

Relationships between parasitoid complexes which limits the populations of *Pieris brassicae* Linné, 1758 and *Pieris rapae* Linné, 1758 (Lepidoptera: Pieridae), pests in cabbage crops from South-Eastern Rumania

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Rezumat

Relațiile dintre complexe de parazitoizi care limitează populațiile de *Pieris brassicae* Linné, 1758 și *P. rapae* Linné, 1758 (Lepidoptera: Pieridae) dăunătoare în culturile de varză din sud-estul României

Lucrarea prezintă rezultatul studiului privind complexe de parazitoizi primari care intervin în controlul natural a două specii de Pieridae (*Pieris brassicae* și *Pieris rapae*) dăunătoare culturilor de varză din sud-estul României. Pe parcursul perioadei 1998-2001 au fost identificate 5 specii de parazitoizi primari pentru *Pieris brassicae* L și 8 specii pentru *Pieris rapae* L.

Comparativ cu cercetările de acum 30 de ani, în zona Moldovei, numărul speciilor de parazitoizi primari s-a redus dar eficiența în controlul natural a speciilor rămase este crescută astfel încât există un echilibru între atacul dăunătorului și acțiunea limitativă a complexului parazitar. Studiile desfășurate indică drept specii cu rol major în limitarea dăunătorului *Pieris brassicae*: la nivel de ouă - *Trichogramma evanescens* Westwood, 1833 iar la nivelul larvelor *Cotesia glomerata* Linné, 1758. În cazul speciei *Pieris rapae* rolul dominant l-au avut *Cotesia rubecula* Marshall, 1885 și *Hyposoter ebeninus* Gravenhorst, 1829.

Este analizată relația dintre densitatea larvelor de Pieridae și rata parazitării precum și abundența, dominanța și constanța speciilor de parazitoizi primari.

Keywords: Pieridae, cabbage crops, primary parasitoid complexes, host-parasitoid relationship

Introduction

Pieris brassicae and *Pieris rapae* (Pieridae) are some of the most frequent pest of cabbage crops alongside *Mamestra brassicae* Linné, 1758 (Noctuidae) and *Plutella xylostella* Linné, 1758 (Plutellidae).

Studies showed that the first success in naturally limiting the Pieridae pests, especially for *Pieris brassicae*, was made for the climate in Romania, primarily Moldavia, 30 years ago (MUSTAȚĂ 1973, MUSTAȚĂ & ANDRIESCU 1972-1973).

This work presents the role of parasitoid complexes relevant for Pieridae species –pest of cabbage crops in South East of Romania in 1998-2001. The *Pieris brassicae* has 3 generations and *Pieris rapae* - 4 generations and large usage of pesticide in late years has destroyed not just the pest but also the predators and parasitoids.

Materials and methods

The study regarding the parasitoid complexes which limit the population of Lepidoptera species, pest to cabbage crops in South East of Romania, was taken between 1998-2001 in a number of 33 stations and 54 collection data (fig.1).

Among these, in 16 stations (26 collection data) *Pieris brassicae* has been identified and in 24 stations (43 collection data) *Pieris rapae* has been identified.

The Pieridae species have been collected as eggs, larvae and pupae but their presence has been identified also based on specific parasitoids found on plants.

In the lab different species of parasitoids have been obtained through eggs, larvae and pupae.

The data we obtained following our collection from the field has been presented in the form



Fig. 1. South - Eastern Romania with sampling sites:

1 - Gănești, 2 - Tg. Bujor, 3 - Umbrărești, 4 - Costachi Negri, 5- Slobozia Conachi, 6 - Suhurlui, 7- Liești, 8 - Vameș, 9 - Sere Galați, 10 - Șendreni (Galați county); 11 - Smârdan, 12 - Cetatea Dinogetia, 13 - Garvăn, 14 - Văcăreni, 15 - Luncavița, 16 - Gaugagia, 17 - Baia, 18 - Alba (Tulcea county); 19 - Ieșire Brăila, 20 - Baldovinești, 21 - Insula Mica a Brăilei, 22 - Mărașu (Brăila county); 23 - Poiana, 24 - Agigea (Constanța county).

which gives a qualitative impression of the relationship between parasitism and pest density, which may be compared with patterns from other sites. For parasitoid species, abundance, constancy and dominance are analyzed.

All chalcidoid species were identified by Dr. I. ANDRIESCU, tachinids by Dr. H.P. TSCHORSNIG and braconids by Dr. A. LOZAN.

Results

6 pest Lepidoptera species were identified in the cabbage crops in South Eastern Romania: *Pieris brassicae*, *Pieris rapae* (Pieridae), *Mamestra brassicae*, *Autographa gamma* Linné, 1758 și *Helicoverpa armigera* Hubner, 1808 (Noctuidae), *Plutella xylostella* (Plutellidae).

The Pieridae damage was ruling from among those 6 pests Lepidoptera species in the cabbage crops for the specified period, excepting 2000 year

when *Plutella xylostella* had a peak of attack.

The relationships analyzed with reference to the density of *Pieris brassicae* larvae and the percentage of parasitism shows a balance between the pest damage and limitative action of the parasitoid complexes in the first two years (Fig. 2). The parasitoid efficiency was low in the next two years (7.2% in 2000 and 9.2% in 2001) referring to a large number of affected plants (Fig. 2).

Only 5 primary parasitoid species were found from *Pieris brassicae* in 1998-2001: *Cotesia glomerata* Linné, 1758; *Cotesia rubecula* Marshall, 1885 (Braconidae); *Hyposoter ebeninus* Gravenhorst, 1829 (Ichneumonidae); *Trichogramma evanescens* Westwood, 1833 (Trichogrammatidae); *Compsilura concinnata* Meigen, 1824 (Tachinidae).

The eggs average parasitism by *Trichogramma evanescens* was 45.3%. *Cotesia glomerata* had the main part in limiting of the larvae stage and parasitisation rate varied from 71% in 2001 to 90.5% in

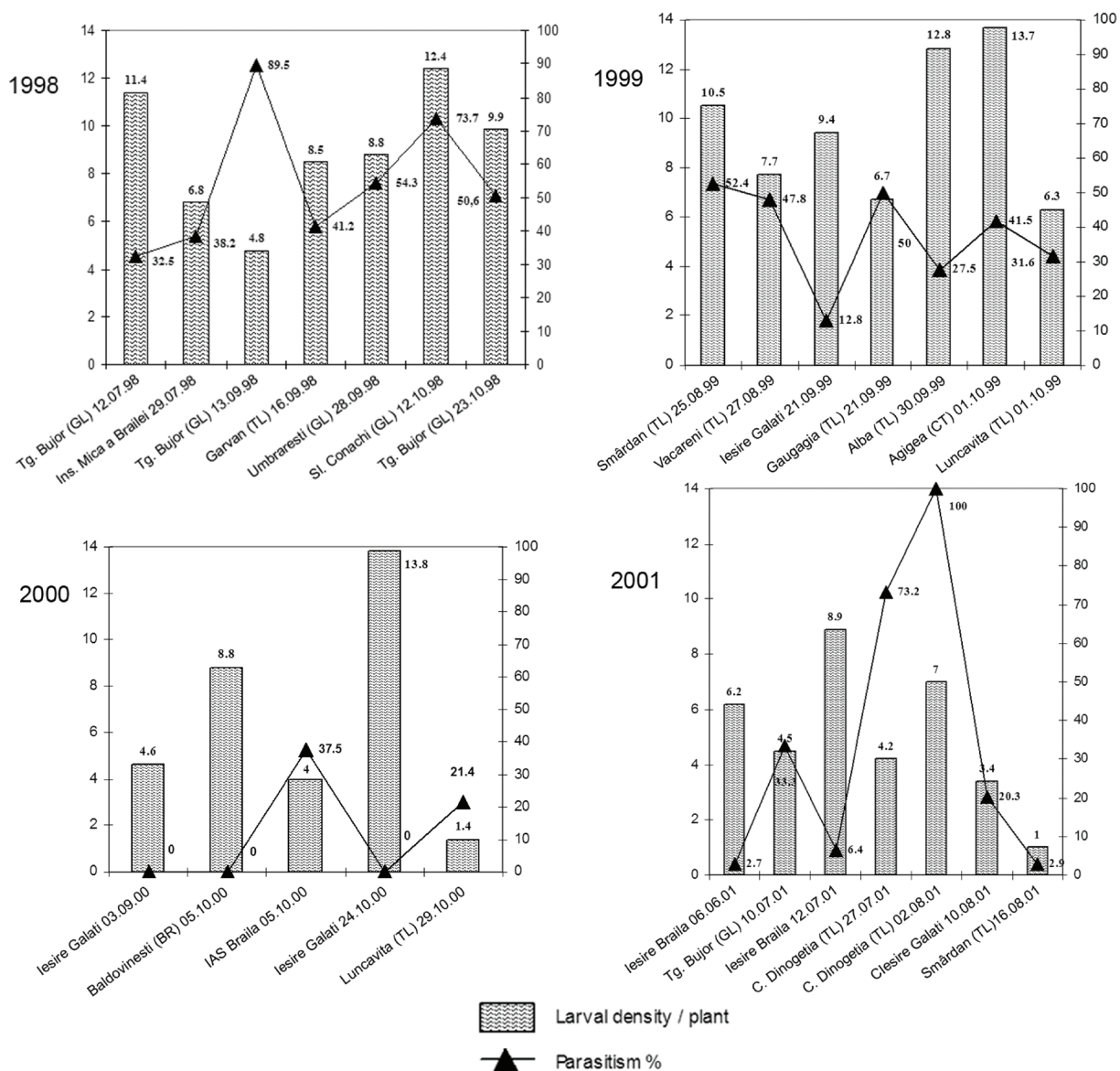


Fig. 2. Incidence of *Pieris brassicae* larval populations and parasitism per sampling dates, by its parasitoids (1998 - 2001)

2000 with an average of 82.4% (Fig 3).

Hyposoter ebeninus play a secondary role in reducing host populations while *Compsilura concinnata* and *Cotesia rubecula* assigned a minor role (Fig 3).

Data was used to calculate indices of abundance, dominance, constancy and index of ecological significance. The most abundant species was *Cotesia glomerata* and the dominant parasitoid of *Pieris brassicae* was *Cotesia glomerata* and *Hyposoter ebeninus* (Table 1). Referring to the constancy, *Cotesia glomerata* is a constant parasitoids and it was found in all cabbage fields in South Eastern Romania, wherever *Pieris brassicae* attacks cabbage (Table 1).

Studies done 30 years ago on parasitoid com-

plexes which limits the *Pieris brassicae* population (MUSTAȚĂ 1973, MUSTAȚĂ & ANDRIESCU 1972-1973) shows 21 parasitoid species of eggs larvae and pupae of this pest.

Reduction on biodiversity spectre of these complexes during 30 years has an explanation not only in the fact that it comes from different areas of the country but also in using the pesticide for chemically preventing the pests. This was required by the intensive development of agriculture in the last years.

Also, most frequent parasitism level of *Pieris brassicae* L. was recorded by *Hyposoter ebeninus* Grav. 30 years ago when, in our studies, *Cotesia glomerata* L. had the main role.

A comparative analyze between to the den-

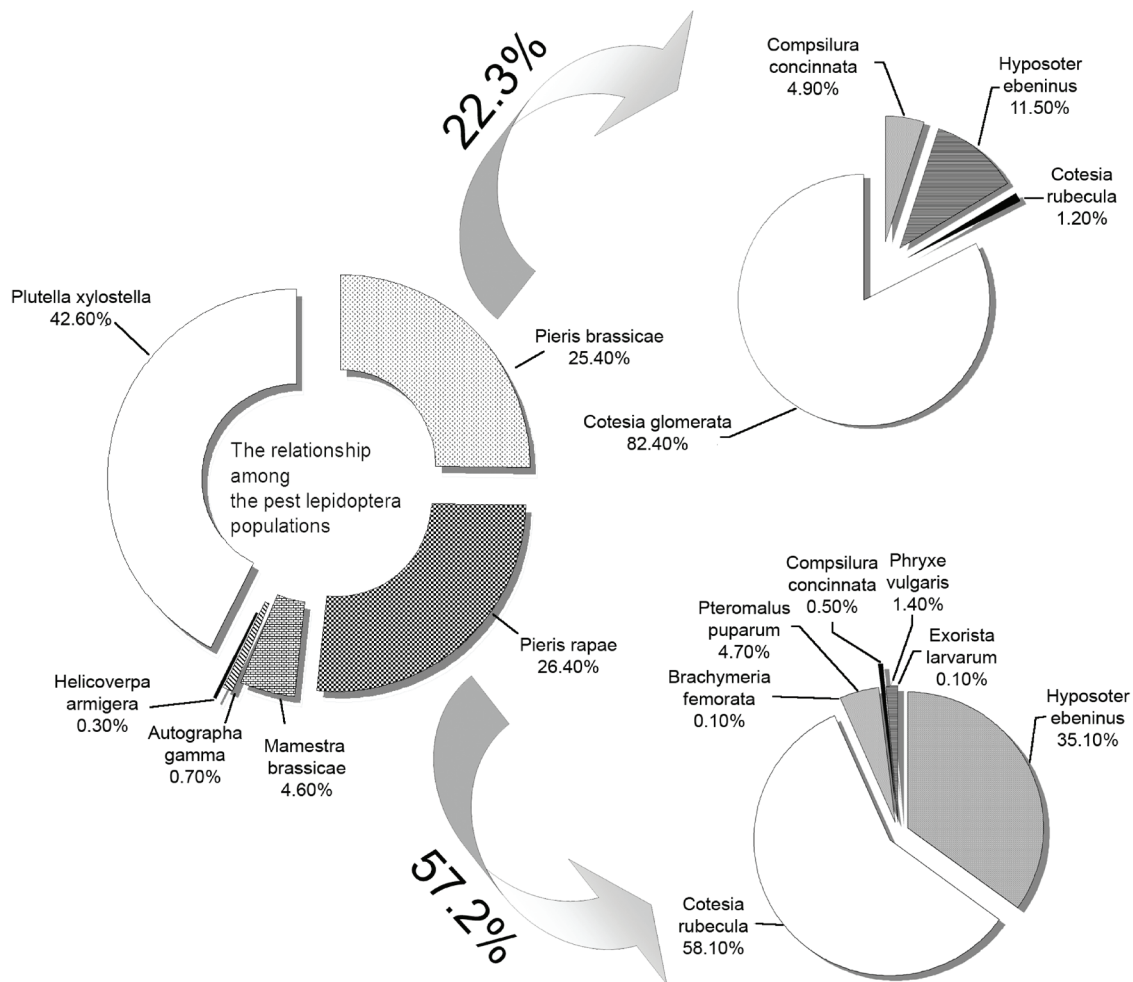


Fig. 3. The parasitoid complex that limited *Pieris brassicae* and *Pieris rapae* populations during the 1998-2001

sity of *Pieris rapae* larvae and the percentage of parasitism shows a high efficiency of the primary parasitoids. Parasitisation data were significant in Tg Bujor –Galați (12.07.1998) where at the level of density from 9 larvae per plant, the percentage of parasitism was 66.7% and from the 5.1 larvae per plant the percentage of parasitism was 91.2% (Cetatea Dinogetia – 02.08.2001) (Fig. 4).

Eight species of primary parasitoids have been identified: *Cotesia rubecula* Marshall, 1885 (Braconidae); *Hyposoter ebeninus* Gravenhorst, 1829 (Ichneumonidae); *Brachymeria femorata* Panzer, 1801 (Chalcididae); *Pteromalus puparum* Linné, 1758 (Pteromalidae); *Trichogramma evanescens* Westwood (Trichogrammatidae); *Compsilura concinnata* Meigen, 1824; *Phryxe vulgaris* Fallen, 1810; *Exorista larvarum* Linné, 1758 (Tachinidae).

***Exorista larvarum* is recorded for the first time as parasite on *Pieris rapae*. *Pieris rapae* - *Brachymeria femorata* is host-parasitoid relationship new for Romania.**

The dominant parasitoids that limit *Pieris rapae* populations was *Cotesia rubecula* and *Hyposoter ebeninus* during to the first two years but in the next period *Cotesia rubecula* become dominant (Fig. 3). During 1998-2001, 58.1% from collected larvae and pupae of *Pieris rapae* was parasitized by *Cotesia rubecula* and 35.1% by *Hyposoter ebeninus* (Fig. 3).

At the pupae level, *Pteromalus puparum* was the main primary parasitoid (Fig. 3).

Parasitism data of the eggs by *Trichogramma evanescens* were insignificant, only 15.8%.

Cotesia rubecula and *Hyposoter ebeninus* belonged to the eudominant species from the dominance point of view (Table 1). Out of the euconstant species (*Cotesia rubecula*), *Hyposoter ebeninus* was a constant parasitoid in the crops fields wherever *Pieris rapae* attacks cabbage (Table 1). Therefore a characteristic species which limit *Pieris rapae* populations, for the studied area, was *Cotesia rubecula* and *Hyposoter ebeninus* (Table 1). Those

Table 1

The syncological analysis of the parasitoid species in the Pieridae pest populations
 (A) = Abundance; (B) = Dominance; (C) = Constancy; (IES) = Index of ecological significance

<i>Pieris brassicae</i> L.					<i>Pieris rapae</i> L.				
Species	(A) No	(D) %	(C) %	(IES) %	Species	(A) No	(D) %	(C) %	(IES) %
<i>Cotesia glomerata</i>	355	82,4	80,8	66,6	<i>Cotesia rubecula</i>	667	58,1	82,6	48
<i>Hyposoter ebeninus</i>	50	11,6	38,5	4,5	<i>Hyposoter ebeninus</i>	403	35,1	71,7	25,2
<i>Compsilura concinnata</i>	21	4,9	26,9	1,3	<i>Pteromalus puparum</i>	54	4,7	26,1	1,2
<i>Cotesia rubecula</i>	5	1,2	19,2	0,2	<i>Phryxe vulgaris</i>	16	1,4	13,04	0,2
					<i>Compsilura concinnata</i>	6	0,5	6,5	0,03
					<i>Brachymeria femorata</i>	1	0,09	2,2	0,002
					<i>Exorista larvarum</i>	1	0,09	2,2	0,002

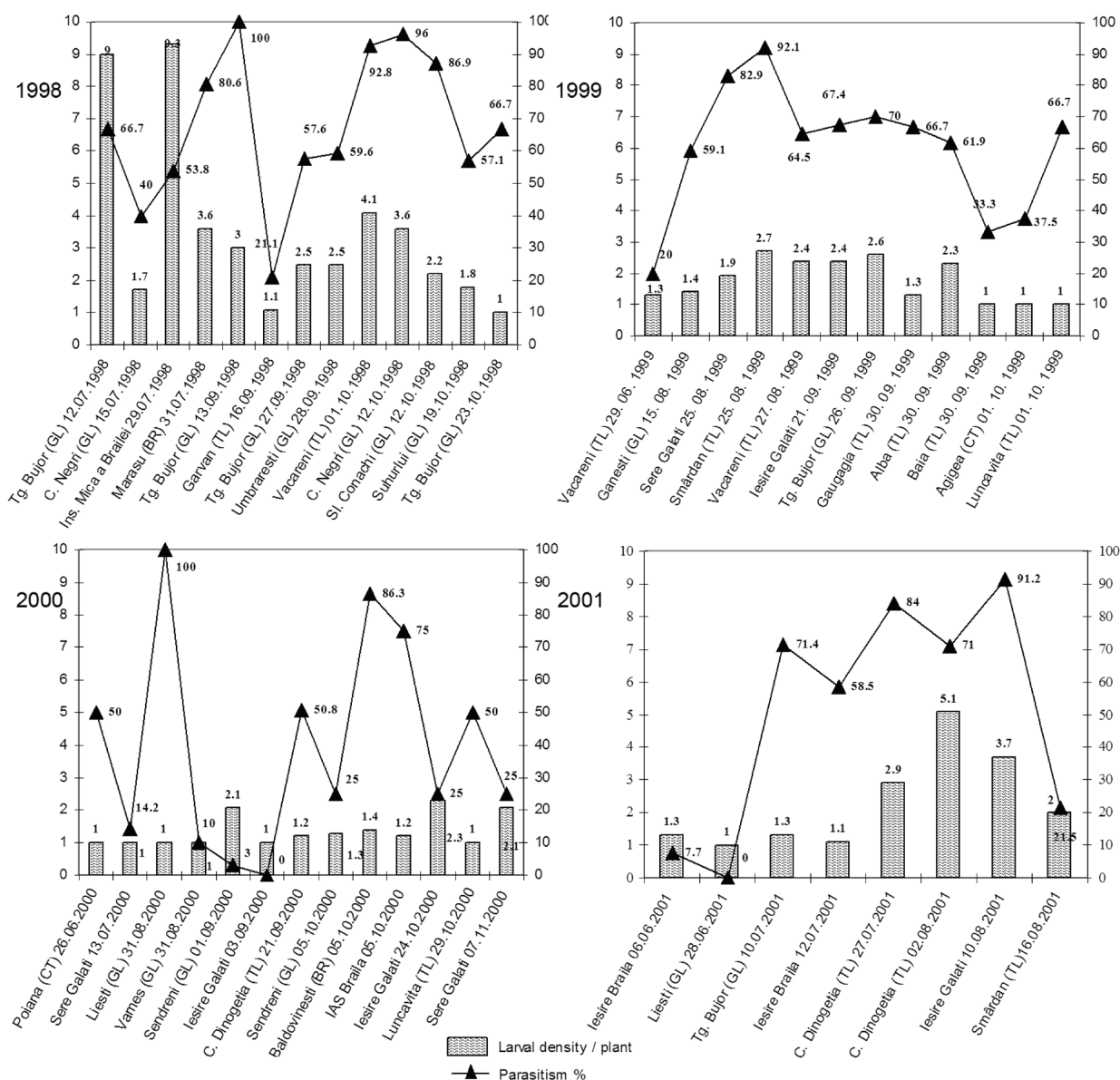


Fig. 4. Incidence of *Pieris rapae* larval populations and parasitism per sampling dates, by its parasitoids (1998 - 2001)

species play a minor role in a natural control of *Pieris rapae*.

Comparing with the research done 30 years ago, they remained typical (key) species. This has been determined by the usage of pesticide to chemically prevent the pest through the calendaristic chemical treatments due to intensive development of agriculture lately.

The parasitoid complexes belonged to the two Pieridae species are a few common species.

As far as the efficiency of the parasitisation, the results show that within complexes with less species, there are swings which tend to balance naturally the pest. This is also shown in the sites where the crops have not been treated.

Acknowledgements

I would like to thank prof. dr. I. ANDRIESCU - "Al. I. Cuza" University Iași, Romania, dr. H. P. TSCHORSNIG (Naturkundemuseum, Stuttgart, Germany) and dr. A. LOZAN – Institute of Entomology, Academy of Sciences of the Czech Republic for identifying parasitoid species and for their help in bibliographical search. I am also grateful to dr. A. RUCĂNESCU (Institute of Biological Research Cluj-Napoca, Romania) for discussions and useful suggestions.

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Received: 6.09.2004
Accepted: 10.09.2004
Printed: 25.09.2005