DROUGHT EFFECT ON PEST ATTACK IN FIELD CROPS

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ABSTRACT

The paper presents a synthesis regarding the evolution of some pest species, favoured by dry and warm weather in field crops.
Data on maize leaf weevil, sunn pest populations, wheat thrips, wheat stem sawflies, some aphids and cicads, ground flea beetle are presented to illustrate the weather influence. The data show the favourable effect of drought on these pests attack. The attack values were increased under conditions of dry and warm weather as compared with conditions of cold and wet weather.
To diminish the drought impact on pests attack, satisfactory results were obtained by the application of seed chemical treatment for soil pests and by the application of modern crop technologies for other pests.

Key words: drought, field crops, pests

INTRODUCTION

The evolution of invertebrates, including insects, is strongly influenced by the ecological factors, especially temperature, closely linked with air humidity and soil moisture (Arion, 1957; Manolache and Boguleanu, 1967; Ghizdavu et al., 1997; Bărbulescu et al., 2002). As hetero-thermal animals, insects have variable body temperature, depending on the temperature of environment, in which they live, and the temperature changes influence both body temperature and all vital processes, including the attack on plants and the damage level. Similarly, the humidity directly or indirectly influences the insects modifying the behaviour and prolificacy. The influence of these factors on pests is species-dependant: there are species, at which the evolution and especially the attack are favourably influenced by wet and cold weather, as well as species which are favourably influenced by dry and warm weather (Popov, 1979; Boguleanu et al., 1980; Ghizdavu et al., 1997; Bărbulescu et al., 2002). The humidity deficit and high temperatures intensify the pest attack, and due to plant debility, the feeding increases to cover the nutrient and water needs, increased by the hydric disequilibrium (Baniţă et al., 1996, 1999; Bărbulescu, 1972; Bărbulescu et al., 1984-2001; Popov, 1977, 1991, 2003a,b; Popov et al., 1983, 2003).

MATERIAL AND METHODS

In the last half of the century, researches were performed at NARDI Fundulea, as well as at the research stations from South Romania, with frequent drought conditions. The behaviour of the following main pests was tested: *Tanymecus dilaticollis* in maize; *Eurygaster integriceps, Haplothrips tritici, Macrosiphum avenae, Schizaphis graminum*, *Rhopalosiphum* spp., *Macrosteles sexnotatus, Psammotettix* spp.*, Javessela pelucida*, *Cephus pygmaeus, Trachelus tabidus* in wheat; *Aphtona euphorbiae* in linseed; *Brevicorynae brassicae* in rape. For each pest and crop, the work method was different, having in view the evolution of biological cycle and the way of attack, as well as the fluctuation of population level depending on the climatic factor (Baniţă et al., 1996; Bărbulescu, 1972; Bărbulescu et al., 1984-2001; Popov, 1977, 1979, 1991, 2004; Popov et al., 1985, 1988, 2003, 2004).

RESULTS AND DISCUSSION

In order to emphasize the way in which the drought influences the pest evolution, we present data about the attack produced by the main pests under the above mentioned conditions.

The sunn pest (*Eurygaster integriceps*) is one of the main pest of South and East of Romania, the attack by larvae and, under certain conditions, by adults contributing to quantitative and qualitative yield reduction. There is a disordered periodicity in the population level of this pest (Bărbulescu, 1973; Popov, 1977, 1979; Popov et al., 2003). After a continuous increase of population level which reaches high densities causing high wheat yield losses, a depression period follows, the population level diminishing very much. Among the years with massive occurrences, we notice: 1964 (Paulian and Bărbulescu, 1970); 1985, 1986 (Bărbulescu et al., 1986, 1987) and especially 1996 (Bărbulescu et al., 1997; Popov et al., 1997, 1998) and the critical year 2003 (Popov, 2003a).

In 1996, although the population level was not too high, 2-5 individuals/m^2, the adult attack was extremely strong especially for wheat in emergence-tillering stage.

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Because the adult attack of 1996 was so strong (Bărbulescu et al., 1997), it is necessary to present in details the factors which determined the attack occurrence under the conditions of an atypical year from the viewpoint of drought effect on sunn pest adults.

The factors which influenced the attack intensity in the South Romania, in 1996, were:

- late emergence of wheat in autumn but especially in spring;
- continuous snow layer (beginning of November end of April), without days with temperatures adequate for crop emergence;
- strong soil compaction, which unfavourably affected the wheat root growth in spring;
- very late spring with sudden warming and without rainfall, which did not allow the vegetation recovering and increased the plant debility;
- wheat plants were stressed due to high temperatures, heat and superficial root system;
- increased aggressiveness of adults due to high temperatures.

In the agricultural year 2002-2003, the small grains, especially wheat, were dramatically influenced by the evolution of climate, which amplified the presence and attack of sunn pest, as well as of other insects such as cereals flies, wheat thrips or oats beetle, although these caused less significant damages.

In the case of sunn pest, the high population biological reserve in autumn, illustrated by an increased density in forests (6.23 individuals/m^2 as compared with 3.11 in 2002 and 2.14 in 2001), as well as a normal mortality of 17.7% in winter (as compared with 21.1% in 2001 and 10.6% in 2002), with no influence on population level were already a cause for concern. However, the virulent adult attack manifestation, caused by environmental factors which influenced especially the plant but also the pest biological cycle, substantially exceeded the expectations.

Several peculiarities of the 2003 wheat crop determined important consequences: reduction of cultivated areas, especially in the South-eastern of Romania, where many fields were abandoned; reduced plot density/m^2, below normal limits, determined by many factors such as: poor plant establishment; plant losses due to frost, water logging, weak root system, no tilling; late vegetation due to prolonged cold intervals; very late springtime which did not allow the recovering of vegetation and acelerated the plant debility, sudden warming and no rainfalls; stagnation of growth determined by the lack of moisture around the roots, inefficient development of root system, by plant losses determined by soil crust as well as by attacks produced by some pests (cereal flies, thrips or oat beetle); high temperatures at the end of April and beginning of May (37.5^{0}C, on 3rd May at Călăraşi, multiannual maximum) which accentuated the weakness of the crop.

Under these conditions, the spring migration of sunn pests, from forests to fields was rapid and, in a short interval, on whole cultivation area. A strong aggressiveness of adults was noticed, determined by:

- higher density of adults into crop as compared with previous years;
- the disparity between the early attack time of adults and the wheat late vegetation stage, reduced growth and hydric disequilibrium;
- increased aggressiveness of each adult, due to high temperatures which determined an excessively active rearing to cover both nutrient and water needs.

Having in view the elements which characterized the plant/pest relation, in 2003, a rapid intervention to control the sunn pest adults and an EDT lower than normal were recommended: 5 individuals/m^2 for crops with normal density and vegetation stage, and below 5 individuals/m^2 for crops with reduced density, weak tillering and growth. Thus, in 2003, the treatment against adults was necessary on all areas from the South of Romania, even for 1 individual/m^2, and the late chemical application had strong negative effects. The percentage of the attacked straws was very high (Tables 1 and 2) at both shooting-boot stage for crops (Table 3) with reduced density and delayed vegetation. The reproduction ability (Table 4) is strongly influenced by temperature and rainfall, determining the variable level of populations and implicitly of attack and damages (Popov et al., 1997).

The negative impact of larvae and new adult attack on wheat quality is well-known.

To reduce this impact, chemical treatments on all cultivation areas with sunn pest densities over the EDT are required.

What is the significance of EDT? Normally, depending on many factors, such as wheat cultivar, vegetation and climate conditions, fertilization, the yield quality is not affected by a percent of up to 2% pricked grains.

Table 1. Effect of wheat vegetation stage and density on attack of sunn pest (*Eurygaster integriceps*) adults, in South Romania, 1996

Vegetation stage	Plant density/ m²	Attacked plant (%)
Emergence- tilling	250-300	90-100
	450-500	70-90
Shooting-boot stage	200-250	75-80
	350-400	50-70
	550-650	20-40

Under Romanian conditions, the EDT of wheat is 5 individuals/m^2 with no serious implications on quality. For wheat seed multiplication, EDT is 3 individuals/m^2. Over these values of EDT, all areas with higher density levels must be protected by chemical treatments. This EDT level, is established based on the fact that, during its development, an insect usually pricks 45-50 grains. At an yield of 4.5-5 t/ha, the damage is 0.4% pricked grains. By a correct warning and by the chemical application under the best conditions, the crop is protected against sunn pest attack.

Table 2. Attack of sunn pest (*Eurygaster integriceps)* adults in wheat depending on the pest density/m² and ecological conditions

Specification	Ecological conditions	Density (adults/m²)	Total attack (%) (leaves, stems, ears)
Romania (1973)	normal	2	1.8 – 5.9
		5	4.0 – 9.0
		20 (experimental)	10.9 – 23.1
Bulgaria (1969)	normal	2	5.6
		5	10.4
		30 (experimental)	16.0
Romania (1996)	extremely unfavourable	2 – 5	20 – 100
Romania (2000)	normal	2 - 7	3 – 10
Romania (2003)	extremely unfavourable	2 - 8	30 - 100

Table 3. Attack of sunn pest (*Eurygaster integriceps)* adults depending on vegetation stage and plant density under various climatic conditions in the South Romania

Vegetation stage	1996 (excessive drought)		2000 (normal climatic conditions)		2003 (excessive drought)	
	plants/ m²	Attacked plants %	plants/ m²	Attacked plants %	plants/ m²	Attacked plants %
Emergence-tilling	250-300	90-100	350-400	7-12	150-200	90-100
	450-500	70-90	450-500	4-8	250-400	80-95
Shooting-boot stage	200-250	75-80	350-400	5-10	150-200	60-70
	350-400	50-70	450-550	3-7	250-400	25-55
	550-650	20-40	600-700	2-5	-	-

Table 4. Reproduction ability of *Eurygaster integriceps* in different years, as compared with multiannual average 1970-2005, on NARDI Fundulea area

Year	Prolificacy (egg/female)		
	Under field conditions	Under controlled conditions	
		average	maximum
1970 - 2005	41,0	58,4	311
Climatic conditions favourable to the pest			
1986	56,3	71,3	298
1996	47,1	69,9	302
2002	50,4	65,7	271
Climatic conditions unfavourable to the pest			
1972	27,4	33,2	103
1989	18,8	27,1	87
1998	37,5	53,8	209
2005	31,8	49,4	165

To protect the yield of 2003 against the sunn pest attack, the choice of EDT was very important, due to crop state and pest density. In areas in which the crops had a normal evolution, the EDT was 5 individuals/m^2 and 2 individuals/m^2 for seed multiplication crops. But, on large areas, the plant density was much reduced, with a predicted lower yield. Under those circumstances, to save the yield quality, the chemical treatments were necessary at a lower than normal EDT. Although the chemical treatments against adults were applied on large areas, the level of larvae populations was high, over EDT, on all areas. In the case of late chemical treatment application, at the half of May, the density of pest was over 10 viable egg laying, which means, a potential of tens larvae/m^2, much over the EDT. Also, due to very high temperatures, the eclosion of larvae began early (5th-8th May), leading to rapid larvae evolution. By this early biological cycle, in relation with the host plant phenology, the insect rearing began on grains from the first developmental stages, amplifying, in this way, the negative impact on yield and quality.

Taking into consideration the elements which characterized the host plant-pest relation in 2003, the chemical treatments were rapidly applied on all damaged areas. The decision to apply chemicals on certain areas was difficult due to a reduced yield level, sometimes below 1,000 kg/ha, the treatment cost being too high as compared with the expected income.

The wheat thrips (*Haplothrips tritici*) is a common pest in Romania, especially in the South, but usually with no significant damages. However, under excessive drought conditions, the damages could be significant, as it was in 1996, when, due to reduced plant densities, the adult thrip attack was significant (Bărbulescu et al., 1997).

The aphids (*Macrosiphum avenae, Schizaphis graminum, Rhopalosiphum* spp.) and **cicads** (*Macrosteles sexnotatus, Psammotettix* spp., *Javesella pelucida*) could be dangerous pests in small grains under favourable conditions of temperature and heat, immediately after plant emergence. It is known that drought is present in most autumns in the South, and the early sowing and emergence of wheat and barley could coincide with the optimum pest flight. Under these circumstances, the damages could be direct, by plant pricking and vacuolar juice suckling, or indirect, as vectors of various virus diseases and mycoplasms (Bărbulescu et al., 1984-2001; Nicolae et al., 1980; Popov, 1984; Popov et al., 1983, 1988; Sin et al., 1982). This kind of situations was frequently registered during 1978-1983, because of farmers tendency to plant earlier, fact that required chemical treatment application in autumn, on about 200,000 ha.

Wheat stem sawflies (*Cephus pygmaeus* and *Trachelus tabidus*). *Trachelus tabidus*, prevalent in Middle and Near East, is now frequently spread North of Danube (Baniță et al., 1996, 1999). If, in the first half of the last century, *Cephus pygmaeus* was prevalent in Romania, presently, *Trachelus tabidus* is constant and prevalent, from Dolj County to the Black Sea (Table 5). This indicates a trend to aridity in South Romania.

Table 5. Structure of stem sawflies populations (*Cephus pygmaeus* and *Trachelus tabidus*) in various areas (average 1998-2004)

Locality / County	*Trachelus tabidus (%)*	*Cephus pygmaeus (%)*
Simnic/Dolj	72,4	27,6
Valu lui Traian, Constanța	67,8	32,2
Caracal/Olt	66,4	33,6
Fundulea/Călăraşi	55,0	45,0
Albota/Argeş	30,6	69,4
Podul Iloaiei/Iaşi	9,7	90,3

From table 6, one can see that, one of the explanations is the more rapid adult occurrence of *Trachelus tabidus* in spring, almost ten days earlier as compared to *Cephus pygmaeus*. This phenomenon is favoured by the early springs of the last years, such as 2002, 2003 (very dry year) and 2004 (extremely wet year).

In the case of **carabid beetle** (*Zabrus tenebrioides*), one of the most effective and cheap methods to prevent the pest attack is the crop rotation, by limiting small grain monoculture. But, due to various factors, more or less objective, monoculture is hard to avoid, and wheat or barley monoculture can be found on 800,000-1,000,000 ha each year. This situation correlated with climatic conditions very favourable to pest development, leads to relatively strong attacks of *Zabrus temebrioides* in Romania.

Table 6. Flight dynamics of stem sawflies (*Cephus pygmaeus* and *Trachelus tabidus*) in 2001 and 2004

Date	*Trachelus tabidus* (%)				*Cephus pygmaeus* (%)			
	2001	2002	2003	2004	2001	2002	2003	2004
30 March	-	3	9	-	-	-	-	-
2 April	-	7	21	-	-	-	5	-
7 April	1	11	36	-	-	3	8	-
11 April	4	24	58	5	1	5	14	3
15 April	6	38	63	8	3	8	27	7
20 April	10	44	70	16	5	17	36	14
27 April	16	63	83	37	10	26	43	24
4 May	43	76	88	45	21	31	60	33
9 May	48	88	97	57	33	38	68	46
12 May	54	91	98	68	39	49	75	56
19 May	69	96	100	79	55	67	83	60
21 May	79	98	-	84	74	78	90	78
30 May	89	100	-	93	80	91	96	84
2 June	98	-	-	99	92	99	100	89
7 June	100	-	-	100	97	100	-	93
12 June	-	-	-		99	-	-	99
19 June	-	-	-		100	-	-	100

The pest is difficult to control, due to prolonged rearing and harmfulness period of larvae, from October to the beginning of May. The high adaptation of carabid beetle biology to host-plant phenology and the significant role of humidity in its evolution are well-known. The biological cycle begins during winter cereals sowing-emergence stage, with egg laying, and the larvae occurrence and development coincide with the first stages of plant development. Under normal climatic conditions, with high soil moisture, the attack is more harmful when the rearing of larvae begins earlier, after plant emergence, and young plantlets are rapidly destroyed before shooting. Under these circumstances, spots that are completely destroyed occur until winter. In the years with dry autumns, the dry soil makes larvae rearing and development more difficult and the attack occurs later, after the first rains, with no obvious damages. The late attack in spring, is less visible, because the plants have a high biomass, fact that camouflages the damage and ensures a better survival of the attacked plants. If the emergence took place in winter, during January-February, partially at the beginning of March, the feeding takes place on weak plants, and the attack is also strong. Another atypical situation, can be found in early winters, with extremely cold temperatures at the end of November, and frozen soil till the last decade of April, when, the attack is very late but extremely virulent on untreated areas. One can conclude that the carabid beetle attack is under a very strong influence of climatic factors.

Table 7 shows that the attack produced by carabid beetle larvae during the last years, was extremely diversified, most damages being recorded in spring, as a consequence of the dry climate, which did not allow a normal evolution of crops and implicitly a normal rearing of larvae.

Table 7. Influence of climatic factors on attack of carabid beetle (*Zabrus tenebrioides*) larvae, during 1995-2003

Agricultural year	Area of surrounding ARDS:				
	Fundulea	Caracal	Simnic	Secuieni	Oradea
1995 in autumn	low	rare	low	no influence	rare
1996 in spring	variable	February-March	February-March	March	March-April
1996 in autumn	rare	rare	rare	rare	variable
1997 in spring	February-March	March	March-April	February-March	February-March
1997 in autumn	No influence	rare	No influence	No influence	No influence
1998 in spring	March	March	March-April	February-March	April
1998 in autumn	low	No influence	Rare	No influence	Rare
1999 in spring	March	March	March-April	February-March	April
1999 in autumn	No influence	variable	No influence	Low	No influence

2000 in spring	18 March - 14 April	April	March-April	15.March-8.April	April
2000 in autumn	Rare	No influence	Low	Variable	No influence
2001 in spring	22.March-4.April	March-April	March-April	25.March-9.April	April
2001 in autumn	No influence	Rare	No influence	Low	No influence
2002 in spring	12.April-5.May	20.March-18.April	27.March-3.May	April	April
2002 in autumn	No influence	variable	No influence	No influence	variable
2003 in spring	20.April-3.May	17.April-6.May	8.April-30.April	23.April-10.May	April

Note: rare/variable attack: attack recorded only in early crops

Under these conditions, the protection against carabid beetle could only be achieved at an optimum level, by preventive chemical treatments applied to wheat, barley, rye or triticale seeds, with a product which could ensure an adequate protection during long time, from October to April.

Maize leaf weevil (*Tanymecus dilaticollis*) represents the main harmful pest of maize and sunflower crops. The attack produced in the first vegetation stages, frequently leads to the yield reduction or crop destruction (Paulian, 1973, 1978; Bărbulescu et al., 2002).

Being a thermo- and xerophilous insect, spread especially in arid and semi-arid areas of Romania, the adults are very active at high temperatures and low humidity while the low temperatures and high rainfall interfere very much with their activity.

The data from table 8 obviously show the rainfall effect on the attack produced by maize leaf weevil. Based on a scale of attack from 1 to 9, in which 1 = no attack and 9 = completely destroyed plant, in 1985, 1986, 1989, 1995, due to reduced rainfall, the attack was very strong, with maximum or close to maximum values. However, in 1984, 1999, 2000, higher rainfall reduced the attack. The same differentiation of the attack values was noticed in the case of saved plants, too. In years in which, the attack intensity was very high, the percentage of saved plants was very low or the crop was completely destroyed while in years with higher rainfall, the ratio of saved plants was higher (Bărbulescu et al., 1984-2001). Seed treatments with recommended systemic insecticides significantly reduced the attack, up to 100% of the plants being saved.

Table 8. Influence of climatic factors on maize leaf weevil (*Tanymecus dilaticollis*) attack (Fundulea area) during 1984-2003

Year	Attack intensity (1 – 9)		Saved plants (%)		Rainfall (mm)			
	Untreated	Treated	Untreated	Treated	April	May		Total
					III	I	II	
1984	4.9	1.5	72	100	21.0	0.2	31.4	52.6
1985	8.9	4.7	2	80	2.7	0	4.2	6.9
1986	8.5	3.2	12	99	6.0	4.1	7.7	17.8
1989	9.0	3.2	0	100	2.3	12.2	8.1	22.6
1994	8.7	3.0	10	100	6.7	2.5	2.3	11.5
1995	8.4	3.1	9	98	4.1	7.1	18.2	29.4
1999	4.3	2.9	90	100	48.9	12.0	36.7	97.6
2000	5.7	2.8	67	100	40.4	2.4	25.3	68.1
2001	4.8	2.4	86	100	3.2	19.1	13.0	35.3
2002	7.6	3.2	20	93	8.9	0.0	0.9	9.8
2003	7.8	3.3	43	94	5.8	0.1	0.0	5.9

Green bug aphid (*Schizaphis graminum*) control can be decisive for the success of the sorghum for grain crops in Romania (Bărbulescu, 1972). The data from table 9, recorded in the first years of sorghum for grain cultivation in Romania, under conditions of a very strong attack, show that, during maximum occurrence of pest (June), the average values of aphid density per plant were influenced by temperature and humidity.

Thus, in 1963 and especially in 1968, 248, respectively 325 aphids/plant, were recorded vs. 59, respectively 66 aphids/plant, in 1966 and 1969. This difference of aphid population level depended on the climatic conditions: in years with high temperatures and low humidity the aphid density per plant was higher, while in years with low temperatures and high humidity the aphid density per plant was smaller (Sin et al., 1982).

Flea beetles (*Aphtona euphorbiae*) is the main pest of linseed crop in Romania, especially during the first vegetation stages, leading to strong seed and fiber yield reduction (Brudea et al., 1982; Gheorghe et al., 1985; Voicu et al., 1997).

Table 10 presents data regarding this pest attack during several years with representative values (Bărbulescu et al., 1984, 1986, 1987, 1990, 1991, 1992). The attack produced by flea beetle varied widely depending on the climatic conditions. Thus, high values of attack were recorded in 1983, 1985, 1986, 1989, 1990 due to higher temperatures and low rainfall while in 1991, the attack was reduced due to cold and wet weather during pest occurrence and attack. Treatments with approved systemic chemicals significantly reduced the attack, ensuring a good protection of plantlets against flea beetle even in the case of a strong attack.

Cabbage aphid (*Brevicorynae brassicae*) produces significant damages in rape crops. Grown on increasing areas in recent years, rape is confronted with a strong aphid attack, determined by excessive drought which encourages a high pest proliferation.

Thus, the aphid densities in 2001 were, in some cases of several thousands per plant, requiring chemical treatments on large areas. Because, the most dangerous effect of attack takes place especially during the first vegetation stages, it is necessary to correctly apply the seed treatment with approved systemic insecticides, to reduce the drought influence on attack. Correct crop management practices can help plants to better resist some pests attack by reducing the drought stress.

As a conclusion, the drought obviously affects the above mentioned pest attacks, increasing this effect on the crops.

The drought produces the same effect, in the case of other harmful pests too, such as beet rot weevil (*Bothynoderes punctiventris*), sugar beet flea beetle (*Chaetocnema tibialis*), turnip flea beetle (*Phyllotreta atra*), hop flea beetle (*Psylliodes attenuata*), oats beetle (*Lema melanopa*), as well as defoliation *Lepidoptera,* especially in alfalfa, sunflower and soybean.

Table 9. Influence of temperature and humidity on green bug aphid (*Schizaphis graminum*) density during maximum occurrence, 1-30 June

Year	Average aphid (density/plant)	Average temperature (°C)			Air relative humidity (%)	Rainfall (mm)
		Min.	Max.	Average		
1963	248	13.4	28.1	20.8	62	30.3
1966	59	12.4	24.7	18.7	71	69.1
1967	145	12.4	25.6	18.9	77	55.6
1968	325	13.7	28.8	21.4	65	25.5
1969	66	13.9	25.2	19.3	87	216.6

Table 10. Influence of temperature and humidity on flea beetle (A*phtona euphorbiae*) attack at NARDI Fundulea

Year	Attack degree (%)		Average temperature (°C)			Rainfall (mm)		
	Untreated	Treated	April	May	Average	April	May	Total
1983	25.5	7.0	12.7	18.0	15.3	21.0	48.7	70
1985	21.0	1.0	12.4	19.3	15.8	6.5	10.9	17
1986	18.5	1.7	13.1	17.7	15.4	29.0	18.9	48
1989	15.5	1.0	13.5	16.0	14.7	45.9	27.2	73
1990	18.5	8.0	11.0	16.4	15.7	37.6	70.3	108
1991	9.5	0.5	10.1	14.0	12.0	70.9	181.7	253

CONCLUSIONS

Main field crops (maize, sorghum, small grains, sunflower, rape, soybean) are always attacked by many harmful insects. Drought conditions, especially in the South of the country, encourage the population development and their attack, amplifying the yield losses; higher aggressiveness of the insects is determined by the increased need to extract water, from weak plants.

In maize and sunflower, the warm and dry weather during germination-emergence, obviously influences the attack of maize leaf weevil (*Tanymecus dilaticollis*), its virulence leading to the crop destruction on large areas.

The attack produced by sunn pests of cereals is strongly influenced by the climatic conditions during April-May; the drought effect amplify damages up to wheat crop destruction on large areas.

The drought has the same amplifying effect on the attack of other pests in small grains (thrips, aphids, cicads, stem sawflies), sorghum (green bug aphid), linseed (flea beetle) or rape (cabbage aphid).

Good results in reducing the drought effect on soil pest attack are obtained by the seed chemical treatment with approved systemic insecticides with a good solubility.

Correct crop management practices could contribute to the alleviation of drought effect on pest aggressiveness.

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