

Epidemiological surveillance of bluetongue in Sicily

S. Caracappa⁽¹⁾, M. Bagnato⁽²⁾, P. Sghembri⁽²⁾, A. Guercio⁽³⁾, F. Prato⁽⁴⁾, G. Tumino⁽⁵⁾, A. Migliazzo⁽⁶⁾,
F. Geraci⁽⁶⁾, S. Vullo⁽⁶⁾, S. Agnello⁽⁶⁾ & C. Di Bella⁽⁶⁾

- (1) Direzione Sanitaria, Istituto Zooprofilattico Sperimentale della Sicilia 'A. Mirri', Via G. Marinuzzi 3, 90129 Palermo, Sicily, Italy
- (2) Ispettorato Regionale Veterinario, Assessorato Regionale alla Salute Piazza Ottavio Ziino, 90100 Palermo, Sicily, Italy
- (3) Area di Diagnostica Virologica, Istituto Zooprofilattico Sperimentale della Sicilia 'A. Mirri', Via G. Marinuzzi 3, 90129 Palermo, Sicily, Italy
- (4) U.O. Sistema Informativo e Statistica, Istituto Zooprofilattico Sperimentale della Sicilia 'A. Mirri', Via G. Marinuzzi 3, 90129 Palermo, Sicily, Italy
- (5) Area Ragusa, Istituto Zooprofilattico Sperimentale della Sicilia 'A. Mirri', C.da Nunziata, Km 1,3, S.P. 40, 97100 Ragusa, Sicily, Italy
- (6) Area Sorveglianza Epidemiologica, Istituto Zooprofilattico Sperimentale della Sicilia 'A. Mirri', Via G. Marinuzzi 3, 90129 Palermo, Sicily, Italy

Summary

The authors describe the status of bluetongue (BT) since 13 October 2000, when the first outbreak was reported in Sicily. The results of the epidemiological surveillance programme, based on sentinel animals distributed over the entire region, are also given.

In Sicily, the incidence of the disease is relatively low compared to some other areas in the Mediterranean Basin. Seventy-five outbreaks of the disease were recorded in the first three epidemics (October 2000 to May 2003). Overall morbidity was 13.25%, mortality 5.36% and the case fatality rate 41.49%. The Province of Catania seems to have been the worst affected; the incidence rate in August 2002 was 0.8%. The monthly incidence rate was calculated for sentinel animals of which the estimated total was 3 654, distributed in 63 areas. It is important to underline that in the period under consideration, a total of 2 382 animals was examined. During the surveillance period, which extended from September 2001 to May 2003, the incidence of BT peaked in September 2002, at $5.91\% \pm 0.979$. The cumulative incidence rate from September 2001 to August 2002 and September 2002 to March 2003 was $4.53\% \pm 0.76$ and $20.03\% \pm 1.85$, respectively. The circulation of BT virus serotypes 2, 4, 9 and 16 is described, as revealed by seroconversion in sentinel animals.

Keywords

Bluetongue – Epidemiology – Italy – *Orbivirus* – Outbreaks – Sentinel animals – Serotypes – Sicily.

Introduction

The aim of this study is to provide a description of the first three epidemics of bluetongue (BT) in Sicily, using the principal epidemiological indicators. The spread of infection was monitored through a control group of sentinel animals with seroconversions tracked through a data bank. Following the first appearance of BT during the summer of 2000, the disease spread from the islands and the southern tip of Italy up into the centre of the mainland and into parts of the northern regions (4). The presence of a biological vector through which the infection spreads, means that the distribution of the disease is

strongly linked to geo-climatic conditions. During the summer and autumn of 2000, Italy was struck by the most severe epidemic of BT ever recorded in Europe, affecting Sardinia, Sicily and Calabria, i.e. in regions where 54.7% of the entire Italian sheep and goat populations are located. During the second epidemic (16 May 2001 to 13 April 2002) the virus spread to the north. The number of regions affected rose to seven, namely: Tuscany, Lazio, Basilicata, Campania, Calabria, Sicily and Sardinia. The third epidemic (15 April 2002 to 14 May 2003) affected eight regions, namely: Basilicata, Puglia, Campania, Lazio, Molise, Calabria, Sardinia and Sicily (8).

Since attempting to combat vectors is not realistic, methods of preventing BT are essentially based on preventive measures using live-attenuated vaccines (2, 5, 6). To date, no country in the world affected by the disease has been able to definitively eradicate the infection except in rare instances where it has spontaneously disappeared. In September 2001, vaccination against BTV serotypes 2 and 9 was initiated throughout Italy. In Sicily, vaccination against BTV-2 commenced in October 2001 in the Provinces of Palermo, Agrigento and Trapani (7).

Materials and methods

As soon as the disease was reported in Sicily, a surveillance network was established throughout the region by the *Azienda Sanitaria Locale* (ASL) to swiftly identify any symptoms that might indicate the presence of BT. Between October and December 2000, 1 758 sheep and goat farms were visited, totalling 177 138 animals. Clinical surveillance in the affected areas was detailed and intensive. The sentinel animals were spread throughout the entire region, which was subdivided into areas of 400 km² with at least 58 sentinel animals in each area.

A commercially available c-ELISA kit was used to conduct tests, and was replaced in June 2003 by a c-ELISA product from the National Reference Centre for Exotic Diseases (CESME: *Centro Studi Malattie Esotiche*). All the sera that gave positive results to the c-ELISA were confirmed by CESME using their method of seroneutralising with reference viral structures belonging to serotypes 2, 4, 9 and 16. The following epidemiological indicators were used to describe the infected areas: incidence rate, morbidity, mortality rate and fatality rate as calculated according to Thrusfield (9). MapInfo Version 7.0 was used to obtain geographical figures and plot thematic maps, whilst Epiinfo 2000 was used to measure frequency and tendencies to variation. The database was set up by Sigla (*Sistema Informativo per la Gestione dei Laboratori di Analisi*).

For comparisons between percentages, the critical ratio (*Z*) test (3) was used with Software EpiCalc 2000 Version 1.02.

Table I

Number of outbreaks, animals present, symptoms, deaths and epidemiological indicators during the first, second and third epidemics in Sicily, November 2000-May 2003

Epidemic	No. of outbreaks	Animals present	Animals showing symptoms	Deaths	Morbidity (%)	Mortality (%)	Fatality (%)
First	16	1 896	198	118	9.93	5.92	59.60
Second	6	1 055	133	29	12.61	2.75	21.80
Third	53	13 866	2 389	1 029	17.23	7.42	43.07

Results

Disease outbreaks

In Sicily, the first outbreak was registered in the Giardinello area of the Province of Palermo on 13 October 2000 (1). From that date until 28 November 2000 (date of the last outbreak in 2000), 16 outbreaks, all involving BTV-2, were recorded (Fig. 1): 12 in the Province of Palermo, 2 in Agrigento and 2 in Trapani. The clinical situation was most serious in the Province of Palermo. During the first epidemic, from 13 October 2000 to 15 May 2001, the level of morbidity was 9.93%, with a mortality rate of 5.92% and a fatality rate of 59.60% (Table I and Fig. 2).

The second epidemic, dating from 16 May 2001 to 13 May 2002, comprised six outbreaks (Fig. 1): two in the Province of Messina and four in the Province of Siracuse. Morbidity was recorded at 12.61%, mortality at 2.75% and the fatality rate at 21.80%, with an overall decrease in all epidemiological indicators compared to the first epidemic (Table I; Fig. 2). During the second epidemic, 4.87% morbidity was recorded in the Province of Siracuse, with mortality at 0.78%, as opposed to the two outbreaks in Messina where the recorded levels stood at 34.46% and 8.11%, respectively.

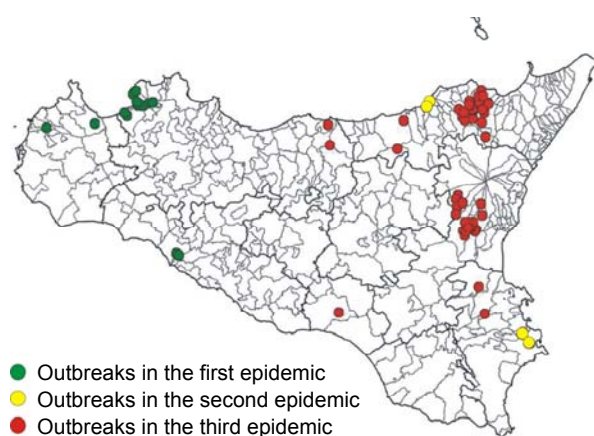


Figure 1
Outbreaks of bluetongue recorded during the first, second and third epidemics in Sicily, November 2000-May 2003

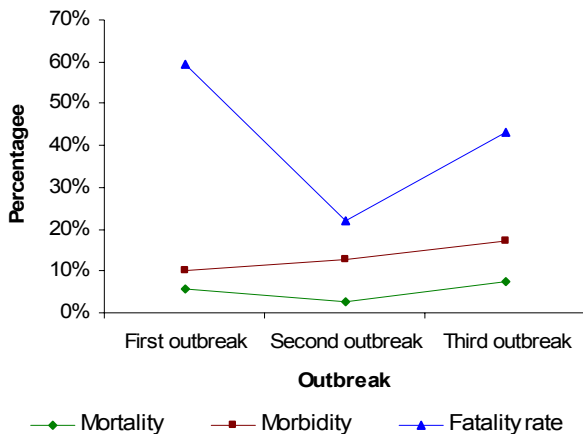


Figure 2 Comparison of epidemiological indicators for the three epidemics of bluetongue in Sicily, November 2000-May 2003

The third epidemic, from 14 May 2002 to 14 May 2003 affected 19 local councils with a total of 53 outbreaks (Fig. 1), of which 28 occurred in the Province of Messina, 21 in Catania, 2 in Palermo, 1 in Caltanissetta and 1 in Siracuse. During the third epidemic, morbidity was 17.23%, mortality 7.43% and the fatality rate 43.07% (Table I; Fig. 2). In each outbreak, the disease was caused by BTV-2 or BTV-9. It has not been possible to establish the exact role of the two serotypes in the outbreaks. Morbidity increased significantly in the second epidemic compared to that of the first ($p < 0.05$) and again, in the third epidemic compared to the second ($p < 0.01$).

Seroconversion of sentinel animals

Upon careful analysis, an increase in the overall monthly incidence (of all serotypes) can be traced from June 2002, reaching a peak in September 2002 where the incidence of seroconversion reached $5.87\% \pm 0.97\%$ compared to that of all the sentinel animals (Fig. 3). After declining in the month of October 2002, the incidence increased to $3.81\% \pm 0.82\%$ and $3.94\% \pm 0.95\%$ in November and December of the same year. Analysing seroconversions in the bovine sentinel animals and recording the monthly incidence per serotype, it is clear that the trends and values of BTV-2, present in Sicily since the first outbreak, largely reflect the trends and values of overall seroconversions (Figs 4 and 5).

Serotype 9 first appeared on 12 October 2001 during the second epidemic, reaching peak incidence in December 2002 and March 2003, with levels of $1.56\% \pm 0.61\%$ and $1.43\% \pm 0.62\%$, respectively

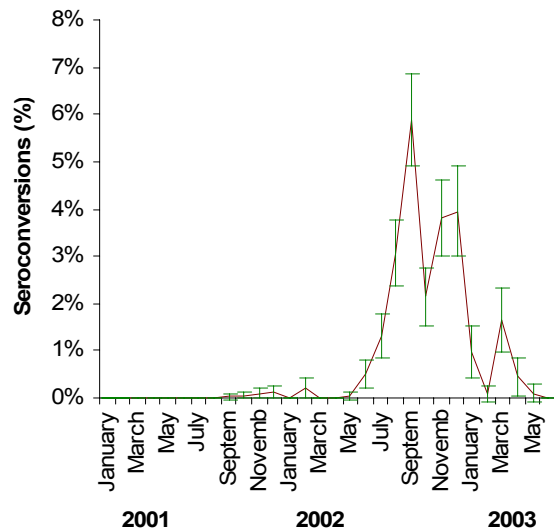


Figure 3 Overall monthly incidence of seroconversions to bluetongue in sentinel animals in Sicily, January 2001-May 2003

(Fig. 6). Seroconversions caused by serotype 4 were recorded in November 2002 in the Province of Siracuse, whilst in December 2002, serotype 16 occurred in the same province. The highest incidence recorded for BTV-4 was between $0.09\% \pm 0.13\%$ in November 2002 and $0.16\% \pm 0.23\%$ in January 2003 (Fig. 7).

The highest incidence for serotype 16 was recorded in December 2002 at a level of $0.25\% \pm 0.24\%$

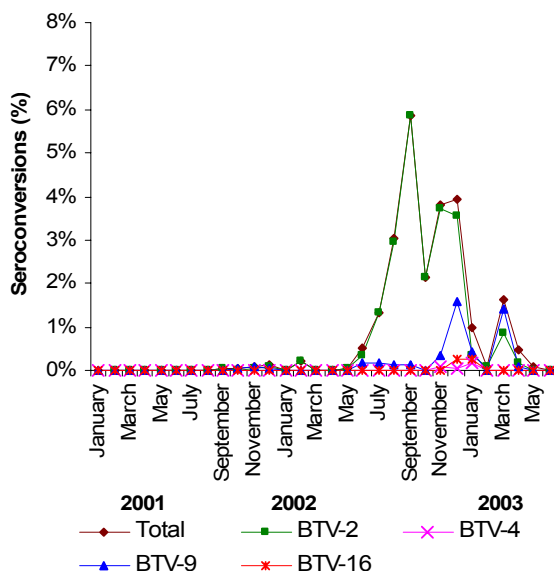


Figure 4 Monthly incidence of seroconversions to each of four bluetongue virus serotypes in Sicily, January 2001-May 2003

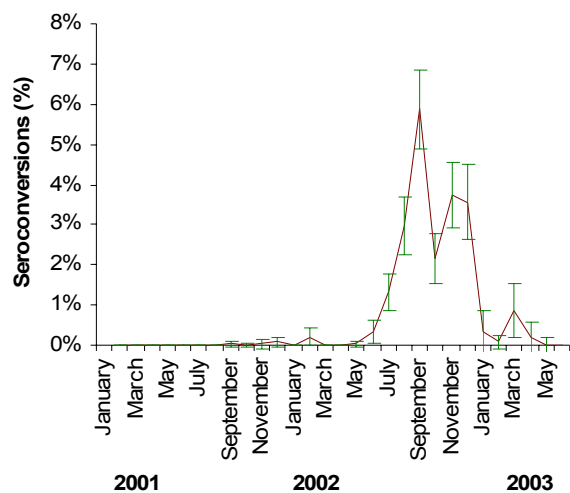


Figure 5
Monthly incidence of seroconversions caused by bluetongue virus serotype 2 in sentinel animals in Sicily, January 2001-May 2003

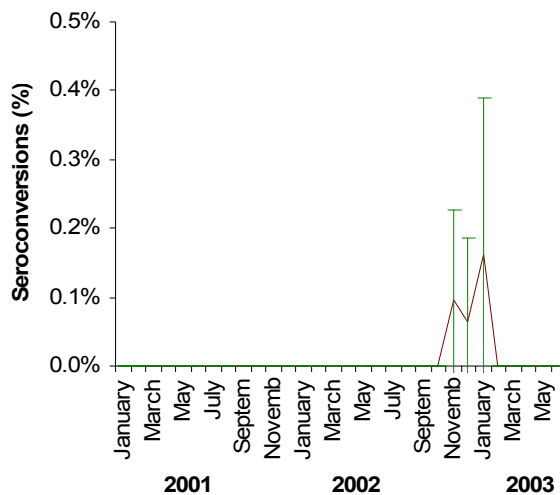


Figure 7
Monthly incidence of seroconversions caused by bluetongue virus serotype 4 in sentinel animals in Sicily, January 2001-May 2003

(Fig. 8). In the period from September 2001 to August 2002, there was an overall cumulative incidence of $4.53\% \pm 0.76\%$; this value reached levels of $20.03\% \pm 1.85\%$ between September 2002 and March 2003. Similarly, a noticeable increase in the cumulative incidence of the serotypes was observed from the first to the second epidemic. Cumulative incidence levels for serotype 2 rose from 4.02% to 18.12% while those for serotype 9 rose from 0.58% to 3.30% . The monthly incidence for each province during the months of June and July 2002, revealed that the sentinel animals experienced

seroconversions only in Messina ($5.38\% \pm 2.96\%$, $16.50\% \pm 5.07\%$, respectively). In August, seroconversions were observed in the provinces of Messina, Catania and Enna ($13.56\% \pm 5.05\%$, $4.61\% \pm 1.88\%$, $8.96\% \pm 3.95\%$ respectively) with few changes throughout September, October and November. In November, however, seroconversions were also detected in the Province of Siracuse ($3.74\% \pm 1.86\%$). The seroconversions persisted throughout December in Siracuse and Messina, spreading to the Provinces of Ragusa and Agrigento ($8.56\% \pm 3.03\%$, $3.85\% \pm 7.39\%$, $10.47\% \pm 3.61\%$, $11.56\% \pm 4.18\%$, respectively) (Fig. 9).

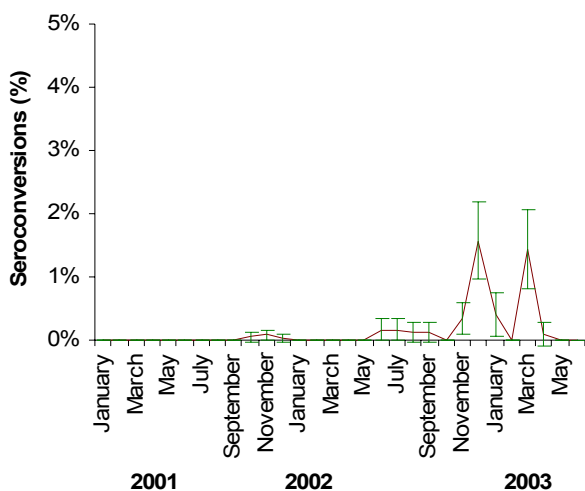


Figure 6
Monthly incidence of seroconversions caused by bluetongue virus serotype 9 in sentinel animals in Sicily, January 2001-May 2003

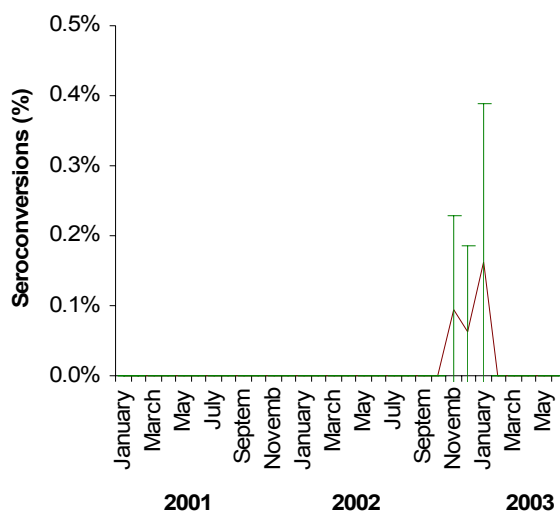


Figure 8
Monthly incidence of seroconversions caused by bluetongue virus serotype 16 in sentinel animals in Sicily, January 2001-May 2003

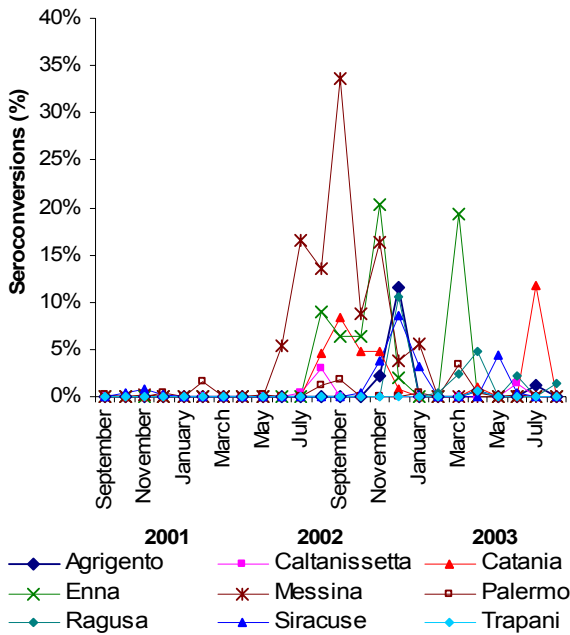


Figure 9
Monthly incidence of bluetongue seroconversions in each affected province of Sicily, September 2001-July 2003

Incidence rates in August were significantly higher in the Provinces of Messina and Enna ($p < 0.01$ and $p < 0.05$, respectively), remaining highest in September in the Province of Messina ($p < 0.01$). In October, the disease was spread equally through three provinces (Messina, Enna and Catania). In November, a significant peak was reached ($p < 0.01$) in the Provinces of Messina and Enna. Finally, the seroconversions spread throughout the provinces of Ragusa and Agrigento during December without significant changes ($p < 0.05$) (Fig.10).

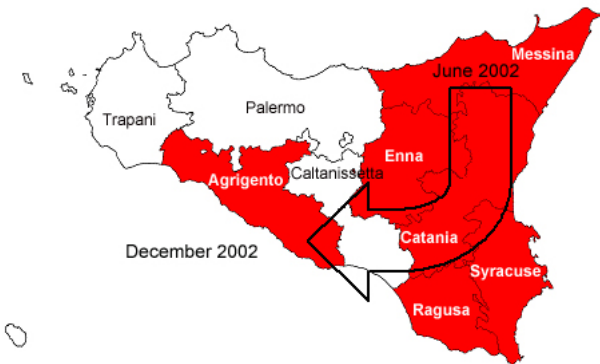


Figure 10
Spread of bluetongue and seroconversions in Sicily, June-December 2002

Discussion

The epidemiological study conducted for each outbreak never indicated that animals had been introduced either from Sardinia or from any other region. In addition, there was no record of infected animals being moved from the western Province of Palermo (where the first outbreaks occurred) to the eastern areas around Trapani and Agrigento (where subsequent outbreaks occurred). The clinical surveillance network and epidemiological studies performed in all the regions have also shown that BT was confined to the known areas of the outbreaks, since no symptoms of BT were recorded in any other flocks visited. The epidemiological development of BT in Sicily was rather unusual, especially when compared to the much more extensive development of the disease in other regions affected.

The results show that the overall increase in seropositivity of susceptible species during the three epidemics involved the entire island. Examining the three epidemics as a whole, the morbidity level was 13.25%, the mortality rate 5.36% and the fatality rate 41.49%. If the monthly incidence of disease is considered in relation to the regional sheep and goat populations, the highest peak was reached in August 2002, with 0.19%; this figure highlights the lack of association between the disease and actual loss of animals, although a significant increase in morbidity can be observed from the first to the third epidemic (Fig. 11).

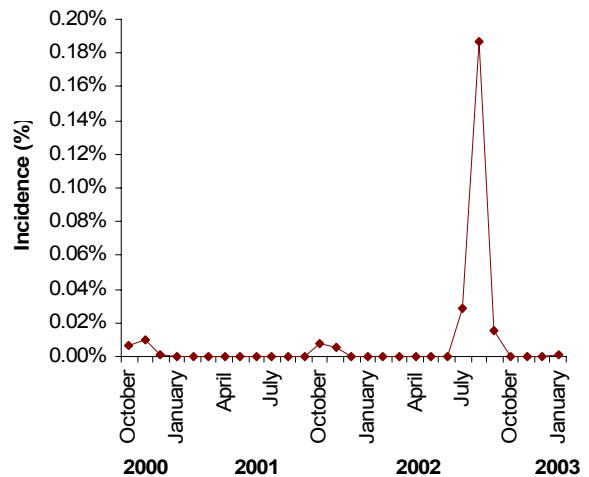


Figure 11
Regional incidence of bluetongue in Sicily, as a proportional percentage of the regional sheep and goat populations, October 2000-January 2003

The different mortality levels and fatality rates observed for the two serotypes in the second epidemic may confirm the lower pathogenicity of serotype 9. During 2003, seroconversions seem to have decreased dramatically, although it is important to note that the number of tests on sentinel animals in the Province of Messina was also reduced. However, these observations continue to be of relevance to the preceding years of study, since any changes in overall climatic conditions could undermine theories on seasonal or territorial 'risk'.

References

1. Caracappa S., Di Bella C., Guercio A., Prato F. & Torina A. (2001). – Emergenza bluetongue in Sicilia: controllo del territorio ed attività di sorveglianza. Atti della Giornate di Studio 'bluetongue stato dell'arte e possibili strategie di contenimento'. Perugia, 16 November, 53-66.
2. European Commission (EC) (2000). – Possible use of vaccination against bluetongue in Europe. Report of the Scientific Committee on Animal Health and Animal Welfare. EC, Brussels, 26.
3. Fleiss J.L. (1981). – Statistical methods for rates and proportions, 2nd Ed. John Wiley & Sons, Chichester, 23-24.
4. Lelli R., Calistri P., Rolesu, S., Patta C., Sulis F. & Uleri R. (2000). – Bluetongue: un problema anche italiano. *Praxis Vet.*, **21** (4), 2-7.
5. Ministero della Salute (2001). – Ordinanza del 11 maggio: Misure urgenti di profilassi vaccinale obbligatoria contro la febbre catarrale degli ovini (bluetongue). Disposizioni per lo spostamento degli animali. Allegato 1, parte 4, 1-16.
6. Ministero della Salute (2002). – Ordinanza del 11 maggio 2001. Rev. 3 del 18/03/2002: Misure urgenti di profilassi vaccinale obbligatoria contro la febbre catarrale degli ovini (bluetongue). Piano di sorveglianza entomologica Anno 2002. Allegato 1, parte 2, 1-8.
7. Migliazzo A. (2002). – Epidemiologia della Bluetongue in Sicilia; I e II epidemia (tesi di laurea A.A. 2001/2002, Università degli Studi di Parma, Facoltà di Medicina Veterinaria, Dipartimento di Malattie Infettive degli Animali). PhD thesis, Parma University.
8. Pini A. & Prosperi S. (1999). – Bluetongue. *In* Manuale di malattie esotiche. *Vet. Ital.*, **31**, (Monografia 20), 34-55.
9. Thrusfield M. (1997). – Veterinary epidemiology, 2nd Ed. Blackwell Science, Oxford, **4**, 37-59.