# Records of *Chrysomya albiceps* in Northern Italy: an ecological and forensic perspective

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*Knowledge of the carrion-breeding insects present at a local level is important and necessary for defining the* post-mortem *interval. Climate changes and globalisation are affecting species ranges and population dynamics. In this note, we report the incidence of* Chrysomya albiceps *(Diptera: Calliphoridae) on dead human bodies and carrion in Northern Italy. These data confirm the spread of this species in the Northern regions. The partial sequencing of a 583-bp region of the cytochrome oxidase subunit 1 gene of an Adriatic population did not reveal any difference compared to the same genomic region in the African and South American populations of this species.*

Key words: climate change - forensic entomology - insect dispersion - COI

Flies, especially Calliphoridae, are the first insects to arrive on a corpse after death, and, for forensic entomologists, they play a privileged role in defining the *post mortem* interval (PMI) (Smith 1986). Within the species belonging to Calliphoridae, different trophic behaviours, as well as changes in food preferences, have been described during development. The calliphorid species *Lucilia*, *Calliphora*, *Protophormia* and *Phormia* are exclusively saprophagous, whereas the young larvae of the *Chrysomya* species feed on decomposing organic matter but the second and third stage larvae become predatory on the larvae of other Diptera (Ulyett 1950, Braack & Retief 1986, Faria & Godoy 2001). These feeding habits have direct consequences on the composition of body-breeding fauna (Grassberger et al. 2003).

*Chrysomya albiceps* (Wiedemann, 1819) (Diptera: Calliphoridae) is a well-known hemisynanthropic fly (Verves 2004). Larvae develop in animal carrion, human cadavers and in faeces and they can cause primary and secondary cutaneous myiasis in mammals (Zumpt 1965, Marchenko 1985, Smith 1986, Hall & Smith 1993, Hall & Wall 1995, Paraluppi & Linhares 1995, Queiroz et al. 1997, Soler 2000, Adham et al. 2001, Madeira 2001, Grassberger et al. 2003). Adults of both sexes feed on faeces, carrion and rotting fruit (Martinez-Sanchez et al. 2000).

*C. albiceps* is widely distributed in the Southern Palaearctic, Northern Oriental and Afrotropical regions and was recently found in Central and South America (Baumgartner & Greenberg 1984, Schumann 1986, Grassberger et al. 2003, Verves 2004, Richards et al. 2007).

In their work on the distribution of *C. albiceps* in Southern Europe and on the applications and importance of this species in forensic entomology, Grassberger et al. (2003) reported the probable distribution of this species in the Turano-European region (indicated in the text as the Palaearctic distribution). In the Grassberger article, the presence of *C. albiceps* is indicated in Italy only in the city of Bari (Southern Italy) (Introna et al. 1998) and probably from other locations in the South and Center of Italy and the Southern part of the Po Plain. Furthermore, in the checklist of Italian fauna (Minelli et al. 1993-1995), this species is is only listed for the Southern peninsular regions and for Sicily.

## MATERIAL AND METHODS

In the last year, an increasing interest in forensic entomology in Italy and in Europe in general and a call for the re-writing of the carrion-breeding insect list at a local scale (Grassberger & Frank 2004, Vanin et al. 2008) encouraged the collection of new records of "forensically important" species. The continuous sampling of these species is a priority in order to investigate the dispersion of new species caused by climate change and globalisation (Turchetto & Vanin 2004a, b) and to prevent and control sanitary and veterinary emergences. During 2007, three collections of *C. albiceps* species from human corpses and animal carrion were performed in Northern Italy (Fig. 1). Entomological sampling and studies were performed following the standards and guidelines proposed by the European Association of Forensic Entomology (Amendt et al. 2006).

## RESULTS AND DISCUSSION

*C. albiceps* maggots were first found in the clothes of a young dead woman found indoors at end of July 2007, close to the city of Chioggia (Venice) (45°08'N; 12°15''E). The body was in a stage of advanced decomposition and signs of strangling were evident. The minimal PMI was estimated to be seven-eight days. In this case, larvae (LIII) and pupae of *Sarcophaga* sp. were also collected. No adults were obtained from the larvae.

In August 2007, a second sample of 11 maggots (LIII) was collected during the autopsy of a 57-year-old

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Received 12 August 2008
Accepted 3 March 2009

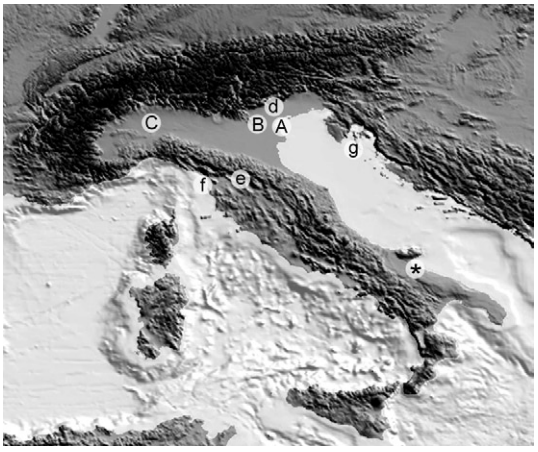


Fig. 1: records of *Chrysomya albiceps* larvae, collected in 2007 from human and animal carrions [A: Chioggia (Venice); B: Padua; C: Milan] and adults collected and examined by one of the author (SV) in 2008 [d: Treviso; e: Florence; f: Pisa; g: Island of Krk (Croazia)]. Asterisk indicates the record reported by Introna et al. (1998) from Bari.

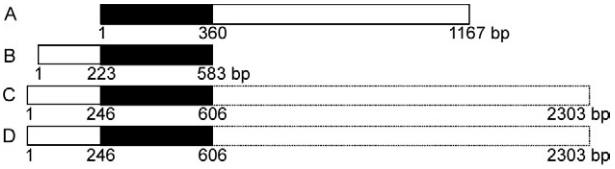


Fig. 2: comparison between the cytochrome oxidase subunit 1 gene (COI) sequences AB112839 obtained from a South African population of *Chrysomya albiceps* (A) (Harvey et al. 2003), the sequence EU503116 obtained from the Italian population (Chioggia) (B), the sequence AF083657 obtained from the Egyptian population (C) and from the Brazilian population (D) (Wells & Sperling 1999). Gray boxes show the overlapping region. Harvey et al. (2003) found a maximum of intraspecific variation of 0.2% for African *C. albiceps* populations using the 1167 bp COI sequences.

woman, found dead in her house in the city of Padua (45°24'N; 11°52'E). The body was in a stage of advanced decomposition and was partially mummified. No sign of injury was found. On the body, larvae (LIII) of *C. albiceps* and larvae (LIII) and pupae of *Phormia regina*, Sarcophagidae and Phoridae species were collected. The proper identifications were confirmed by analysis of the adults obtained from the larvae. The temperature of the collection period ranged between 24.9 ± 3.6°C during the day and 20.7 ± 2.1°C during the night (max: 32.9°C; min 15.7°C).

The third sample was obtained during an experiment carried out on fresh and burned pigs in the outskirts of Milan (45°27'N; 9°11'E). Larvae were collected during July and August 2007. Identification of the samples was confirmed by analysis of the adults obtained from the larvae.

In addition, several collections of adults were performed during the summer and fall of 2008 in the Northern and Central Italian regions and on the Island of Krk, Croatia (Fig. 1).

The collections of *C. albiceps* reported in this note validate the previously doubtful and uncertain records from Northern Italy, which were based on single immature specimens that were destroyed or misplaced after identification. All of our specimens, except for the individuals used for the molecular analyses, are stored in the private collection of SV (Treviso).

It is worth mentioning that the presence of *C. albiceps* in Northern Italy confirms the spread of this species in the Northern regions (Grassberger et al. 2003, Verves 2004). The dispersion of this species towards the Northern regions as well as its demographic explosion are correlated to the climate change, as has been demonstrated for several species of insects, vertebrates and plants (Turchetto & Vanin 2004a, Maistrello et al. 2006, Parmesan 2006). Neither the studies of the dipterological collections of several Italian Natural History Museums nor the recent research performed (with different collection methods) in the beech-wood belt in the Northern Apennines revealed the presence of this species in the past (Cerretti & Vanin 2003, Raffone 2005a, b, Vanin & Lencioni 2006).

A partial sequence (583 bp) of the cytochrome oxidase subunit 1 gene (COI) (EU503116) was obtained from larvae collected in the city of Chioggia by PCR as reported in Nelson et al. (2007). The sequences were used to confirm the morphological identification of the larvae. The sequence alignment of the available COI sequences of *C. albiceps* from Africa (AB112836, AB112839, AB112840, AB112842, AB112849, AB112851, AB112854, AB112858, AB112865, AF083657) (Wells & Sperling 1999, Harvey et al. 2003) and South America (Wells & Sperling 1999) (Fig. 2), performed with ClustalW software (Thompson et al. 1994), revealed an identity of 100% and of 97.78%, respectively, with the sequences of *C. rufifacies* (AF083658). These data confirm the morphological identification and indicate that the sequence we used cannot be used to distinguish populations. Identification of more informative sequences will be necessary in order to understand the origin of the dispersion of these species and to investigate on bodies probably transferred for long distance.

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