

Table S1. Evidence for distribution of air sacs and tracheal compression in adults across hexapod orders. In most cases, there are only data for a few species in each order. Only one or two representative publications are listed, though often more could be shown.

| Order or Family | Air Sacs | Tracheal Compression | Link to Image or video |
|-----------------|---|--|---|
| Protura | None. (Dittrich and Wipfler, 2021; Herhold et al. 2023) | No data | |
| Collembola | None (Dittrich and Wipfler, 2021) | No data | |
| Diplura | None (Dittrich and Wipfler, 2021) | No data | |
| Archaeognatha | None (Dittrich and Wipfler, 2021) | No data | |
| Zygentoma | None (Dittrich and Wipfler, 2021; Herhold et al. 2023) | No. Synchrotron x-ray; n=1 | |
| Odonata | Extensive. (Weis-Fogh, 1964; Herhold et al. 2023) | Yes. Synchrotron x-ray; 2 species dragonfly (n=4 each) and 1 damselfly (n=2) (Westneat et al., 2006) | X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39223100 |
| Emphemeroptera | Alimentary air sac (Herhold et al. 2023) | No. Synchrotron x-ray; n=1 | |
| Dermoptera | None. (Jaglarz et al., 2019; Herhold et al. 2023) | Yes. Synchrotron x-ray; 1 species, n=3 (Westneat et al., 2006) | |
| Plecoptera | Aliimentary air sac (Herhold et al. 2023) | No data | |
| Zoraptera | no data | No data | |
| Orthoptera | Extensive. (Harrison et al., 2013; Herhold et | Yes. synchrotron x-ray; 3 species n>4, grasshoppers and crickets | X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39220226 |

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| | al. 2023) | Westneat et al. 2003 (Harrison et al., 2013) | |
| Grylloblattodea | None (Herhold et al. 2023) | No data | |
| Mantophasmatodea | No data | No data | |
| Phasmatodea | None. (Strauß, 2021; Herhold et al. 2023) | No data | |
| Emblidina | Alimentary air sac (Herhold et al. 2023) | No data | |
| Blattodea | No air sacs observed in 10/11 species (7 of 8 species shown in FigShare); also (Dittrich and Wipfler, 2021; Herhold et al. 2023) | Yes. Synchrotron x-ray; <i>Blattella germanica</i> (Westneat et al., 2006) | X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39223763 X-ray images of 8 cockroach species FigShare link: 10.6084/m9.figshare.22121633 |
| Mantodea | Dittrich and Wipfler 2021 report no air sacs; Herhold et al. report air sacs in head of one species. <i>Hierodula membranacea</i> , a large flying species, has air sacs (Kerry et al., 1987) | Yes. Synchrotron x-ray; 1 species (Westneat et al., 2006) | X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39223766 |
| Psocodea | None. (Mukerji and Sen-sarma, 1955) | No data | |
| Hemiptera | Air sacs in a flying but not a nonflying species. | Yes. N > 3 animals <i>Oncopeltus</i> sp. | |

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| | (Miller, 1961) (Wigglesworth, 1954) | | |
| Thysanoptera | None. (Polilov and Smakov, 2016) | No data | |
| Hymenoptera (Vespidae) | No data | No data | |
| Hymenoptera (Formicidae) | Air sacs in each tagma (Keister 1963) (see synchrotron images, also (Meyer, 1989)) | Yes. Synchrotron x-ray; head and thorax of 3 ant species. Westneat et al. 2003 | Air sacs in head of male ant, Link FigShare: 10.6084/m9.figshare.22089179 X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39220211 |
| Hymenoptera (Apidae) | (Meyer, 1989) | Yes. Synchrotron x-ray; <i>Bombus</i> and <i>Apis</i> sp. (Westneat et al., 2006) | X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39220220 |
| Raphidioptera | No data | No data | |
| Neuroptera | None in <i>Chrysopa pallens</i> (Zhao et al., 2022) But reported for large fliers (Newport, 1851) | No data | |
| Megaloptera | No data | No data | |
| Strepsiptera | No data | No data | |
| Coleoptera (Carabidae) | None. See synchrotron videos Thoracic and abdominal air sacs were reported in tiger beetles (Yeger and Spangler, 1995) | Yes. Synchrotron x-ray; 4 carabid species. Westneat et al. 2003 Socha et al. 2008 Hochgraf et al. 2019 | X-ray Video Links FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39220214 https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39220217 |
| Coleoptera (Buprestidae) | Extensive. (Miller, 1966) | No data | |
| Coleoptera | Extensive. (Miller, | Yes. 2 species. | https://askabiologist.asu.edu/sites/default/files/ |

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| (Scarabaeidae) | 1966) | | games/beetle-dissection/play.html |
| Coleoptera (Curculionidae) | None. (Miller, 1966) | No data | |
| Coleoptera (Cerambycidae) | None. (Miller, 1966) | No data | |
| Coleoptera (Tenebrionidae) | None. (Pendar et al., 2019; Raš et al., 2018) | Yes. (Pendar et al., 2015) | |
| Mecoptera | None. (Herford, 1938; Wigglesworth, 1935) | Yes. (Herford, 1938) | |
| Diptera | In head and thorax. (Manning and Krasnow, 1993) | Yes. Multiple animals and species. (Westneat et al., 2006) (Hale et al., 2006) | X-ray Video Link FigShare: https://figshare.com/articles/media/Insect_Respiration_X-ray_Videos/22082384?file=39220229 |
| Lepidoptera | Extensive. (Lowe et al., 2013; Newport, 1851) | Yes. Synchrotron x-ray; 2 species. N=6 each. | |
| Trichoptera | No data | No data | |

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