



Systematics, Morphology and Biogeography

Coleoptera species of forensic importance from Brazil: an updated list



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ABSTRACT

A list of the Coleoptera of importance from Brazil, based on published records was compiled. The checklist contains 345 species of 16 families allocated to 16 states of the country. In addition, three species of two families are registered for the first time. The fauna of Coleoptera of forensic importance is still not entirely known and future collection efforts and taxonomic reviews could increase the number of known species considerably in the near future.

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Introduction

The development of forensic entomology in Brazil was well reported by Pujol-Luz et al. (2008). It started in 1908, with the pioneers Roquette-Pinto and Oscar Freire, who noted the high diversity of the native fauna of necrophagous insects and the impossibility of direct application of the methods developed in Europe. Oscar Freire (1914a,b) was the first to present a collection of insects associated with his investigations, mainly obtained from human corpses and small animals in Bahia State. Herman Lüderwaldt (1911) published a list of Coleoptera associated with several kinds of carrion in São Paulo, which is still an important reference on the subject. In 1941, Samuel Pessôa and Frederick Lane published a paper regarding Scarabaeidae of medico-legal importance (Pessôa and Lane, 1941). After this period, the studies and the information regarding forensically important species of Coleoptera from Brazil became disperse and available in books, articles, catalogues, reports and collections or other non-indexed sources (i.e. monographs, dissertations and theses).

Almeida and Mise (2009) published the first list of South American Coleoptera, comprising 15 families and Vasconcelos and Araújo (2012) presented a list of insects collected in northeastern Brazil.

The forensic importance of Coleoptera is often underestimated due to the belief that they occur only at late stages of decomposition. However, more studies about their taxonomy, biology and

behaviour are needed before their importance can be fully understood (see Midgley et al., 2010). The diversity of Coleoptera and the lack of taxonomic studies have direct effect in how the beetles can be used in forensic entomology, mostly because unidentified material cannot be used for a postmortem interval estimative.

Coleoptera families with known predatory and necrophagous habit (i.e. carrion feeders) are listed as having potential forensic importance (see Smith, 1986; Byrd and Castner, 2010). The necrophilous habit (i.e. associated with carrion/corpses) is an indicative of the potential forensic importance, but the correct identification is the first step for the better understanding of the role of the species at their environment and guide future studies about its biology and distribution.

The main objective of this study was to present an updated list of Coleoptera species associated with carrion/corpses in Brazil. More specifically, it aimed to provide updated data about the geographical distribution and substratum in which species were collected, as well as to provide a checklist of current valid names.

Material and methods

The list of species of Coleoptera was based on information collected from published literature from 1908 to 2014 with some new data included (Table 1) and consider mostly studies of forensic entomology, ecological succession and fauna surveys performed in Brazil.

The taxa considered of potential forensic importance followed two criteria: lists of Coleoptera families associated with carrion available in previous studies (e.g. Payne, 1969; Smith, 1986; Mise

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Table 1
Compiled list of Coleoptera species of forensic importance from Brazil.

| Family/species | Diet/carcass | Geographical distribution | References |
|---|-----------------------------------|--|---|
| Carabidae | | | |
| <i>Arthrostictus speciosus</i> (Drury, 1829) | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Clivina</i> sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Galerita</i> sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Taeniolobus crenulatus</i> Chaudoir, 1842 (?) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| Carabidae sp. | Human | Campinas (SP) | Carvalho et al., 2000 |
| Carabidae sp. | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| Carabidae sp. 1 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Carabidae sp. 1 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Carabidae sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Carabidae sp. 3 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Carabidae sp. 4 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Carabidae sp. 5 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Cleridae | | | |
| <i>Necrobia ruficollis</i> (Fabricius, 1775) | Pig, not specified | Campinas (PR), São Paulo (SP), Curitiba (PR) | Luederwaldt, 1911; Mise et al., 2007 |
| <i>Necrobia rufipes</i> (De Geer, 1775) | Human, pig, rabbit, not specified | São Paulo (SP), Campinas (SP), Curitiba (PR), Ribeirão do Pinhal (PR), Uberlândia (MG), Serra Talhada (PE) | Luederwaldt, 1911; Souza and Linhares, 1997; Carvalho et al., 2000; Cruz and Vasconcelos, 2006; Rosa et al., 2011; Silva and Santos, 2012; Mayer and Vasconcelos, 2013; Mise et al., 2013 |
| Cleridae sp. | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| Dermestidae | | | |
| <i>Dermestes maculatus</i> (De Geer, 1774) | Human, pig, rat, rabbit | Campinas (SP), Curitiba (PR), Uberlândia (MG), Serra Talhada (PE) | Souza and Linhares, 1997; Carvalho et al., 2000; Cruz and Vasconcelos, 2006; Rosa et al., 2011; Souza and Vasconcelos, 2013; Mise et al., 2013 |
| <i>Dermestes peruvianus</i> Laporte, 1840 | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Dermestes</i> sp. | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| Dermestidae sp. 1 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Geotrupidae | | | |
| <i>Bolpapium striatopunctatum</i> (Laporte, 1840) | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| Histeridae | | | |
| <i>Aeletes nicolasi</i> Leivas, 2012 | Rabbit | Curitiba (PR) | Leivas et al., 2012 |
| <i>Aeletes</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Atholus</i> sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Euspilotus azureus</i> (Sahlberg, 1823) (=Euspilotus "grupo" azureus; <i>Saprinus azureus</i> Sahlberg, 1823); (=Euspilotus nigrita (Blanchard, 1842)) | Pig, rabbit | Campinas (SP), Curitiba (PR), Manaus (AM), Capão do Leão (RS) | Souza and Linhares, 1997; Mise et al., 2007; Mise et al., 2010; Souza et al., 2008; Mise et al., 2013 |
| <i>Euspilotus</i> (Hesperosaprinus) sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Euspilotus</i> sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Euspilotus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Euspilotus</i> sp. | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Euspilotus</i> sp. | Pig | Campinas (SP) | Carvalho et al., 2000 |
| <i>Euspilotus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Euspilotus</i> spp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Hister</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Hister</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Hololepta</i> sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Omalodes</i> (<i>Omalodes</i>) <i>bifoveolatus</i> Marseul, 1853 | Pig | Manaus (AM) | Almeida and Mise, 2009; Mise et al., 2010 |
| <i>Omalodes</i> (<i>Omalodes</i>) <i>foveola</i> Erichson, 1834 | Pig | Manaus (AM), Serra Talhada (PE) | Mise et al., 2010; Mayer and Vasconcelos, 2013 |
| <i>Omalodes</i> (<i>Omalodes</i>) <i>lucidus</i> Erichson, 1834 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Omalodes</i> (<i>Omalodes</i>) <i>planifrons</i> Marseul, 1853 | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Omalodes</i> sp. | Pig | Campinas (SP) | Carvalho et al., 2000 |
| <i>Omalodes</i> sp. | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Operclipygus subterraneus</i> Caterino and Tishechin, 2013 (=Operclipygus hospes (Lewis, 1902)) | Rabbit | Curitiba (PR) | Corrêa et al., 2012; Caterino and Tishechin, 2013 |
| <i>Phelister sanguinipennis</i> Marseul, 1853 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Phelister</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Phelister</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|---|--------------------|--|--|
| <i>Phelister</i> sp. 1 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Phelister</i> sp. 2 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Phelister</i> sp. 3 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Scapomegas auritus</i> Marseul, 1855 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Xerosaprinus</i> sp. | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| Histeridae sp. | Rat | Campinas (SP) | Monteiro-Filho and Penereiro, 1987 |
| Histeridae sp. | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| Histeridae spp. | Pig, not specified | São Paulo (SP), Campinas (SP), Uberlândia (MG) | Luederwaldt, 1911; Carvalho et al., 2004; Rosa et al., 2011 |
| Histeridae sp. 1 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Histeridae sp. 2 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Histeridae sp. 3 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Histeridae sp. 4 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Histeridae sp. 5 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| Leiodidae (=Cholevidae) | | | |
| <i>Dissochaetus amazonicus</i> Gnaspini, 1999 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Dissochaetus murray</i> Reitter, 1884 | Rat, rabbit | Curitiba (PR) | Moura et al., 1997; Mise et al., 2013 |
| <i>Hydnobius</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| Monotomidae (=Rhizophagidae) | | | |
| <i>Rhizophagidae</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| Nitidulidae | | | |
| <i>Carpophilus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Stelidota geminata</i> (Say, 1825) | Rabbit | Curitiba (PR) | present study |
| <i>Stelidota octomaculata</i> (Say, 1825) | Rabbit | Curitiba (PR) | present study |
| Nitidulidae sp. | Rat | Campinas (SP) | Monteiro-Filho and Penereiro, 1987 |
| Nitidulidae sp. 1 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Nitidulidae sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Nitidulidae sp. 3 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Ptiliidae | | | |
| Ptiliidae sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| Ptiliidae sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| Scarabaeidae | | | |
| <i>Anomiopus</i> sp. | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Aphengium sordidum</i> Harold, 1868 | Not specified | (ES) | Pessôa and Lane, 1941 |
| <i>Aphodiinae</i> sp.1 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Ataenius aequalis</i> Harold, 1880 | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Ataenius picinus</i> Harold, 1868 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Ataenius</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Ataenius</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Ataenius</i> sp. 1 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Ataenius</i> sp. 2 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Ateuchus apicatus</i> (Harold, 1867) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Ateuchus brevis</i> (Harold, 1868) (= <i>Choeridium breve</i> Harold, 1868) | Not specified | São Paulo (Ipiranga) (SP) | Pessôa and Lane, 1941 |
| <i>Ateuchus carbonarium</i> (Harold, 1868) (= <i>Choeridium carbonarium</i> Harold, 1868) | Not specified | São Paulo (Ipiranga) (SP), Cantareira (SP) | Pessôa and Lane, 1941 |
| <i>Ateuchus carbonarius</i> (Harold, 1868) | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Ateuchus mutilatus</i> (Harold, 1868) (= <i>Choeridium mutilatum</i> Harold, 1867) | Not specified | Nova Friburgo (RJ), Petrópolis (RJ), Serra da Bocaina (RJ), Serra de Macaé (RJ), Campos do Jordão (SP) | Pessôa and Lane, 1941 |
| <i>Ateuchus palperatus</i> (Germar, 1824) (= <i>Choeridium pauperatum</i> Germar, 1824) | Not specified | São Paulo (SP), São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Ateuchus striatulum</i> (Preudhomme de Borre, 1886) (= <i>Choeridium striatulum</i> Preudhomme de Borre, 1886) | Not specified | Franca (SP) | Pessôa and Lane, 1941 |
| <i>Ateuchus subquadratus</i> (Harold, 1868) (= <i>Choeridium subquadratum</i> Harold, 1868) | Not specified | São Paulo (Ipiranga) (SP), Campos do Jordão (SP), "without locality" (MT) | Pessôa and Lane, 1941 |
| <i>Ateuchus vividus</i> Germar, 1824 | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Ateuchus vividus</i> Germar, 1824 (= <i>Choeridium vividum</i> Germar, 1824) | Not specified | Franca (SP) | Pessôa and Lane, 1941 |
| <i>Boucomontius Dendropaemon convexus</i> Harold, 1869 (= <i>Tetramereia convexus</i>) | Not specified | Manicoré (AM), São Paulo (SP), (GO), (MG), (SP) | Pessôa and Lane, 1941 |
| <i>Canthidium</i> (<i>Canthidium</i>) <i>aff. depressum</i> (Boucomont, 1928) | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Canthidium</i> (<i>Canthidium</i>) <i>decoratum</i> Perty, 1830 | Not specified | São Paulo (SP), São Paulo (Ipiranga) (SP), Jundiá (SP), Campinas (SP), Leopoldo Bulhões (GO) | Luederwaldt, 1911; Pessôa and Lane, 1941 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|---|--------------------|--|--|
| <i>Canthidium</i> (<i>Canthidium</i>) <i>dispar</i> Harold, 1867 (=C. <i>Canthidium dispar</i>) | Not specified | São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthidium</i> (<i>Canthidium</i>) <i>lucidum</i> Harold, 1867 | Not specified | São Paulo (Ipiranga) (SP) | Pessôa and Lane, 1941 |
| <i>Canthidium</i> (<i>Canthidium</i>) <i>manni</i> Arrow, 1913 | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Canthidium</i> (<i>Canthidium</i>) <i>splendidum</i> (Preudhomme de Borre, 1886) | Not specified | São Paulo (SP), São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthidium</i> (<i>Eucanthidium</i>) <i>breve</i> (Germar, 1824) | Not specified | São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthidium politum politum</i> Harold, 1867 (=Canthidium (<i>Eucanthidium</i>) <i>trinodosum</i> (Boheman, 1858)) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Canthidium</i> sp. | Rat | Curitiba (PR) | Moura et al., 1997 |
| <i>Canthidium</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Canthidium</i> spp. | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Canthon</i> (<i>Canthon</i>) <i>chalybaeus</i> Harold, 1868 (=Canthon <i>conformis</i> Harold, 1868) | Not specified | (SP) (SP), (RS), (SC), (SP), (RJ), (MT), (BA), (PA) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Canthon</i>) <i>angularis</i> Harold, 1868 | Not specified | (RJ), (PR), (SC), (SP) | Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Canthon</i>) <i>curvipes</i> Harold, 1868 | Not specified | São Paulo (SP), São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Canthon</i>) <i>lituratus</i> (Germar, 1813) | Not specified | (AM), (BA), (PE), (MT), (RJ), (SP). Vila Nova (BA), (SP) (Ipiranga) (SP) | Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Canthon</i>) <i>mutabilis</i> Lucas, 1859 | Not specified | Jundiá (SP), (RS), (SC), (SP), (RJ), (MT) | Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Canthon</i>) <i>podagricus</i> Harold, 1868 | Not specified | São Paulo (SP), São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Canthon</i>) <i>substriatus</i> (Harold, 1868) (=Canthon <i>substriatus</i> Harold, 1868) | Not specified | Barretos (SP) | Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Francmonrosia</i>) <i>dives</i> Harold, 1868 | Not specified | São Paulo (SP), (MG), (GO), (MT) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Francmonrosia</i>) <i>rutilans</i> Castelnau, 1840 | Rat, not specified | São Paulo (SP), (MG), (AM), Campinas (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941; Monteiro-Filho and Penereiro, 1987 |
| <i>Canthon</i> (<i>Francmonrosia</i>) <i>tetraodon</i> Blanchard, 1845 | Not specified | (RS), (SC), (SP), (ES) | Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Goniocanthon</i>) <i>smaragdulus</i> (Fabricius, 1781) | Not specified | (ES), (MG), (RJ), (SP), (RS) | Pessôa and Lane, 1941 |
| <i>Canthon</i> (<i>Pseudepilissus</i>) <i>muticus</i> Harold, 1867 | Not specified | São Paulo (Ipiranga) (SP) | Pessôa and Lane, 1941 |
| <i>Canthon</i> aff. <i>sordidus</i> (Harold, 1868) | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Canthon septemmaculatus</i> Latreille, 1811 (=Canthon <i>septemmaculaus</i> (Latreille, 1811)) | Not specified | São Paulo (SP), Manaus (AM), Juazeiro (BA), Vila Nova (BA), Pirapora (MG), São Paulo (Ipiranga) (SP), Campinas (SP), Franca (SP), Alto da Serra (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Canthon smaragdulus</i> (Fabricius, 1781) (=Canthon <i>speculifer</i> Castelnau, 1840) | Not specified | (ES), (RJ), (MT), (RS), (SC), (SP) | Pessôa and Lane, 1941 |
| <i>Canthon</i> sp. | Pig | Campinas (SP), Serra Talhada (PE) | Carvalho et al., 2000; Mayer and Vasconcelos, 2013 |
| <i>Canthon triangularis</i> Drury, 1770 | Not specified | (AM), Manaus (AM) | Pessôa and Lane, 1941; Mise et al., 2010 |
| <i>Canthon tristis</i> Harold, 1862 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Canthon unicolor</i> Blanchard, 1845 (=Canthon <i>opacus</i> Lucas, 1857) | Not specified | (SP), (MG) | Pessôa and Lane, 1941 |
| <i>Canthon virens</i> Mannerheim, 1829 | Not specified, pig | (ES), (RJ), (SP), Jundiá (SP), Campinas (SP), Franca (SP), Uberlândia (MG) | Pessôa and Lane, 1941; Rosa et al., 2011 |
| <i>Chalcocopris hesperus</i> (Olivier, 1789) | Not specified | (ES), (MG), (RJ), (SP) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>acrisius</i> (MacLeay, 1819) (=Phanaeus (<i>Coprophanaeus</i>) <i>camargoi</i> Pessôa) | Not specified | P. Murtinho (MS) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>cerberus</i> (Harold, 1869) (=Phanaeus (<i>Coprophanaeus</i>) <i>cerberus</i> Harl.) | Not specified | (ES), Passa Quatro (MG), Serra da Bocaina (RJ) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>cyanescens</i> (d'Olsoufieff, 1924) (=Phanaeus (<i>Coprophanaeus</i>) <i>cyanescens</i> Olsouf.) | Not specified | (MT), Bragança (PA), Cuiabá (PA), (SP), Serra Talhada (PE) | Pessôa and Lane, 1941; Mayer and Vasconcelos, 2013 |
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>dardanus</i> (MacLeay, 1819) (=Phanaeus (<i>Coprophanaeus</i>) <i>arrowi</i> d'Olsoufieff) | Not specified | Piassaguera (SP) | Pessôa and Lane, 1941 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|--|---------------------------|---|---|
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>jasius</i> (Olivier, 1789) (=Phanaeus (<i>Coprophanaeus</i>) <i>jasius</i> Oliv.) | Not specified | Vila Nova (BA), Franca (SP), Jundiá (SP), Campinas (SP), Rio Preto (SP), São Paulo (Ipiranga) (SP), Serra de Comunati (PE), (GO) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>milon</i> (Blanchard, 1843) (=Phanaeus (<i>Coprophanaeus</i>) <i>milon</i> Blanch.) | Not specified | Sul do Brasil | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Coprophanaeus</i>) <i>spitzi</i> (Pessôa, 1934) (=Phanaeus (<i>Coprophanaeus</i>) <i>spitzi</i> Pessôa) | Not specified | Leopoldo Bulhões (GO), Vianópolis (GO) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Megaphanaeus</i>) <i>bonariensis</i> (Gory, 1844) (=Phanaeus (<i>Megaphanaeus</i>) <i>bonariensis</i> Gory) | Not specified | São Paulo (SP), Porto Epitácio (SP), S. Grande (SP), Funil (SP), São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Megaphanaeus</i>) <i>ensifer</i> (Germar, 1824) (=Phanaeus (<i>Megaphanaeus</i>) <i>ensifer</i> Germ.) | Pig, not specified | São Paulo (SP), Lusanvira (SP), Norte da Bahia, Sul do Paraná, Campinas (SP), João Pessoa (PB), Uberlândia (MG) | Luederwaldt, 1911; Pessôa and Lane, 1941; Carvalho et al., 2000; Endres et al., 2005; Rosa et al., 2011 |
| <i>Coprophanaeus</i> (<i>Megaphanaeus</i>) <i>lancifer</i> (Linnaeus, 1767) | Pig | Manaus (AM) | Ururahy-Rodrigues et al., 2008; Mise et al., 2010 |
| <i>Coprophanaeus</i> (<i>Metallophanaeus</i>) <i>horus</i> (Waterhouse, 1891) (=Phanaeus (<i>Metallophanaeus</i>) <i>horus</i> Waterh.) | Not specified | Faz. da Fâia (MT) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Metallophanaeus</i>) <i>punctatus</i> (d'Olsoufieff, 1924) (=Phanaeus (<i>Coprophanaeus</i>) <i>punctatus</i> Olsuf.) | Not specified | (MT) (?) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> (<i>Metallophanaeus</i>) <i>saphirinus</i> (Sturm, 1828) (=Phanaeus (<i>Metallophanaeus</i>) <i>saphirinus</i> Sturm) | Rat, not specified | São Paulo (Ipiranga) (SP), Cantareira (SP), São Paulo (SP), Campos do Jordão (SP), Leme (SP), Jundiá (SP), Ribeirão Preto (SP), Curitiba (PR) | Pessôa and Lane, 1941; Moura et al., 1997 |
| <i>Coprophanaeus</i> (<i>Metallophanaeus</i>) <i>thalassinus</i> (Perty, 1830) (=Phanaeus (<i>Coprophanaeus</i>) <i>thalassinus</i> Perty) | Not specified | (SP) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> <i>bellicosus</i> (Olivier, 1789) (=Phanaeus (<i>Megaphanaeus</i>) <i>bellicosus</i> (Oliv.)) | Not specified | São Paulo (Ipiranga) (SP), Joinville (SC) | Pessôa and Lane, 1941 |
| <i>Coprophanaeus</i> <i>dardanus</i> (MacLeay, 1819) (=Coprophanaeus (<i>Coprophanaeus</i>) <i>dardanus</i> (MacLeay, 1819)) | Not specified | Joinville (SC), Corupá (SC), Raiz da Serra (SP), Porto Alegre (SP) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Aganhyboma</i>) <i>tresignatum</i> Harold, 1881 | Not specified | (ES), (MG) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Calhyboma</i>) <i>carinatum</i> (Westwood, 1837) | Not specified | Região Amazônica | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Calhyboma</i>) <i>verruciferum</i> Felsche, 1911 | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Deltochilum</i> (<i>Deltochilum</i>) <i>dentipes</i> Eschscholtz, 1822 | Not specified | (RJ), (SP), (PR), (SC), PontaGrossa (PR) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Deltochilum</i>) <i>irroratum</i> (Castelnau, 1840) | Not specified | (AM), (ES), (RJ), (SC) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Deltochilum</i>) <i>orbiculare</i> van Lansberge, 1874 | Not specified | Bacia Amazônica, (BA), (MT) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Deltohyboma</i>) <i>aff. guyanense</i> Paulian, 1933 (=Deltochilum <i>aff. guyanense</i>) | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Deltochilum</i> (<i>Deltohyboma</i>) <i>morbillosum</i> Burmeister, 1848 | Not specified | São Paulo (SP), Jundiá (SP), (RJ), (SP), (MG) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Deltohyboma</i>) <i>sculpturatum</i> Felsche, 1907 (=Deltochilum <i>sulphuratum</i> Felsche, 1907) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Deltochilum</i> (<i>Deltohyboma</i>) <i>sp.</i> | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Deltochilum</i> (<i>Euhyboma</i>) <i>brasiliense</i> (Castelnau, 1840) (=Deltochilum <i>brasiliense</i> (Castelnau, 1840)) | Human, pig, not specified | São Paulo (SP), São Paulo (Ipiranga) (SP), (ES), (RJ), (MG), (SP), (SC), Campinas (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941; Carvalho et al., 2000 |
| <i>Deltochilum</i> (<i>Hybomidium</i>) <i>icarus</i> (Olivier, 1789) | Not specified | Pirapora (MG), Pouso Alegre (MG), Murtinho (MS), Manaus (AM) | Pessôa and Lane, 1941; Mise et al., 2010 |
| <i>Deltochilum</i> (<i>Parahyboma</i>) <i>furcatum</i> (Castelnau, 1840) | Not specified | (ES), (RJ), Salto Grande (SP) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> (<i>Rubrohyboma</i>) <i>rubripenne</i> (Gory, 1831) | Not specified | (RJ), (SP), (SC), (RS), São Paulo (SP), São Paulo (Ipiranga) (SP), Jundiá (SP), Rocinha (SP), Rio de Janeiro (RJ), Maracujá (MT) | Pessôa and Lane, 1941 |
| <i>Deltochilum</i> <i>peruanum</i> Paulian, 1938 | Pig | Manaus (AM) | Mise et al., 2010 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|---|--------------------|---|--|
| <i>Dendropaemon</i> (<i>Corpophanaeoides</i>) <i>hirticollis</i> d'Olsoufieff, 1924 (= <i>Dendropaemon monte</i> Pessoa and Lane, 1936) | Not specified | Ouro Preto (MG), Santa Bárbara (MG) | Pessôa and Lane, 1941 |
| <i>Dendropaemon</i> (<i>Dendropaemon</i>) <i>amyntas waterhousii</i> d'Olsoufieff, 1924 (= <i>Dendropaemon waterhousei</i> Olsoufieff, 1924) | Not specified | Ribeirão Preto (SP) | Pessôa and Lane, 1941 |
| <i>Dendropaemon</i> (<i>Dendropaemon</i>) <i>crenatostratus</i> Felsche, 1909 | Not specified | (SP) | Pessôa and Lane, 1941 |
| <i>Dendropaemon</i> (<i>Dendropaemon</i>) <i>denticollis</i> Felsche, 1909 | Not specified | P. Murtinho (MS), Irara (MG), Vianópolis (GO) | Pessôa and Lane, 1941 |
| <i>Dendropaemon</i> (<i>Dendropaemon</i>) <i>viridipennis</i> (Laporte, 1831) | Not specified | São Paulo (Ipiranga) (SP), S. Bernardo (SP), Irara (MG) | Pessôa and Lane, 1941 |
| <i>Dendropaemon</i> (<i>Dendropaemon</i>) <i>viridis</i> Perty, 1833 | Not specified | São Paulo (Ipiranga) (SP) | Pessôa and Lane, 1941 |
| <i>Dendropaemon</i> (<i>Paradendropaemon</i>) <i>ganglbaueri</i> Felsche, 1909 | Not specified | São Paulo (SP) | Pessôa and Lane, 1941 |
| <i>Diabroctis mimas</i> (Linnaeus, 1758) (= <i>Taurocopris mimas</i> Linneu) | Not specified | (GO), (MT), (SP), (AM), (PA), (BA) | Pessôa and Lane, 1941 |
| <i>Diabroctis mirabilis</i> (Harold, 1877) (= <i>Taurocopris luederwaldti</i> Pessôa, 1941) | Not specified | São Paulo (SP) ("probably") | Pessôa and Lane, 1941 |
| <i>Diabroctis mirabilis</i> (Harold, 1877) (= <i>Taurocopris mirabilis</i> Harold, 1877) | Not specified | Agudos (SP), P. Murtinho (MS), Vianópolis (GO) | Pessôa and Lane, 1941 |
| <i>Dichotomius</i> (<i>Dichotomius</i>) <i>agesilaus</i> (Waterhouse, 1891) (= <i>Pinotus</i> <i>agesilaus</i> Waterhouse, 1891) | Not specified | (PR), (SC) | Pessôa and Lane, 1941 |
| <i>Dichotomius</i> (<i>Dichotomius</i>) <i>boreus</i> (Olivier, 1789) | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Dichotomius</i> (<i>Dichotomius</i>) <i>longiceps</i> (Taschenberg, 1870) (= <i>Pinotus</i> <i>longiceps</i> Taschenbg., 1870) | Not specified | (SP), (MT), (GO), Campinas (SP), Serra Negra (SP), Franca (SP), Avanhandava (SP) | Pessôa and Lane, 1941 |
| <i>Dichotomius</i> (<i>Dichotomius</i>) <i>semiaeneus</i> (Germar, 1824) (= <i>Pinotus semiaeneus</i> Germar) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Dichotomius</i> (<i>Homocanthonides</i>) <i>smaragdinus</i> (Perty, 1833) (= <i>Pinotus smaragdinus</i> (Perty, 1830)) | Not specified | (SP), (MT), (GO) | Pessôa and Lane, 1941 |
| <i>Dichotomius</i> (<i>Luederwaldtinia</i>) <i>geminatus</i> (Arrow, 1913) | Pig | Serra Talhada (PE) | Mayer and Vasconcelos, 2013 |
| <i>Dichotomius</i> (<i>Luederwaldtinia</i>) <i>nisus</i> (Olivier, 1789) (= <i>Pinotus nisus</i> (Olivier, 1789)) | Not specified, pig | (PA), (BA), (PE), (MG), (ES), (SP), (RS), Uberlândia (MG), Serra Talhada (PE) | Pessôa and Lane, 1941; Rosa et al., 2011; Mayer and Vasconcelos, 2013 |
| <i>Dichotomius</i> (<i>Luederwaldtinia</i>) <i>opacipennis</i> (Luederwaldt, 1931) | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Dichotomius</i> (<i>Luederwaldtinia</i>) <i>sericeus</i> (Harold, 1867) | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| <i>Dichotomius</i> (<i>Selenocopris</i>) <i>ascanius</i> (Harold, 1869) (= <i>Pinotus</i> <i>ascanius</i> Harold) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Dichotomius</i> (<i>Selenocopris</i>) <i>fissus</i> (Harold, 1867) (= <i>Pinotus</i> <i>fissus</i> Harold, 1867) | Not specified | (SP), (RJ), (MG), (ES) | Pessôa and Lane, 1941 |
| <i>Dichotomius</i> sp. | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| <i>Dichotomius</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Dichotomius</i> sp. | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Dyscinetus</i> sp. | Pig | Curitiba (PR) probably accidental | Mise et al., 2007 |
| <i>Eurysternus aeneus</i> Génier, 2009 | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Eurysternus calligrammus</i> Dalman, 1824 | Not specified | São Paulo (Ipiranga) (SP), Cantareira (SP), Jundiá (SP), Blumenau (SC), Corupá (=Hansa Humboldt) (SC) Brasil | Pessôa and Lane, 1941 |
| <i>Eurysternus calligrammus</i> Dalman, 1824 (= <i>Eurysternus opacus</i> Lucas, 1857) | Not specified | | Pessôa and Lane, 1941 |
| <i>Eurysternus calligrammus</i> Dalman, 1824 (= <i>Eurysternus scotinoides</i> Castelnau, 1840) | Not specified | Brasil | Pessôa and Lane, 1941 |
| <i>Eurysternus foedus</i> Guérin-Méneville, 1830 | Not specified | Brasil | Pessôa and Lane, 1941 |
| <i>Eurysternus hypocrita</i> Balthasar, 1939 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Eurysternus impressicollis</i> Casteunal, 1840 | Not specified | São Paulo (Ipiranga) (SP) | Luederwaldt, 1911; Pessôa and Lane, 1941 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|---|---------------------------|--|--|
| <i>Eurysternus parallelus</i> Castelnau, 1840 (=Eurysternus femoralis Lucas, 1857) | Human, pig, not specified | Campinas (SP) | Pessôa and Lane, 1941; Carvalho et al., 2000 |
| <i>Eurysternus</i> sp. (=Eurysternus sp.) | Rat | Curitiba (PR) | Moura et al., 1997 |
| <i>Eutrichillum hirsutum</i> (Boucomont, 1928) (=Trichillum hirsutum Boucomont) | Not specified | (SP) | Pessôa and Lane, 1941 |
| <i>Gromphas lacordairei</i> Brullé, 1834 | Not specified | Piracicaba (SP), Anhangabí (SP), Curitiba, Artaga (?) (PR), Joinville (SC), Blumenau (SC), Harmonia (SC), (RS), P. Murtinho (MS) | Pessôa and Lane, 1941 |
| <i>Holocephalus eridanus</i> (Olivier, 1789) | Not specified | (ES), (RJ), (MG) | Pessôa and Lane, 1941 |
| <i>Isocoprís inhiatus</i> (Germar, 1824) (=Pinotus inhiatus (Germar, 1824)) | Not specified | (SP), (PR), (MG) | Pessôa and Lane, 1941 |
| <i>Labarrus pseudolividus</i> (Balthasar, 1941) | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Leucothyreus</i> sp. (=Leucothyreus sp.) | Pig | Curitiba (PR) probably accidental | Mise et al., 2007 |
| <i>Malagoniella (Malagoniella) virens</i> (Harold, 1869) (=Megathopa virens Harold, 1869) | Not specified | Brasil | Pessôa and Lane, 1941 |
| <i>Malagoniella (Megathopomima) puncticollis aenicollis</i> (Waterhouse, 1890) (=Megathopa aenicollis Waterhouse, 1890) | Not specified | Brasil | Pessôa and Lane, 1941 |
| <i>Megathopa</i> sp. | Rat | Campinas (SP) | Monteiro-Filho and Penereiro, 1987 |
| <i>Megathopa</i> sp. | Rat | Curitiba (PR) | Moura et al., 1997 |
| <i>Ontherus (Ontherus) appendiculatus</i> (Mannerheim, 1829) | Not specified, pig | (SP), (PR), (RS), (MT), (MG), (ES), (BA), (CE), (AM), Uberlândia (MG) | Pessôa and Lane, 1941; Rosa et al., 2011 |
| <i>Ontherus (Ontherus) cephalotes</i> Harold, 1869 | Not specified | São Paulo (Ipiranga) (SP), Cantareira (SP), Blumenau (SC), Joinville (SC), Rio Negrinho (SC), Nova Petrópolis (RS) | Pessôa and Lane, 1941 |
| <i>Ontherus (Ontherus) digitatus</i> Harold, 1868 | Not specified | São Paulo (Ipiranga) (SP), Franca (SP), Pirapora (MG), Juazeiro (BA), (MT) | Pessôa and Lane, 1941 |
| <i>Ontherus (Ontherus) sulcator</i> (Fabricius, 1775) (=Ontherus nesus Laporte, 1840) | Not specified | (AM), (RJ), (SP), (MT), (RS) | Pessôa and Lane, 1941 |
| <i>Ontherus</i> sp. | | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Ontherus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Onthophagus (Onthophagus) bidentatus</i> Drapiez, 1819 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Onthophagus (Onthophagus) buculus</i> Mannerheim, 1829 | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Onthophagus (Onthophagus) hirculus</i> Mannerheim, 1829 | Not specified, pig | São Paulo (SP), Uberlândia (MG) | Luederwaldt, 1911; Rosa et al., 2011 |
| <i>Onthophagus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Oxysternon (Mioxysternon) spiniferum</i> (Castelnau, 1840) (=Oxysternon curvispinum Olsoufieff, 1824) | Not specified | Porto Murtinho (MS) | Pessôa and Lane, 1941 |
| <i>Oxysternon (Oxysternon) conspicillatum</i> (Weber, 1801) | Not specified | Serra dos Parecis (MT), Manaus (AM), S. Paulo de Olivença (AM), (GO) | Pessôa and Lane, 1941 |
| <i>Oxysternon (Oxysternon) palemo</i> Castelnau, 1840 | Not specified | (GO), Diamantina (MG), São João del Rei (MG), Avanhanda (SP), Lussanvira (SP) | Pessôa and Lane, 1941 |
| <i>Pedaridium hirsutum</i> (Harold, 1859) | Not specified | Franca (SP) | Pessôa and Lane, 1941 |
| <i>Phanaeus (Notiophanaeus) dejeani</i> Harold, 1868 (=Phanaeus (Phanaeus) dejeani Harold) | Not specified | (PA), São Paulo (Ipiranga) (SP), São Paulo (SP) | Pessôa and Lane, 1941 |
| <i>Phanaeus (Notiophanaeus) kirbyi</i> Vigors, 1825 (=Phanaeus (Phanaeus) kirbyi Vigors) | Not specified | E. da Barra (MG), Diamantina (MG), (MT), Castro (PR) | Pessôa and Lane, 1941 |
| <i>Phanaeus (Notiophanaeus) palaeno</i> Blanchard, 1845 (=Phanaeus (Phanaeus) palaeno Blanch.) | Not specified | Castro (SP), E. da Barra (MG), Serra Diamantina (MG), Agudos (SP) | Pessôa and Lane, 1941 |
| <i>Phanaeus (Notiophanaeus) splendidulus</i> (Fabricius, 1781) (=Phanaeus (Phanaeus) floriger Kirby) | Not specified | Rio de Janeiro (RJ), São Paulo (Ipiranga) (SP), Avanhanda (SP), (ES), (SC) | Pessôa and Lane, 1941 |
| <i>Phanaeus (Notiophanaeus) splendidulus</i> Fabricius, 1781 (=Phanaeus (Phanaeus) splendidulus (Fabricius)) | Not specified | (SP), Castro (PR), Serra Diamantina (MG), V. Alegre (MG) | Pessôa and Lane, 1941 |
| <i>Phyllophaga</i> sp. | Pig | Itumbiara (GO) probably accidental | Marchiori et al., 2000 |
| <i>Pinotus</i> sp. (=Dichotomius sp.) | Rat | Curitiba (PR) | Moura et al., 1997 |
| <i>Scatonomus fasciculatus</i> Erichson, 1835 | Not specified | São Paulo (SP), Alto da Serra (SP), Serra da Bocaina (SP), (MG), (RS) | Pessôa and Lane, 1941 |
| <i>Scatonomus insignis</i> Harold, 1867 | Not specified | Jundiá (SP), Franca (SP) | Pessôa and Lane, 1941 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|---|----------------------|---|--|
| <i>Scatrichus bicarinatus</i> (Harold 1869) (= <i>Scatimus bicarinatus</i> Harold) | Not specified | Brasil | Pessôa and Lane, 1941 |
| <i>Scybalocanthon nigriceps</i> (Harold, 1868) (= <i>Canthon nigriceps</i> Harold, 1869) | Not specified | (AM), (MT), (SP), Franca (SP) | Pessôa and Lane, 1941 |
| <i>Scybalocanthon</i> sp. | Pig | Campinas (SP) | Carvalho et al., 2000 |
| <i>Sulcophanaeus faunus</i> (Fabricius, 1771) (= <i>Phanaeus (Phanaeus) faunus</i> (Fabricius, 1771)) | Not specified | (MT) | Pessôa and Lane, 1941 |
| <i>Trichillum externepunctatum</i> Preudhomme de Borre, 1880 | Not specified, pig | São Paulo (SP), Itumbiara (GO), Uberlândia (MG), Serra Talhada (PE) | Pessôa and Lane, 1941; Marchiori et al., 2000; Rosa et al., 2011; Mayer and Vasconcelos, 2013 |
| <i>Trichillum heydeni</i> Harold, 1868 | Not specified | São Paulo (SP), Vila Nova (BA) | Luederwaldt, 1911; Pessôa and Lane, 1941 |
| <i>Trichillum</i> sp. | | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Scarabaeidae</i> sp. | Rat | Campinas (SP) | Monteiro-Filho and Penreiro, 1987 |
| <i>Scarabaeidae</i> spp. | Pig | Campinas (SP), Uberlândia (MG) | Carvalho et al., 2004; Rosa et al., 2011 |
| Hydrophilidae | | | |
| <i>Dactylosternum</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| Megastermini sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| Hydrophilidae sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| Hydrophilidae sp. 1 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Hydrophilidae sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Hydrophilidae sp. 3 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Hydrophilidae sp. 4 | Pig | Curitiba (PR) | Mise et al., 2007 |
| Hybosoridae | | | |
| <i>Chaetodus</i> sp. | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Chaetodus exaratus</i> Arrow, 1909 | Rabbit | Curitiba (PR) | Corrêa et al., 2014 |
| Silphidae | | | |
| <i>Oxelytrum cayennense</i> (Stürm, 1826) (= <i>Silpha cayennensis</i> Stürm) | Pig, human | São Paulo (SP) [*] , Manaus (AM) | Luederwaldt, 1911 [*] ; Mise et al., 2010; Ururahy-Rodrigues et al., 2010; Souza et al., 2014 |
| <i>Oxelytrum discicolle</i> (Brullé, 1840) (= <i>Oxyletrun discicolle</i> sic) | Rat, pig | Curitiba (PR), Campinas (SP), Uberlândia (MG) | Moura et al., 1997; Carvalho et al., 2000; Rosa et al., 2011 |
| <i>Oxelytrum erythrurum</i> (Blanchard, 1840) | Pig, rabbit, chicken | Curitiba (PR) | present study |
| <i>Oxelytrum</i> spp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Silphidae</i> sp. | Rat | Campinas (SP) | Monteiro-Filho and Penreiro, 1987 |
| Staphylinidae | | | |
| <i>Aleochara (Aleochara) bonariensis</i> Lynch, 1884 (= <i>Aleochara lateralis</i> Erichson, 1839) | Pig | São Paulo (SP), Campinas (SP), Ribeirão do Pinhal (PR) | Luederwaldt, 1911; Souza and Linhares, 1997; Silva and Santos, 2012 |
| <i>Aleochara (Aleochara) pseudochrysorrhoea</i> Caron, Mise and Klimaszewski, 2008 (= <i>Aleochara</i> sp. 1) | Pig, rabbit | Curitiba (PR) | Mise et al., 2007; Caron et al., 2008; Mise et al., 2013 |
| <i>Aleochara (Coprochara) notula</i> Erichson, 1839 (= <i>Aleochara notula</i>) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Aleochara (Xenochara) taeniata</i> Erichson, 1839 (= <i>Aleochara taeniata</i>) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Aleochara</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Aleochara</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Aleochara</i> sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Aleochara</i> sp. 3 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Amblyopinodes gahani gahani</i> (Fauvel, 1901) (= <i>Amblyopinus gahani</i> Fauvel) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Anotylus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Anotylus</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Anotylus</i> sp. 1 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Anotylus</i> sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Atheta brasiliiana</i> Bernhauer, 1908 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Atheta iheringi</i> Bernhauer, 1908 (= <i>Ocalea</i> sp. 1) | Pig, rabbit | Curitiba (PR) | Mise et al., 2007; Mise et al., 2013 |
| <i>Atheta mayalis</i> Bernhauer | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Atheta</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Belonuchus</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Belonuchus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Belonuchus xanthopus</i> Solsky, 1868 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Carpelinus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Cilea</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Coproporus</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Creophilus variegatus</i> Mannerheim, 1830 (= <i>Creophilus variegatus</i> (Linnaeus)) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Cryptobium</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|---|--------------------|---------------------------------|---|
| <i>Dybelonetes hibridus</i> (Erichson, 1840) | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Echiaster</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Eulissus chalibaeus</i> Mannerheim, 1830 (= <i>Eulissus chalibaeus</i> (Mannerheim)) | Rat, pig | Campinas (SP), Uberlândia (MG) | Souza and Linhares, 1997; Moretti et al., 2008; Rosa et al., 2011 |
| <i>Eulissus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Falagria (Anaulacaspis) fissula</i> Erichson 1840 (= <i>Falagria fissula</i> (Erichson)) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Heterothops</i> sp. (= <i>Heterotops</i>) | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Heterothops</i> spp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Hoplandria aleocharoides</i> Bernhauer, 1908 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Hoplandria</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Lepitacnus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Lissohypnus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Lithocharis</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Nacaeus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Neobisnius</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Neohypnus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Neohypnus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Neophyrus</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Ocalea</i> sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Oligotergus</i> sp. 1 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Oligotergus</i> sp. 2 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Osorius</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Oxytelus</i> sp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Oxytelus subnitidus</i> Reitter, 1909 (= <i>Oxytelus subnitidus</i> Bernhauer) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Philonthus brasiliensis</i> Bernhauer, 1916 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Philonthus feralis</i> Erichson, 1840 (<i>Philonthus feralis</i> Erichson (sic)) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Philonthus flavolimbatus</i> Erichson, 1840 | Not specified, pig | São Paulo (SP), Uberlândia (MG) | Luederwaldt, 1911; Rosa et al., 2011 |
| <i>Philonthus</i> sp. | Rabbit | Curitiba (PR) | Mise et al., 2013 |
| <i>Philonthus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Philonthus</i> sp. 1 | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Philonthus</i> sp. 1 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Philonthus</i> sp. 2 | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Philonthus</i> sp. 2 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Philonthus</i> sp. 3 | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Philonthus</i> sp. 3 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Philonthus</i> sp. 4 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Philonthus</i> sp. 5 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Philonthus</i> sp. 6 | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Philonthus</i> spp. | Pig | Uberlândia (MG) | Rosa et al., 2011 |
| <i>Platydracus ochropygus</i> (Nordmann, 1837) | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Platydracus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Platydracus</i> sp. | Pig | Cutitiba (PR) | Mise et al., 2007 |
| <i>Plociopterus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Quedius</i> sp. | Pig | Cutitiba (PR) | Mise et al., 2007 |
| <i>Stethusa luederwaldti</i> (Bernhauer, 1908) (= <i>Atheta luederwaldti</i>) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Stethusa lurida</i> (Erichson, 1839) (= <i>Atheta lurida</i>) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Stilocharis</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Thoracophorus</i> sp. | Pig | Cutitiba (PR) | Mise et al., 2007 |
| <i>Xanthopygus bicolor</i> Laporte, 1835 | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Xanthopygus</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Xanthopygus</i> sp. | Pig | Campinas (SP) | Souza and Linhares, 1997 |
| <i>Aleocharinae</i> sp. | Pig | Manaus (AM) | Mise et al., 2010 |
| <i>Philonthina</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Oxypodini</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Staphilininae</i> sp. | Pig | Cutitiba (PR) | Mise et al., 2007 |
| <i>Staphylinidae</i> spp. | Pig | Campinas (SP), Uberlândia (MG) | Carvalho et al., 2000; Carvalho et al., 2004; Rosa et al., 2011 |
| <i>Staphilinidae</i> sp. | Rat | Campinas (SP) | Monteiro-Filho and Penereiro, 1987 |
| <i>Staphilinidae</i> sp. 1 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Staphilinidae</i> sp. 1 | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| <i>Staphilinidae</i> sp. 2 | Pig | Itumbiara (GO) | Marchiori et al., 2000 |
| <i>Staphilinidae</i> sp. 2 | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| Tenebrionidae | | | |
| <i>Lagria villosa</i> (Fabricius, 1871) | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Prostenus periscelis</i> Perty, 1830 | Not specified | São Paulo (SP) | Luederwaldt, 1911 |

Table 1 (Continued)

| Family/species | Diet/carcass | Geographical distribution | References |
|--|--------------------|---|---|
| <i>Xystropus femoratus</i> (Germar) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| Tenebrionidae sp. (=Alleculidae sp.) | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| Tenebrionidae sp. 1 | Pig | Cutitiba (PR) | Mise et al., 2007 |
| Tenebrionidae sp. 2 | Pig | Cutitiba (PR) | Mise et al., 2007 |
| Tenebrionidae sp. 3 | Pig | Cutitiba (PR) | Mise et al., 2007 |
| Tenebrionidae sp. 4 | Pig | Cutitiba (PR) | Mise et al., 2007 |
| Trogidae | | | |
| <i>Omorgus (Omorgus) suberosus</i> (Fabricius, 1775) | Not specified, pig | São Paulo (SP), Itumbiara (GO), Uberlândia (MG), Serra Talhada (PE) | Luederwaldt, 1911; Marchiori et al., 2000; Rosa et al., 2011; Mayer and Vasconcelos, 2013 |
| <i>Omorgus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| <i>Polynoncus gemmingeri</i> (Harold, 1872) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Polynoncus pilularius</i> (Germar, 1824) | Not specified | São Paulo (SP) | Luederwaldt, 1911 |
| <i>Polynoncus</i> sp. | Pig | Curitiba (PR) | Mise et al., 2007 |
| Trogidae sp. | Rat | Curitiba (PR) | Moura et al., 1997 |
| Trogidae sp. 1 | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |
| Trogidae sp. 2 | Pig | Recife (PE) | Cruz and Vasconcelos, 2006 |

Brazilian States cited as abbreviation in parenthesis.

* Distribution restricted to the North of Brazil.

Table 2

Number of records available of Coleoptera of forensic interest per State and Region of Brazil.

| Midwest | | | | North | | | | | | Northeast | | | | | | South | | | Southeast | | | | | | | |
|---------|----|----|----|-------|----|----|----|----|----|-----------|----|----|----|----|----|-------|----|----|-----------|-----|-----|----|----|----|-----|-----|
| DF | GO | MS | MT | AC | AM | AP | PA | RO | RR | TO | AL | BA | CE | MA | PB | PE | PI | RN | SE | PR | SC | RS | ES | MG | RJ | SP |
| 0 | 29 | 6 | 21 | 0 | 51 | 0 | 5 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 2 | 33 | 0 | 0 | 0 | 104 | 16 | 13 | 16 | 57 | 20 | 140 |
| | | 56 | | | | | 56 | | | | | | | | 46 | | | | | | 133 | | | | 233 | |

et al., 2007; Byrd and Castner, 2010); and their feeding habit. Every taxon listed here is described in literature as being necrophagous or predator.

Results and discussion

Our survey listed 345 records of 16 families: Carabidae, Cleridae, Dermestidae, Geotrupidae, Histeridae, Hybosoridae, Hydrophilidae, Leiodidae (=Cholevidae), Nitidulidae, Ptiliidae, Monotomidae (=Rhizophagidae), Scarabaeidae, Silphidae, Staphylinidae, Tenebrionidae and Trogidae, allocated to 16 Brazilian states (Table 1).

In Table 1 we include information about taxa (valid name in the original combination and name as cited in literature), substratum (type of carcass or corpse), distribution (locality and states) and the references where the data was originally cited.

Some taxa have no available information about the substratum and they are referred here as “not specified”. Several species do not have available information beyond family, tribe or genera (referred as “taxa.sp”) and we present the information the way it was published. The apparently repetition of some taxa are due the unknown identification, meaning that it is impossible to say if they are the same species.

Scarabaeidae was the family with the highest number of specimens registered (158), followed by Staphylinidae (84) and Histeridae (36 species).

Three species are recorded for the first time: *Stelidota geminata* (Say, 1825) and *Stelidota octomaculata* (Say, 1825) (Nitidulidae) in rabbit carcass and *Oxelytrum erythrurum* (Blanchard, 1840) (Silphidae) in pig, rabbit and chicken carcasses.

The majority of records collected for Scarabaeidae are from Pessoa and Lane (1941) which performed a review of Scarabaeidae of medico-legal importance in Brazil. Considering the abundance of registers for this family, and their saprophagous habits, Scarabaeidae apparently have a great unexplored potential for forensic entomology. In the same scenario Nitidulidae is a family known of necrophagous species (see Abbott, 1937; Payne, 1969) have been

largely underestimated and its value in forensic investigations is still to be established (Byrd and Castner, 2010).

As it was stated before, the potential forensic interest of the species is based not only in their records on carcasses but also upon their feeding habit. The knowledge about behaviour and ecological roles in Coleoptera is not as clear as it is in Diptera. Abbott (1937) and Payne (1969) produced an informative review about the behaviour of Coleoptera on carrion, but not much has been done since then. The result is that many taxa with potential importance have been neglected.

The families listed in the present study have documented necrophilous habit, but have not been necessarily found in corpses or used as evidence in actual cases. However, most families have been recorded as associated with human corpses: Cleridae, Dermestidae, Histeridae and Staphylinidae (Turchetto et al., 2001); Silphidae (Souza et al., 2014); Geotrupidae (Nuorteva, 1977); Rhizophagidae and Tenebrionidae (Méglin, 1894); Hydrophilidae and Leiodidae (Easton and Smith, 1970); Nitidulidae (Adair and Kondratieff, 1996); Carabidae, Ptiliidae and Scarabaeidae (Motter, 1898); Trogidae (Lefebvre and Gaudry, 2009). Even though several taxa listed here belong to families referred as saprophagous (i.e. organic matter feeders – Torre-Bueno, 1989), the presence of those families near or in corpses provides a certain level of certainty to affirm that they are associated with the corpse and have a potential use for forensic entomology.

In forensic entomology studies, Coleoptera is frequently mentioned as an order of great importance alongside Diptera. However, the importance of the order is often neglected due to taxonomic difficulties or other issues regarding the role of those insects in corpses. Several species (Table 1) were reported in carcasses as potential indicators for forensic entomology, but registers from human corpses are rare. The question at this point is the absence of species or the lack of available knowledge (e.g. tools for identification, behavioural and ecological data) that does not allow the use of the group in real cases? As mentioned before, Coleoptera have a great potential for forensic entomology, but is often underestimated especially when Diptera is available.

The reported occurrences (Table 2) are restricted to 16 states and showed a biased pattern towards Southeast (233) and South (133) regions, being São Paulo (SP) (140) and Paraná (PR) (104) the most representative states.

Due its massive territory and biased efforts of collect, not much is known about the Coleoptera of potential importance in Brazil. Future efforts should focus on experiments in different regions and states to increase the database of necrophilous insects. The list of names presented here has the objective to help the dissemination of the correct names of species, often misspelled.

Conflicts of interest

The authors declare no conflicts of interest.

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References

- Abbott, C.E., 1937. The necrophilous habit in Coleoptera. *Bull. Brooklyn Entomol. Soc.* 32, 202–204.
- Adair, T.W., Kondratieff, B.C., 1996. The occurrence of *Nitidula flavomaculata* (Coleoptera: Nitidulidae) on a human corpse. *Entomol. News* 107, 233–236.
- Almeida, L.M., Mise, K.M., 2009. Diagnosis and key of the main families and species of South American Coleoptera of forensic importance. *Rev. Bras. Entomol.* 53, 227–244.
- Byrd, J.H., Castner, J.L. (Eds.), 2010. *Forensic Entomology: The Utility of Arthropods in Legal Investigations*. CRC Press, Florida.
- Caron, E., Mise, K.M., Klimaszewski, J., 2008. Aleochara pseudochrysochorrea, a new species from southern Brazil (Coleoptera Staphylinidae: Aleocharinae), with a complete checklist of Neotropical species of the genus. *Rev. Bras. Entomol.* 25, 827–842.
- Carvalho, L.M.L., Thyssen, P.J., Linhares Palhares, F.A.B., 2000. A checklist of arthropods associated with pig carrion and human corpses in southeastern Brazil. *Mem. Inst. Oswaldo Cruz* 95, 135–138.
- Carvalho, L.M.L., Thyssen, P.J., Goff, M.L., Linhares, A.X., 2004. Observations on the succession patterns of necrophagous insects on a pig carcass in an urban area of southeastern Brazil. *Anil Aggrawal's Internet J. Forensic Med. Tox.* 5, 33–39.
- Caterino, M.S., Tishechkin, A.K., 2013. A systematic revision of *Operclipygus* Marseul (Coleoptera, Histeridae, Exosternini). *ZooKeys* 271, 1–401.
- Corrêa, R.C., Moura, D.P., Leivas, F.W.T., Almeida, L.M., 2012. *Operclipygus hospes* (Lewis) (Coleoptera, Histeridae): a beetle of potential forensic importance for buried bodies. *Neotrop. Entomol.* 41, 254–256.
- Corrêa, R.C., Almeida, L.M., Moura, M.O., 2014. Coleoptera associated with buried carrion: potential forensic importance and seasonal composition. *J. Med. Entomol.* 51, 1057–1066.
- Cruz, T.M., Vasconcelos, S.D., 2006. Entomofauna de solo associada à decomposição de carcaça suína em um fragmento de Mata Atlântica de Pernambuco, Brasil. *Biociências* 14, 193–201.
- Easton, A.M., Smith, K.G.V., 1970. The entomology of the cadaver. *Med. Sci. Law* 10, 208–215.
- Endres, A.A., Hernández, M.I.M., Creão-Duarte, A.J., 2005. Considerações sobre *Coprophanæus ensifer* (Germar) (Coleoptera, Scarabaeidae) em um remanescente de Mata Atlântica no Estado da Paraíba, Brasil. *Rev. Bras. Entomol.* 49, 427–429.
- Freire, O., 1914a. Algumas notas para o estudo da fauna cadavérica da Bahia. *Gazeta Médica da Bahia* 46, 110–125.
- Freire, O., 1914b. Algumas notas para o estudo da fauna cadavérica da Bahia. *Gazeta Médica da Bahia* 46, 149–162.
- Lefebvre, F., Gaudry, E., 2009. Forensic entomology: a new hypothesis for the chronological succession pattern of necrophagous insect on human corpses. *Ann. Soc. Entomol. Fr.* 45, 377–392.
- Leivas, F.W.T., Mise, K.M., Almeida, L.M., Macari, B.P., Gomy, Y., 2012. New species and key of *Aeletes* Horn (Coleoptera: Histeridae: Abraeinae) from Brazil. *Zootaxa* 3175, 63–68.
- Luederwaldt, G., 1911. Os insectos necrophagos paulistas. *Rev. Mus. Paul.* 8, 414–433.
- Marchiori, C.H., Silva, C.G., Caldas, E.R., Vieira, C.I.S., Almeida, K.G.S., Teixeira, F.F., Linhares, A.X., 2000. Artrópodos associados com carcaça de suíno em Itumbiara, sul de Goiás. *Arq. Inst. Biol.* 67, 167–170.
- Mayer, A.C.G., Vasconcelos, S.D., 2013. Necrophagous beetles associated with carcasses in a semi-arid environment in Northeastern Brazil Implications for forensic entomology. *Forensic Sci. Int.* 226, 41–45.
- Mégnin, J., 1894. La faune des cadavres: application de l'entomologie a la médecine légale. *Encyclopedie Scientifique des Aides Memoires*. Masson et Gauthiers-Villars, Paris, pp. 214.
- Midgley, J.M., Richards, C.S., Villet, M.H., 2010. The utility of Coleoptera in forensic investigations. In: Amendt, J., Campobasso, C.P., Goff, M.L., Grassberger, M. (Eds.), *Current Concepts in Forensic Entomology*. Springer, Dordrecht, pp. 57–68.
- Mise, K.M., Almeida, L.M., Moura, M.O., 2007. Levantamento da fauna de Coleoptera que habita a carcaça de *Sus scrofa* L. em Curitiba, Paraná. *Rev. Bras. Entomol.* 51, 358–368.
- Mise, K.M., Souza, A.S.B., Campos, C.M., Keppler, R.L.F., Almeida, L.M., 2010. Coleoptera associados a carcaça de porco em reserva florestal, Manaus, Amazonas, Brasil. *Biota Neotrop.* 10, 321–324.
- Mise, K.M., Corrêa, R.C., Almeida, L.M., 2013. Coleoptero-fauna found on fresh and frozen rabbit carcasses in Curitiba, Paraná, Brazil. *Braz. J. Biol.* 73, 543–548.
- Monteiro-Filho, E.L.A., Penreiro, J.L., 1987. Estudo de decomposição e sucessão sobre uma carcaça animal numa área do estado de São Paulo, Brasil. *Rev. Bras. Biol.* 47, 289–295.
- Moretti, T.C., Ribeiro, O.B., Thyssen, P.J., Solis, D.R., 2008. Insects on decomposing carcasses of small rodents in a secondary forest in Southeastern Brazil. *Eur. J. Entomol.* 105, 691–696.
- Motter, M.G., 1898. A contribution to the study of the fauna of the grave. A study of one hundred and fifty disinterments, with some additional experimental observations. *J. N.Y. Entomol. Soc.* 6, 201–231.
- Moura, M.O., de Carvalho, C.J.B., Monteiro-Filho, E.L.A., 1997. A preliminary analysis of insects of medico-legal importance in Curitiba, state of Paraná. *Mem. Inst. Oswaldo Cruz* 92, 269–274.
- Nuorteva, P., 1977. Sarcosaprophagous insects as forensic indicators. In: Tedeschi, G.C., Eckert, W.G., Tedeschi, L.G. (Eds.), *Forensic Medicine: A Study in Trauma and Environmental Hazards*, vol. 2. Saunders, Philadelphia, pp. 1072–1095.
- Payne, J.A., 1969. Coleoptera associated with pig carrion. *Entomol. Mag.* 105, 224–232.
- Pujol-Luz, J.R., Arantes, L.C., Constantino, R., 2008. Cem anos da Entomologia Forense no Brasil (1908–2008). *Rev. Bras. Entomol.* 52, 485–492.
- Pessôa, S.B., Lane, F., 1941. Coleópteros Necrófagos de Interesse Médico-Legal Ensaio monográfico sobre a família Scarabaeidae de S. Paulo e regiões vizinhas. *Rev. Mus. Paul.* 25, 389–504.
- Rosa, T.A., Babata, M.L.Y., Souza, C.M., Sousa, D., Mello-Patiu, C.A., Vaz-de-Mello, F.Z., Mendes, J., 2011. Arthropods associated with pig carrion in two vegetation profiles of Cerrado in the State of Minas Gerais, Brazil. *Rev. Bras. Entomol.* 55, 424–434.
- Silva, R.C., Santos, W.E., 2012. Fauna de Coleoptera associada a carcaças de coelhos expostas em uma área urbana no Sul do Brasil. *EntomoBrasilis* 5, 185–189.
- Smith, K.G.V., 1986. *A Manual of Forensic Entomology*. British Museum, London.
- Souza, A.M., Linhares, A.X., 1997. Diptera and Coleoptera of potential forensic importance in southeastern Brazil: relative abundance and seasonality. *Med. Vet. Entomol.* 11, 8–12.
- Souza, A.S.B., Kirst, F.D., Krüger, R.F., 2008. Insects of forensic importance from Rio Grande do Sul state in southern Brazil. *Rev. Bras. Entomol.* 52, 641–646.
- Souza, E.R., Rafael, J.A., Xavier Filho, F.F., Da-Silva-Freitas, J.O., Oliveira-Costa, J., Ururahy-Rodrigues, A., 2014. First medicolegal forensic entomology case of central Amazon: a suicide by hanging with incomplete suspension. *EntomoBrasilis* 7, 12–15.
- Torre-Bueno, J.R., 1989. *The Torre-Bueno Glossary of Entomology*. N. Y. Entomol. Soc., New York.
- Turchetto, M., Lafisca, S., Costantini, G., 2001. Postmortem interval (PMI) determined by study sarcophagous biocenoses: three cases from the province of Venice (Italy). *Forensic Sci. Int.* 120, 28–31.
- Uruahy-Rodrigues, A., Rafael, J.A., Wanderley, R.F., Marques, H., Pujol-Luz, J.R., 2008. *Coprophanæus lancifer* (Coleoptera, Scarabaeidae) activity causes the rolling movement of a man-sized carcass in Amazonia, Brazil: a forensic taphonomy report. *Forensic Sci. Int.* 182, 19–22.
- Uruahy-Rodrigues, A., Rafael, J.A., Pujol-Luz, J.R., Henriques, A.L., Queiroz, M.M.C., Barbosa, R.R., Baroni, M.N., 2010. Association of *Oxelytrum cayennense* (Silphidae, Coleoptera) with pig carcasses (*Sus scrofa*, Suidae) in Terra Firme areas in Manaus, Amazonas, Brazil. *EntomoBrasilis* 3, 45–48.
- Vasconcelos, S.D., Araújo, M.C.S., 2012. Necrophagous species of Diptera and Coleoptera in northeastern Brazil: state of the art and challenges for the forensic entomologist. *Rev. Bras. Entomol.* 56, 7–14.