



Stored products mites in cheese ripening: Health aspects, technological and regulatory challenges in Brazil



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ABSTRACT

Stored products mites have been reported in the literature either as a problem (e.g., causing significant economic losses and reducing quality) or as food technology coadjuvants (e.g., providing specific and desirable flavor characteristics to certain cheese types). Stored products mites infestations usually occur in cheeses that need long ripening periods. Effective controls of such infestations have been achieved by implementing good manufacturing practices (GMP) rather than by synthetic or botanical miticides. Although the effects caused by cheese mites during storage may be undesirable in some types of cheese, in certain circumstances, these mites are essential to the production of other types of cheeses (Mimolette and Milbenkäse cheeses). There is a gap of information on the risk status of consumption of mite-containing cheese. Despite this lack of information, the production of mite-containing cheeses has gained new adepts in Brazil. Thus, this study has attempted to summarize the available taxonomic identity of known mite-containing cheeses and possible health problems related to the consumption of the mites associated with these cheeses. Furthermore, the present review also describes the technological challenges and regulatory aspects involved in the production of these cheese types, which can help the Brazilian mite-containing cheese production.

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1. Introduction

Mites present in cheese and other products are known as stored product mites. They are most commonly found in rural areas (Dawood and Ali, 2015; Robertson, 1952; Vogel et al., 2015). Despite their prevalence in grains and meals, it is possible to find stored product mites in other foods (e.g. cheese and raw ham) (Bell, 2014). In the cheese production, mite infestations have usually been observed during the ripening, condition associated to the exposure to contaminated environmental sites (Deong and Roadhouse, 1922; Robertson, 1952). The cheese mites are reported on the cheese surfaces as it starts to develop “brown powders” composed of dead and live mites, cheese residues and mite excrements (Deong and Roadhouse, 1922).

Some of the related cheese mites, such as *Tyrophagus putrescentiae* and *Acarus siro* (Aygun et al., 2007; Melnyk et al., 2010), are mycophagous and the fungus species digested by them are determined according to the digestive enzymatic properties of each species (Hubert et al., 2004; Marcellino and Benson, 2013). In addition, during ripening, symbiotic relationship might occur between mites and fungi that favors the mite access to the rinds of cheese, developing larger aerobic surfaces for the aerobic growth of fungus (Marcellino and Benson, 2013; Peace, 1983). It has been shown yet that the cheeses are infested with two or more mite species and, during ripening under uniform storage conditions, complete replacements of one species by another may occur (Robertson, 1952).

The related cheese mites are usually associated with production economic losses or health problems (Bell, 2014; Deong and Roadhouse, 1922; Douwling and Thomas, 1942; Robertson, 1952). However, by their not well described actions during the ripening process, it has been shown that stored product mites can provide specific and desirable characteristics to some traditional cheeses such as, for example, the French Mimolette and the German Milbenkäse (Bruckner and Heethoff, 2016).

Considering the large number of ripened cheeses in the world, the number of published studies about mite-containing cheeses is surprisingly few, given the susceptibility of cheese to mite infestation and the economic risks they can present to the dairy industry. Some investigations have described procedures that favor or deter mite infestations during the production of mite-containing cheeses and the occurrence of such species (Table 1). The know-how to proceed a successfully production of mite-containing cheeses in Brazil have been completely neglected for the state of

art. To our knowledge, the present work represents the pioneering efforts attempting to summarize potential problems related with the increasing production and commercialization of mite-containing cheeses in Brazil. Here, we also describe the technological challenges (mite species and other facilities conditions to be used) and regulatory aspects (clear laws based on precise thresholds of allowed mite infestations) involved in the production of these cheese types in Brazil.

2. Method

In this systematic review, we did not use statistical techniques (meta-analysis) to combine results of the eligible studies. We conducted an extensive bibliographical search during 2017 using free search engines (Web of Science, Scopus and Google Scholar) that access references and abstract databases on food science. The following key terms were used in our searches: stored products mites; cheese mites; mite ripening cheese; dairy mites; mites in cheeses legislations and guidelines. The titles and abstracts of the articles found in the search were checked against the overall criteria for eligibility and relevance, which were as follows: the year of publication, the relevance of the research question and the citation index.

3. Literature review

3.1. Processing of the mite-containing cheeses

Except for fresh types, cheeses are subjected to ripening processes that are characterized by a series of complex physical, chemical and microbiological changes carried out mainly by enzymes and microorganisms (Almena-Aliste and Mietton, 2014). After such changes, cheeses that were initially compact and tasteless modify their composition, structure, appearance, texture and color and simultaneously develop desirable flavor traits (De Dea Lindner et al., 2008). Thus, although some artisanal cheeses are ripened without control of the room temperature or prevailing environmental humidity, ripening processes consists in maintaining the products in chambers with controlled temperature and humidity for a certain period of time to obtain the desired characteristics (Dores et al., 2013; Martins et al., 2015). During ripening, it is common unexpected events to occur among which the presence of “mite powder” contaminating the cheese surface. This powder is actually mites that infest the cheese during ripening

Table 1
Mite species identified in cheese contaminating mites.

Cheese	Country	Species	Reference
Stilton	England	<i>Tyroglyphus siro</i> (syn. <i>Acarus siro</i>), <i>Tyroglyphus longior</i> and <i>Aleurobius farinae</i>	(Eales, 1917)
Cheddar	England	<i>Carpoglyphus</i> sp., <i>Tyroglyphus siro</i> (syn. <i>Acarus siro</i>), <i>Tyroglyphus longior</i> and <i>Aleurobius farinae</i>	(Eales, 1917)
American cheeses	United States	<i>Tyroglyphus siro</i> (syn. <i>Acarus siro</i>), <i>Tyroglyphus lintneri</i> , <i>Tyrophagus farinae</i> , <i>Tyrophagus longior</i> , <i>Tyrophagus terminalis</i> and <i>Carpoglyphus</i> sp.	(Deong and Roadhouse, 1922)
Unknown	United Kingdom	<i>Tyroglyphus longior</i> var. <i>Castellani</i>	(Douwling and Thomas, 1942)
Unknown	New Zealand	<i>Tyrophagus longior</i> , <i>Tyrolichus casei</i> , <i>Tyroglyphus farinae</i> , <i>Glycyphagus domesticus</i> and <i>Glycyphagus destructor</i>	(Robertson, 1946)
Unknown	United Kingdom	<i>Acarus siro</i> , <i>Acarus chaetoxysilos</i> , <i>Acarus farris</i> and <i>Tyrophagus longior</i>	(Wilkin, 1973)
Cheddar	Canada	<i>Acarus siro</i>	(Peace, 1983)
Surk	Turkey	<i>Tyrophagus putrescentiae</i>	(Aygun et al., 2007)
Cabrales	Spain	<i>Acarus farris</i> and <i>Tyrophagus neiswanderi</i>	(Sánchez-Ramos et al., 2007b)
Milbenkäse	Germany	<i>Tyrolichus casei</i> ^a	(Melnyk et al., 2010)
Mimolette	France	<i>Acarus siro</i> ^a	(Melnyk et al., 2010)
Ras	Egypt	<i>Acarus siro</i> , <i>Acarus farris</i> of <i>acaridae</i> and <i>Carpoglyphus lactis</i>	(Dawood and Ali, 2015)

^a Mites are desirable for the effect they have on the flavor of these cheeses type.

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