For this correction it is mostly enough to establish the dependence upon temperature and vapour content.

Seasonal dynamics of *Empoasca fabae* HARRIS

The population dynamics of *Empoasca* species was already dealt with by several investigators. *E.g.*, it was investigated by NOWACKA and ZOLTANSKA (1974) on various plants in 1971. Their individual-number maxima fell to the same time. According to MOFFIT and REYNOLDS (1972), their abundance is correlated with the mean temperature, frequency does not depend on precipitation. In Poland the *Empoasca* species *(E. pteridis, E. flavescens)* have two generations on medicinal herbs, the first appears in May and June, the second in July and August. In an insectarium, anyway, a third generation, too, can be raised (in August and September) (NOWACKA, ADAMSKA—WILCZEK, 1974).

In the course of investigations we should have liked to clarify the change in individual number of *Empoasca fabae* HARR. in connection with mean temperature and vapour content. In the graphs we are publishing in case of imagos, apart from the original data, the corrected ones, as well, partly because the climogram is not containing the temperature and vapour-content values belonging to each collecting date, partly as it seems so that there are only differences of size between the two curves (Figs. 4, 5, 6).

In 1971, larvae appeared from the end of July, 20 days or so after imagos. The maxima of younger larval phases appeared in the middle of August, those of the older ones a fortnight later, *i. e.*, a week before the imago-maxima. This was, therefore in contradistinction to the following year, a larval development accelerated by the favourable weather.

In 1972, larva and imago appeared simultaneously what is referring to a migration of larvae from the weed ecotone. The size of population was smaller than in the year before. The maxima of older larvae were followed only in 15 days by the imago-maxima. The cause of that may have been the protraction of larval development because of the cool, strongly rainy weather.

In 1973, imagos appear already at the end of June but the early swarming was prevented by a vaporization. Stocking therefore protracted. The larval development was, however, promoted by the favourable warm weather.

To sum it up: Leafhoppers begin multiplying in the weed ecotone from early June. From there, they migrate to condiment paprika at the end of June, in early July. Paprika is a more favourable food-plant for *Empoasca* than the weed ecotone was because after that time only an insignificant amount of them may be found in the latter one. Simultaneously with the settling in of imagos they begin depositing eggs and the first larvae creep forth about a week after that. Their development is strongly influenced by the conditions of temperature and precipitation.

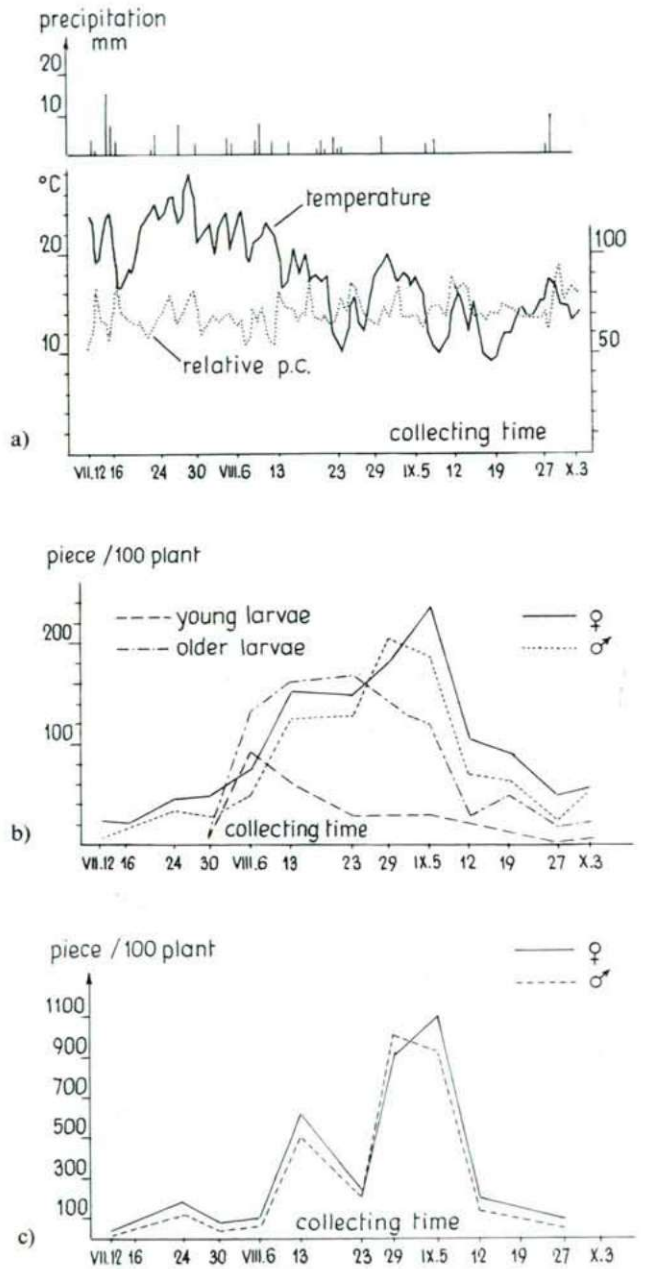

Fig. 4a. Meteorological data in 1971 (daily mean temperature, relative humidity, precipitation).
b. Individual density of larvae and imagos of *Empoasca fabae* HARRIS in 1971.
c. Corrected individual density of imagos of *Empoasca fabae* HARRIS in 1971.

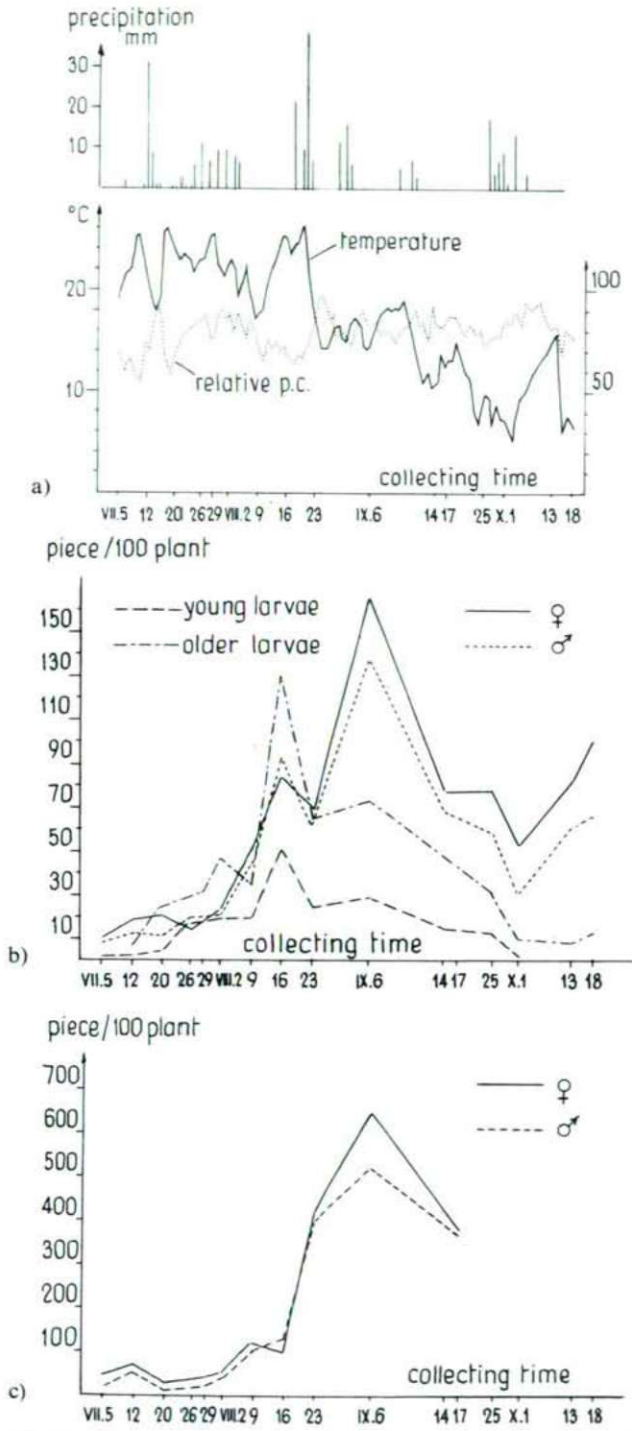

Fig. 5a. Meteorological data in 1972 (daily mean temperature, relative air humidity, precipitation).
b. Individual density of larvae and imagos of *Empoasca fabae* HARRIS in 1972.
c. Corrected individual density of imagos of *Empoasca fabae* HARRIS in 1972.

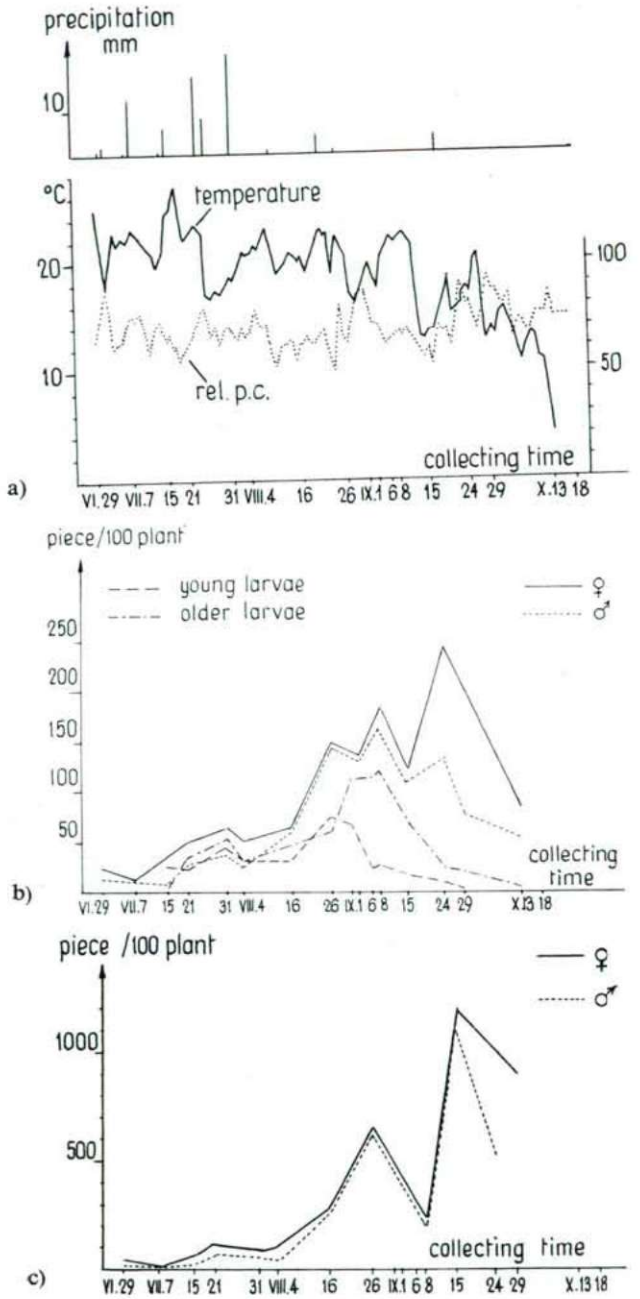

Fig. 6a. Meteorological data in 1973 (daily mean temperature, relative humidity, precipitation).
b. Individual density of larvae and imagos of *Empoasca fabae* HARRIS in 1973.
c. Corrected individual density of imagos of *Empoasca fabae Harris* in 1973.

This could be observed in 1972, as well, only the development protracted more and the size of population was also smaller. The imago-maxima appear, as depending on larvae, one week or two later than those. The imagos can be found on their food-plant till the end of the growing season. But their quantity is, owing to the lower temperature, smaller and smaller. The paprika growing too old has no major significance as the leafhopper is only forced to leave for the weed ecotone by the first frosts, the whithering of the plant.

The change in sex-ratio, the development of the percentage of males, was also followed with attention in the growing season (Fig. 7). The sex-percentage was found approximately 1:1 on *Medicago sativa*. (DECKER—KONSKOLEKAS—DYSART, 1971). According to NOWACKA and ZOLTANSKA (1974), the ♂:♀ ratio is about 1:2 what is essential because the damage caused by ♀ and ♂ individuals is different: that caused by females is significantly graver (NEWTON—HILL—ELGIN, 1970).

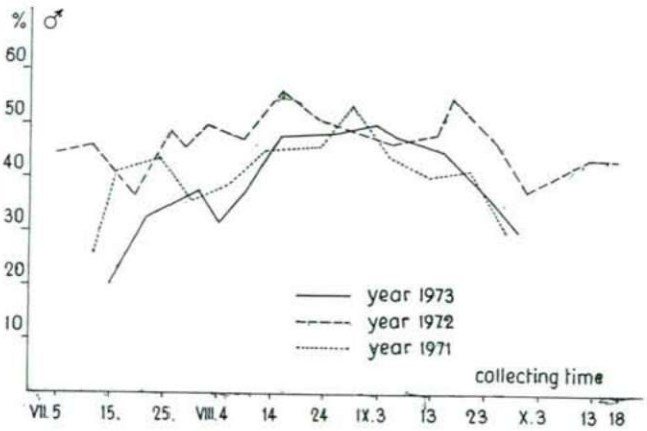

Fig. 7. Change in the percentage of the males of *Empoasca fabae* HARRIS in 1971 to 1973.

It can be established that the percentage of ♂-s is showing a curve with definite tendency. In respect of there years, the values are fluctuating between 25 and 55 per cent. The course of the curve is similar to that of the curves of the individuel frequency of the larvae in older phase. This may suggest that the individual development of ♂ individuals is somewhat faster than that of females, resp. that the males cast their coat earlier. Thus sex-ratio cannot be characterized in the generating time with a proportion but only with an interval, resp. a mean value of that. In the present case, this is about 45 per cent that means the ♂:♀ ratio 1:1.22.

The revealed considerable and systematic occurrence of *Empoasca fabae* HARRIS on condiment paprika is raising the question if it causes a perceptible damage in the household of the plant and in what degree its virus-spreading property participates in propagating the viral diseases of paprika. In so far as the harmfulness of leafhopper were proved by investigations like this, the demonstrated connections of the maxima of larvae and imagos with temperature and vapour content may give points of view to forecast and protection against it.

References

ALEKSIC, Z., SUTIC, D., ALEKSIC, D. (1969): Proucavanje stolbura hao problema u proizvoduji paprike u Jugoszlavije. — Zast. Bilja, Beograd, *20* (105), 235—249.

ANGELI, L. (1968): PAPRIKATERMESZTÉS. Az étkezési és fűszerpaprika termesztése (Paprika-growing. Growing of eating and condiment paprika). — Budapest.

DECKER, G. C., KONSKOLEKAS, C. A., DYSART, R. I. (1971): Some observations on fecundity and sex-rations of the potato leafhopper (*Empoasca fabae*, HEM., HOM., Cicadellidae). — Econ. J., Entomol. *64*, 1127—1129.

GYŐRFFY, GY. (1974): Vizsgálatok egy Szeged környéki fűszerpaprika-tábla tápnövényközösségén (Investigations on the food-plant community of a condiment-paprika field in the vicinity of Szeged). — (Doct. thesis.)

MOFFIT, H. R., REYNOLDS, H. T. (1972): Bionomic of *Empoasca solana* DELONG on cotton (*Gossypium*) in Southern California (USA). — Hilgardia *41* (11), 247—297.

NEWTON, R. C., HILL, R. R., ELGIN, J. H. (1970): Differential injury to alfalfa by male and female Potato Leafhoppers. — J. Econ.-Entomol. *63*, 1077—1079.

NOWACKA, W., ADAMSKA-WILCZEK, J. (1974): Skoczki (Homoptera, Cicadodea) w uprawach roslin lekarskich. — Polskia Pismo Entomologiczne *44*, 393—404.

NOWACKA, W., ZOLTANSKA, E. (1974): Skoczki (Cicadodea, Homoptera) Warzyw baldaszkowych i cebulowych. — Roczniki Nauk Rolniczych Seria E, *4*, Z. 1, 33—46.

SOMOS, A. (1966): A paprika. (Paprika.) — Publishing House of the Hungarian Academy of Sciences. Budapest.

SZALAY-MARZSÓ, L. (1961): Adatok a magyarországi paprikavírusvektorok ismeretéhez (Data on the knowledge of paprika-vírus vectors in Hungary). — Publications of the Scientific Conference on Plant Protection. Budapest.

SZALAY-MARZSÓ, L. (1969): A „100 Növény" módszer és annak kritikája (The method "100 Plants" and a criticism to it). — Research Institute of Plant Protection, Budapest.

SZELÉNYI, G. (1957): Az állattársulási kategóriák (Categories of animal association). — Állattani Közl. *46*, 125—137.

SZIRMAI, J. (1941): A fűszerpaprika leromlását megindító, újhitűségnek nevezett vírus-betegségről (On a viral disease of the name of "neophytism", inducing the degeneration of condiment paprika). In: Növényegészségügyi Évkönyv *1*, 1937—1940, 109—126.

TÓTH, GY. (1968): Hajtatott zöldségfélék állati kártevői és a védekezés lehetőségei, különös tekintettel a fólia alatti termesztésre (Pests of vegetables shot and the possibilities of prevention, with special regard to growing under plastic foil). XVIII. Növényvédelmi Tud. Ért. Budapest.

Address of the author:
DR. GY. GYŐRFFY
Department of Zoology,
A. J. University,
H—6701 Szeged,
P. O. Box, 428. Hungary