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Mites (Acari) important in different agroecosystems and their control in Romania*

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Abstract

Mite problems in different agroecosystems in Romania are presented. Of all phytophagous mites known in the country, four species are found on a wide range of crops, with the two-spotted spider mite, *Tetranychus urticae* Koch, and the broad mite, *Polyphagotarsonemus latus* (Banks), being the most important. The broad mite is difficult to control, but acaricides registered in Romania have provided effective control of this species. Reduction of highly toxic pesticide residues in the environment has been considered important in the country. That could be approached by first reducing the amount of pesticides applied on agricultural land, and second, by finding new pesticides with less toxic active ingredients. This has resulted in reduced numbers of the main groups of pesticides, commercial products and number of active substances. The number of available commercial products varied from 12 in 1972–1979 to five in 1980–1989, ten in 1990–1996, four in 1997–2004 and six in 2010, based on five active ingredients. The causes of the decreasing numbers of acaricide products or active ingredients were the reduced availability of several active ingredients due to toxicological or environmental reasons and the high registration cost. Only three acaricides (Envidor 240 SC, Nissorun 10 WP and Omite 570 EC) and one insecticide/acaricide (Seizer 10 EC) are at present commonly used in Romanian agriculture. At the same time, from the economic point of view, biological control is impractical if not impossible to be applied in commercial crop production under Romanian economical conditions of farmers in absence of subsidies. EU and Romanian policies are discussed.

Key words: Acaricides, chemical control, mites importance, plant pest.

Introduction

Thirty one mite species have been reported from Romanian agroecosystems (Manolache & Boguleanu, 1978). Of all phytophagous mites known in the country, four are found on a range of crops, being the two-spotted spider mite, *Tetranychus urticae* Koch (Tetranychidae), and the broad mite, *Polyphagotarsonemus latus* (Banks) (Tarsonemidae), the most important. Of other species, four are found on small grains, to which they do not cause major problems; three, on ornamentals; 15, in orchards, all very important, two being polyphagous and 13 specific to this type of agroecosystem; and five, on grape vine (Boguleanu, 1988), only two of which are usually controlled with chemicals (Perju *et al*., 2001). The control of *P. latus* is quite difficult, but acaricides registered in Romania have provided effective control of this as well as of other pest mites (Paulian *et al*., 1977; Bărbulescu *et al*., 2002).

Use of plant protection products in Romania

The number of acaricides used in Romania varied considerably in the last 40 years. Twelve were in use during 1972–1979, five in 1980–1989, ten in 1990–1996, four in 1997–2004 and six (based on five active ingredients) in 2010. The last acaricide to be registered in the country was Envidor® 240 SC (spirodiclofen 240 g/L), in 2005. Despite the tendency for reduction in the number of used, expenditures with chemicals has tended to increase. According to data provided by A. Alexandri (Alcedo Ltd.), the total amount of pesticides recently commercialized in Romania corresponded to 110 million Euros in 2003, 120 million Euros in 2004, 130 million Euros in 2005, 136 million Euros in

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2006, 135–140 million Euros (estimate) in 2007, 140–145 million Euros in 2008, 160 million Euros in 2009 and 165 million Euros in 2010. It is estimated that in 2011 it will correspond to 160 million Euros and that in 2012, to 180–200 million Euros. Such increase in expenditure seems to be due mainly to increase in volume of pesticides used, as prices have been quite stable in this period.

Taking as an example the year 2006, which represented a year with regular climate in the country, the proportions (%) of the different pesticides used in the country were: fungicides, 36.5; insecticide-acaricides, 20.4; herbicides, 37.5; products for seed treatment, 4.9; others, 0.7. In 2007, when rainfall was lower than the average, the proportions changed to: fungicides, 20.6; insecticide–acaricides, 28.7; herbicides, 44.0; products for seed treatment, 5.9; others, 0.8 [data provided by A. Alexandri (Alcedo Ltd.)]. Table 1 shows the use of pesticides in each of the main groups of crops in 2008.

TABLE 1. Pesticides used in the integrated control of diseases, pests and weeds in 2008 in Romania [data provided by A. Alexandri (Alcedo Ltd.)].

Product type	Surface (ha)/(ton for seed treatment)	Commercial product (kg/year)	Active ingredient (kg/year)
Herbicides	**52,435.3**	**57,573.42**	**28.272**
Field crops	50,984.3	52,928.42	26.022
Viticulture	1,451	4,645	2.250
Fungicides	**77,304.5/2,698 ton**	**182,206**	**124.639**
Field crops	10,922	15,241	10.02
Field vegetables	4,784.5	7,913.16	4.178
Greenhouse vegetables	243	369	0.239
Viticulture	50,270	137,310	95.560
Fruittree	11,085	17,784.8	13.289
Seed treatment	2,698	4,188	1.351
Insecticides	**45,185/1,362.48 ton**	**63,256.24**	**26.308**
Field crops	20,724	3,073	0.891
Field vegetables	3,053	1,910.96	0.530
Greenhouse vegetables	356	239	0.047
Viticulture	6,169	8,825.40	5.636
Fruit tree	14,883	42,731.44	16.316
Seed treatment	1,362.48	6,476.44	2.888

Forecast and warning for mite attacks in different agroecosystems

In Romania, pest warning service has been considered instrumental for effective control of mite pests in different agroecosystems. These are based on the biological characteristics of the pests, the prevailing levels at each year, their ability to cause damage, their response to prevailing environmental factors and on the effectiveness of available acaricides. Great importance has been attributed to the fact that larvae are more susceptible to acaricides than later developmental stages.

Orchards. Apple is the principal orchard crop in Romania. In general, predatory insects of the genera *Chrysopa* (Neuroptera: Chrysopidae) and *Stethorus* (Coleoptera: Coccinellidae), or predatory mites of the genera *Typhlodromus* (Mesostigmata: Phytoseiidae) and *Tydeus* (Prostigmata: Tydeidae) contribute in maintaining populations of phytophagous mites below the Economic Threshold Levels (ETL) (Perju, 1995). However, in many cases the judicious use of insecticides and acaricides is considered necessary (Teodorescu, 2000).

Based on the number of hibernating eggs, a forecast of spider mite levels in the next season is done. For mites hibernating as eggs, the estimation of levels to be expected in the next year is determined based on the number of hibernating eggs determined between December and March, in two

samples taken from each of 30 trees/plot. Each sample consists of a section of at least 10 cm in length of a two-year-old branch and two fruit buds from each of 60 branches. The buds are examined with a magnifying glass, counting the eggs present in a radius of 1 cm. around each bud.

The estimated numbers are classified in seven classes: Class 0: no eggs; Class 1: 1–5 eggs, assumed average= 2; Class 2: 6–20 eggs; assumed average= 10; Class 3: 21–50, assumed average= 30; Class 4; 51–100, assumed average= 70; Class 5: 101–200: assumed average= 150; Class 6: > 200, assumed average= 300. The number of samples in each class is multiplied by the corresponding assumed averages to estimate the total number of eggs. ETL is assumed at 3,000 eggs/120 fruit buds. The estimation of egg hatching start up is done by fixing early in the winter a section (8–15 cm long) of 2–3 years-old branch onto a board (20 x 10 cm) lined with car transmission oil and hanging it to a tree. In the spring, the device is checked every two days, registering the time when hatching starts.

Estimation of mite population on the leaves is done throughout the growing season, from May to August, examining leaves with a magnifying glass. In total, 120 leaves (two from each of 60 trees) are examined. Initially, leaves are taken from the base of the shoots; as the season goes on, leaves are taken progressively more distally. Recommendation for the implementation of control is done based on determined ETL of five mobile mites/leaf. Usually, 1–2 treatments for mite control are recommended.

Major difficulty has been faced in controlling overwintering mites of the family Eriophyidae in orchards. We have had difficulty in correlating the numbers of hibernating eriophyids and the damage to be expected for the next season. Thus, early treatments with acaricides (before flowering) have been shown more effective against them. Sometimes new applications are necessary in case of severe attacks later in the season (Perju *et al*., 2001).

*Field crops (soybean)***.** Adopted ETL for *Tetranychus urticae* is five mobile mites/leaf. Usually, two–three treatments against mites have been recommended (Popov *et al*., 2007).

*Grape vine***.** The most important pests of grape vine are *T. urticae*, *Panonychus ulmi* (Koch) (Tetranychidae), *Eriophyes vitis* (Pagenstecher) (Eriophyidae) and *Phyllocoptes vitis* Nalepa (Eriophyidae). These mites are widespread in Romania, but the prevailing species vary according to adopted cultivation technology and the chemicals applied.

Long term forecast requires a consideration of the level of the overwintering populations and the forecasted climatic conditions, taking into account that optimal conditions include temperatures between 18–24°C and low rainfall. Short term forecast (for grower's warning) is accomplished based on the results of three surveys. The first is done when flower buds are opening; 40 buds from different points of one plantation are examined with a magnifying glass. The second is carried out 10–15 days before flowering, examining 40 leaves to determine levels of eggs and mobile mites, and the third is done after flowering, using a similar procedure. Treatments are recomended when the following ETLs levels are reached in each survey: 15 mites/shoot (first), 2–3 eggs and mobile mites/leaf (second) and 4–6 eggs and mobile mites/leaf (third). Usually, one-two treatments against mites have been recommended.

*Vegetables***.** *Polyphagotarsonemus latus*, a species that causes damage to field crops in the tropics, now causes severe damage to protected crops in the temperate zones. In Romania, the pest was first reported in 1976, initially in fields of southern Romania and later on pepper and tomato in greenhouses around Bucharest and Ploiesti. It has caused considerable damage to those crops in protected areas and to eggplant and peppers in open field. It has also been found on a wide range of hosts, including ornamentals as *Begonia, Chrysanthemum*, *Gerbera* and *Petunia*.

For effective control in the field, a preventive treatment of seedlings 2–3 days before planting is necessary, to reduce the risk of infestation with mites coming from greenhouses or other sheltered areas. This preventive measure can reduce mite problem on pepper and eggplant by up to 90% (Perju, 1995). Close attention must be paid afterwards, for immediate control action if the mite is found on tomato, pepper or eggplant. If the applied acaricide has no ovicidal effect, treatment should be repeated 2–3 times, after periods of 5–7 days.

Main acaricides used for mite control in Romania

Table 2 shows the main acaricides used in the main Romanian agroecosystems (Rosca & Istrate, 2009).

TABLE 2. Main acaricides approved for use in Romania by the Interministerial Commission for registration of Phytosanitary Products, under supervision of Ministry of Agriculture, Forestry and Rural Development.

Product	Dose	Pests to be controlled	Remarks
		GRAPE VINE	
Envidor 240 SC (spirodiclofen 240 g/L)	0.4 L/ha (1,000 L solution/ treatment)	Glasshouse red spider mite or two-spotted spider mite (*Tetranychus urticae*), rust mites (*Calepitrimerus vitis*)	
Omite 570 EW (propargit 570 g/L)	1.0 L/ha 0.1%	*T. urticae* Grape erineum or blister mite (*Eriophyes vitis*), *C. vitis*	
Nissorun 10 WP (hexithiazox 10%)	0.5 kg/ha	*T. urticae*	
		ORCHADS	
Envidor 240 SC (spirodiclofen 240 g/L)	0.04% (0.6 L/ha)	European red mite or fruit tree red spider mite (*Panonychus ulmi*—eggs and mobile forms), *T. urticae*, apple rust mite (*Aculus schlechtendali*)	
Nissorun 10 WP (hexithiazox 10%)	0.03%	*P. ulmi*	
Omite 570 EW (propargit 570 g/L)	0.1%	*T. urticae, P. ulmi*	
		VEGETABLES	
Envidor 240 SC (spirodiclofen 240 g/L)	0.04% (0.4 L c.p./ha)	*T. urticae*	Pepper (protected areas)
Nissorun 10 WP (hexithiazox 10%)	0.04% (0.4 kg/ha)	*T. urticae*	Pepper (protected areas)
Omite 570 EW (propargit 570 g/L)	0.1%	*T. urticae*, broad mite (*Polyphagotarsonemus latus*)	Pepper (protected areas and field)
Seizer 10 EC (bifentrin 100 g/L)	0.05%	*T. urticae*	Cucumbers (protected areas)
Envidor 240 SC (spirodiclofen 240 g/L)	0.04% (0.4 L c.p./ha)	*T. urticae*	Cucumbers (protected areas)
Nissorun 10 WP (hexithiazox 10%)	0.04% (0.4 kg c.p./ha)	*T. urticae*	Cucumbers (protected areas)
Envidor 240 SC (spirodiclofen 240 g/L)	0.04% (0.4 L c.p./ha)	*T. urticae*	Cucumbers (in thefield)
Omite 570 EW (propargit 570 g/L)	0.1%	*T. urticae, P. latus*	Cucumbers (in protected areas and field)
		SOYBEAN	
Envidor 240 SC (spirodiclofen 240 g/L)	0.3 L/ha	*T. urticae*	
Omite 570 EW (propargit 570 g/L)	0.8 L/ha	*T. urticae*	
Nissorun 10 WP (hexithiazox 10%)	0.4 kg/ha	*T. urticae*	

Regulation of plant protection products in Europe and Romania under the authorization Directive 91/414/EEC

In Romania, Council Directive 91/414/EEC harmonizes the regulation of plant protection products, including acaricides, with regulations adopted by the European Community (EC). This was achieved by establishing agreed criteria about the safety of active substances as well as on their effectiveness. The Directive sets out a two-stage assessment system: harmonizing the process for considering the safety of active substances at an EC level, and once safety of the active substance has been established, allowing product authorizations to be considered at a national level using the established harmonized criteria.

The key points of the Directive are that it provides for the following: establishment of a list of active substances (which forms 'Annex I' of the Directive) that have been shown to be without unacceptable risk to people or the environment; a mechanism for adding active substances to Annex I either as existing active substances are reviewed (under the European Commission Review Programme) or as new ones are authorized; a harmonized authorization process for the marketing and use of plant protection products by Member States only after an active substance is included in Annex I, except where transitional arrangements apply. A re-registration process operates for products already in the market that contain active substance newly included in Annex I. Commission Directive 2010/25/EU of 18 March 2010 amended Council Directive 91/414/EEC to include penoxsulam, proquinazid and spirodiclofen as active substances. Following that determination, Romania shall (in the case of six products containing spirodiclofen as the only active substance, where necessary, amend or withdraw the authorization by 31 January 2012 at the latest (see Commission Directive 2010/25/E, 2010). Causes of decreasing numbers of acaricide products or active ingredients in Romania as well as all over Europe are the reduced availability of active ingredients due to toxicological or environmental reasons and the high cost of authorization for file preparation (especially for products with expected low sale, as those for "niche" application, for which return on investment is long and uncertain). For instance, products of Nihon Nohyaku Company against mites are no longer permitted in Romania (the company has no interest on extending the use) but they are approved for use in the EU. Only three acaricides (Envidor 240 SC, Nissorun 10 WP and Omite 570 EC) and one insecticide/acaricide (Seizer 10 EC) are at present commonly used in Romanian agriculture. At the same time, from the economic point of view, biological control is impractical if not impossible to be applied in commercial crop production under Romanian economical conditions of farmers in absence of subsidies.

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