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RESEARCH ARTICLE

Figures and figure supplements

Olfactory channels associated with the *Drosophila* maxillary palp mediate short- and long-range attraction

Hany KM Dweck *et al*

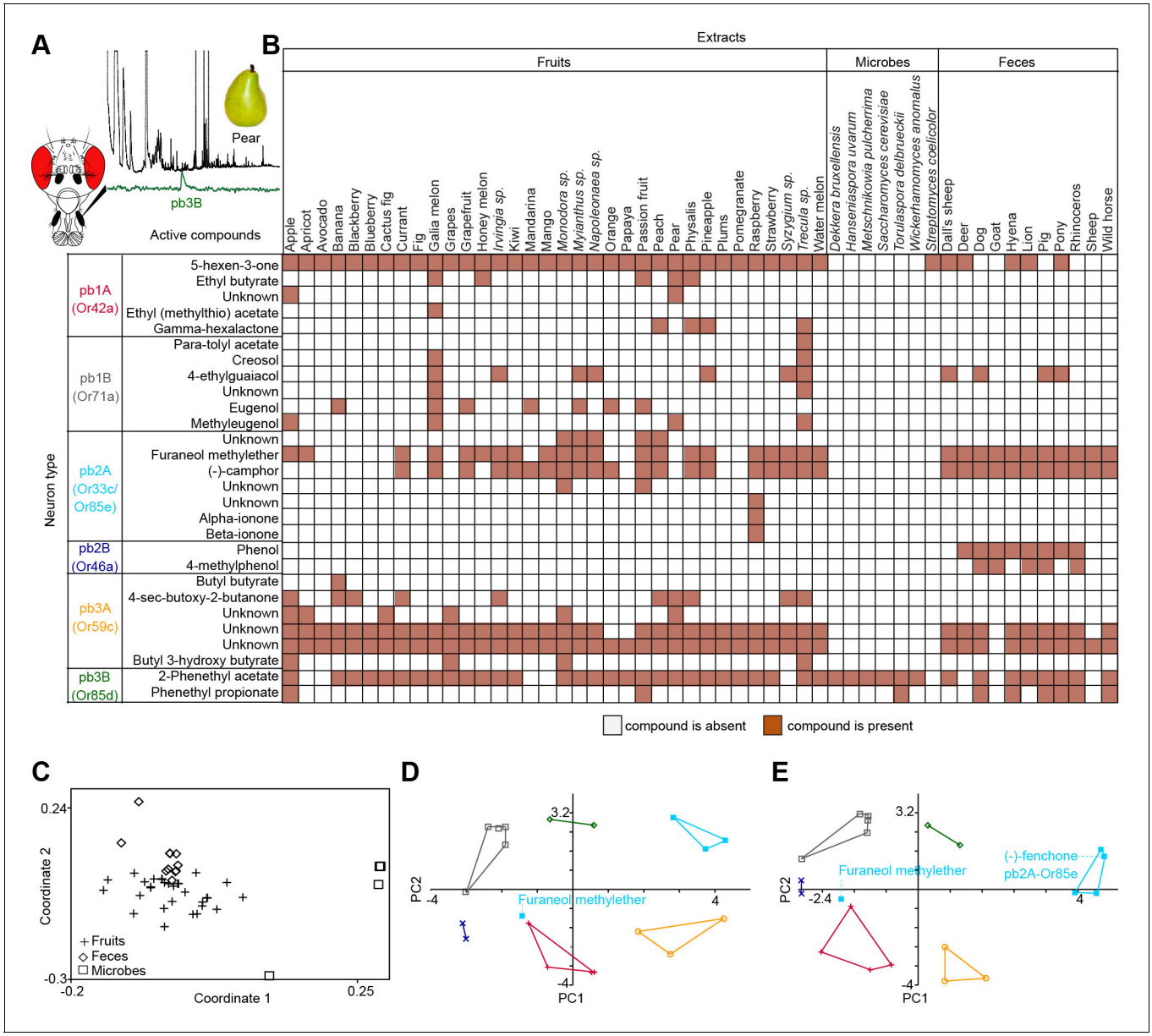

Figure 1. Screen for novel natural ligands for MP-OSNs. (**A**) Representative gas chromatography-linked single sensillum measurement (GC-SSR) from pb3B (green trace) stimulated with headspace extract of pear (black trace). (**B**) Presence/Absence matrix of the physiologically active compounds identified from the different headspace extracts for each MP-OSN in the GC-SSR experiments (i.e. each filled box represents not only the presence of this odor in a specific fruit, but also a physiological response in GC-SSR recordings). (**C**) NMDS plot based on a presence/absence matrix for the active peaks across the tested samples. (**D**) PCA plot showing the distribution of the ligands recognized by MP-OSNs in a 32-dimensional odor space. PC1 and PC2 explain 23% and 22% of the variance, respectively. (**E**) PCA plot showing the distribution of the ligands recognized by MP-OSNs and (-)-fenchone (the main ligand of Or85e-expressing OSNs) in a 32-dimensional odor space. PC1 and PC2 explain 24% and 21% of the variance, respectively.

DOI: 10.7554/eLife.14925.002

The following source data is available for figure 1:

Source data 1. Presence and absence data as well as physicochemical properties of all tested odor samples, that were used to calculate the NMDS plot and the PCAs in ***Figure 1***.

DOI: 10.7554/eLife.14925.003

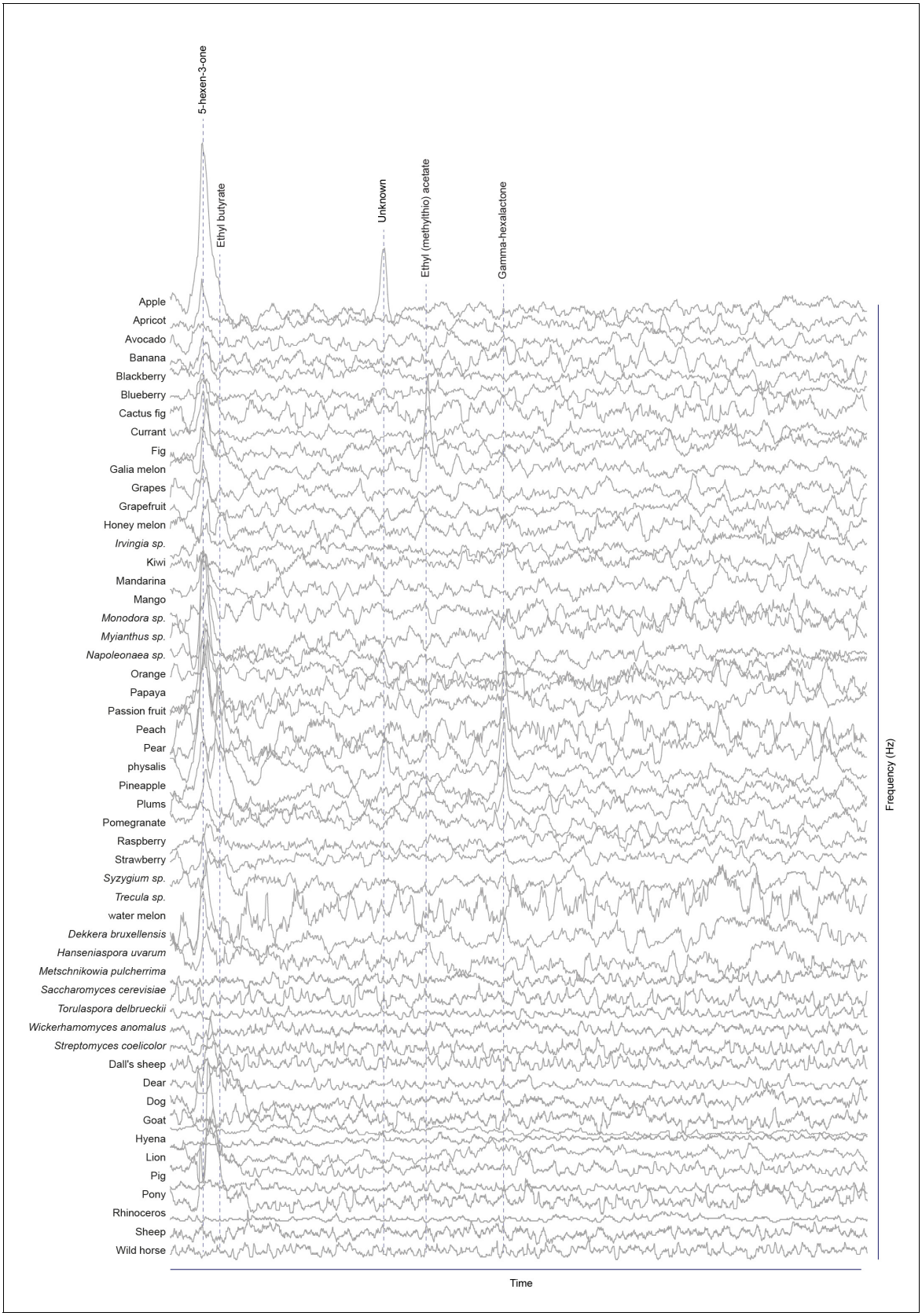

Figure 1—figure supplement 1. Responses of pb1A OSNs type to physiologically active compounds in different extracts.
DOI: 10.7554/eLife.14925.004

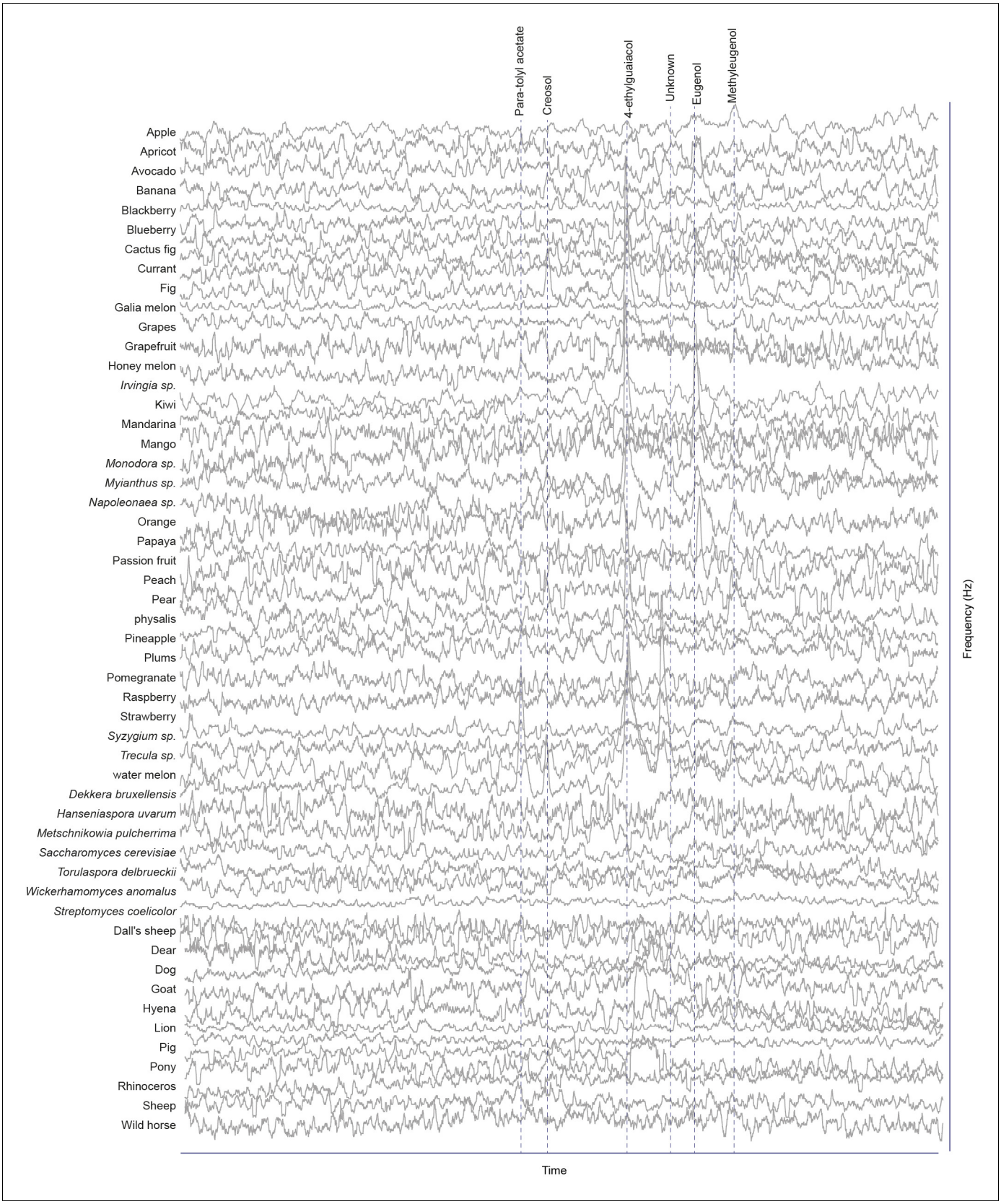

Figure 1—figure supplement 2. Responses of pb1B OSNs type to physiologically active compounds in different extracts.
DOI: 10.7554/eLife.14925.005

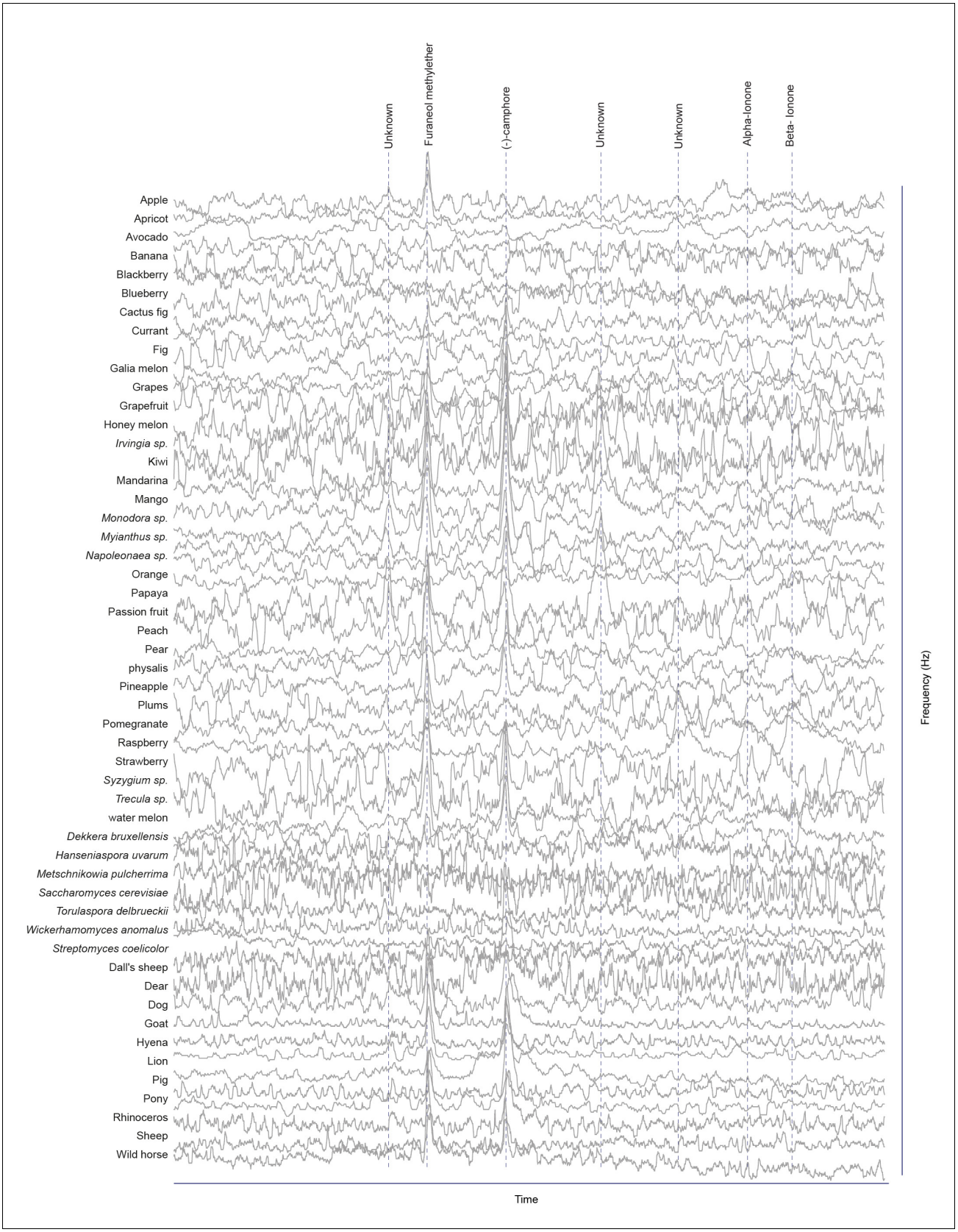

Figure 1—figure supplement 3. Responses of pb2A OSNs type to physiologically active compounds in different extracts.
DOI: 10.7554/eLife.14925.006

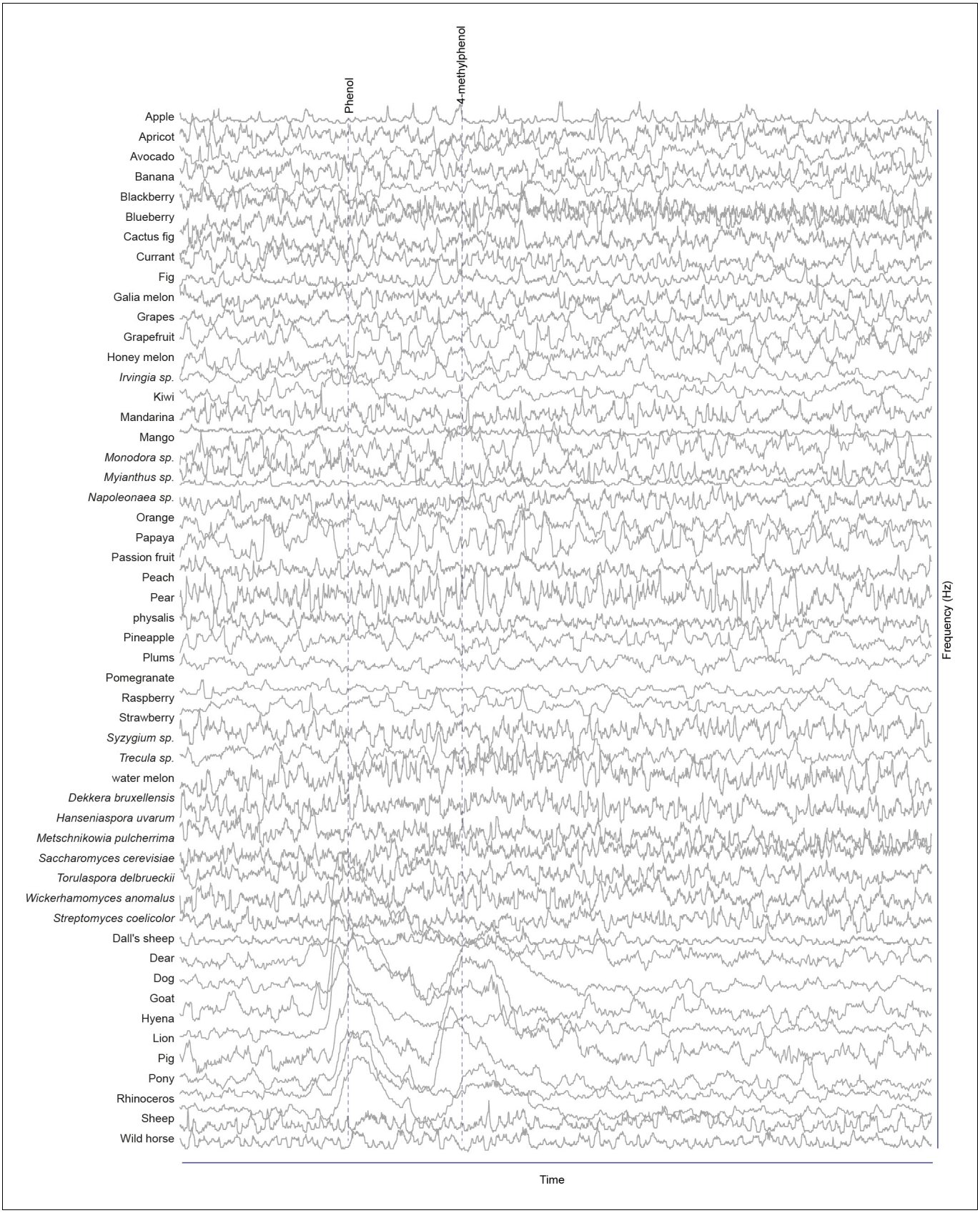

Figure 1—figure supplement 4. Responses of pb2B OSNs type to physiologically active compounds in different extracts.

Figure 1—figure supplement 4 continued on next page

Figure 1—figure supplement 4 continued

DOI: 10.7554/eLife.14925.007

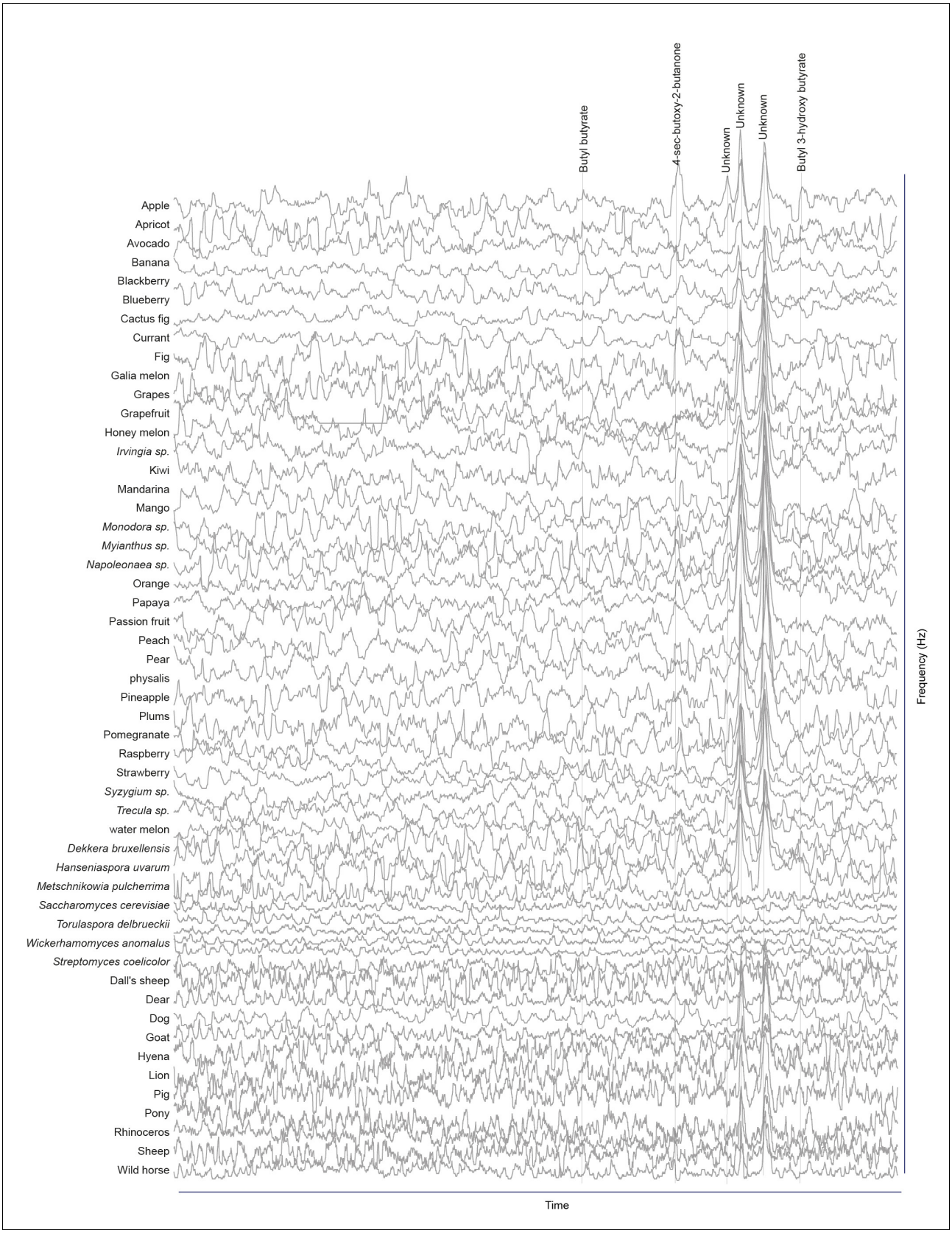

Figure 1—figure supplement 5. Responses of pb3A OSNs type to physiologically active compounds in different extracts.
DOI: 10.7554/eLife.14925.008

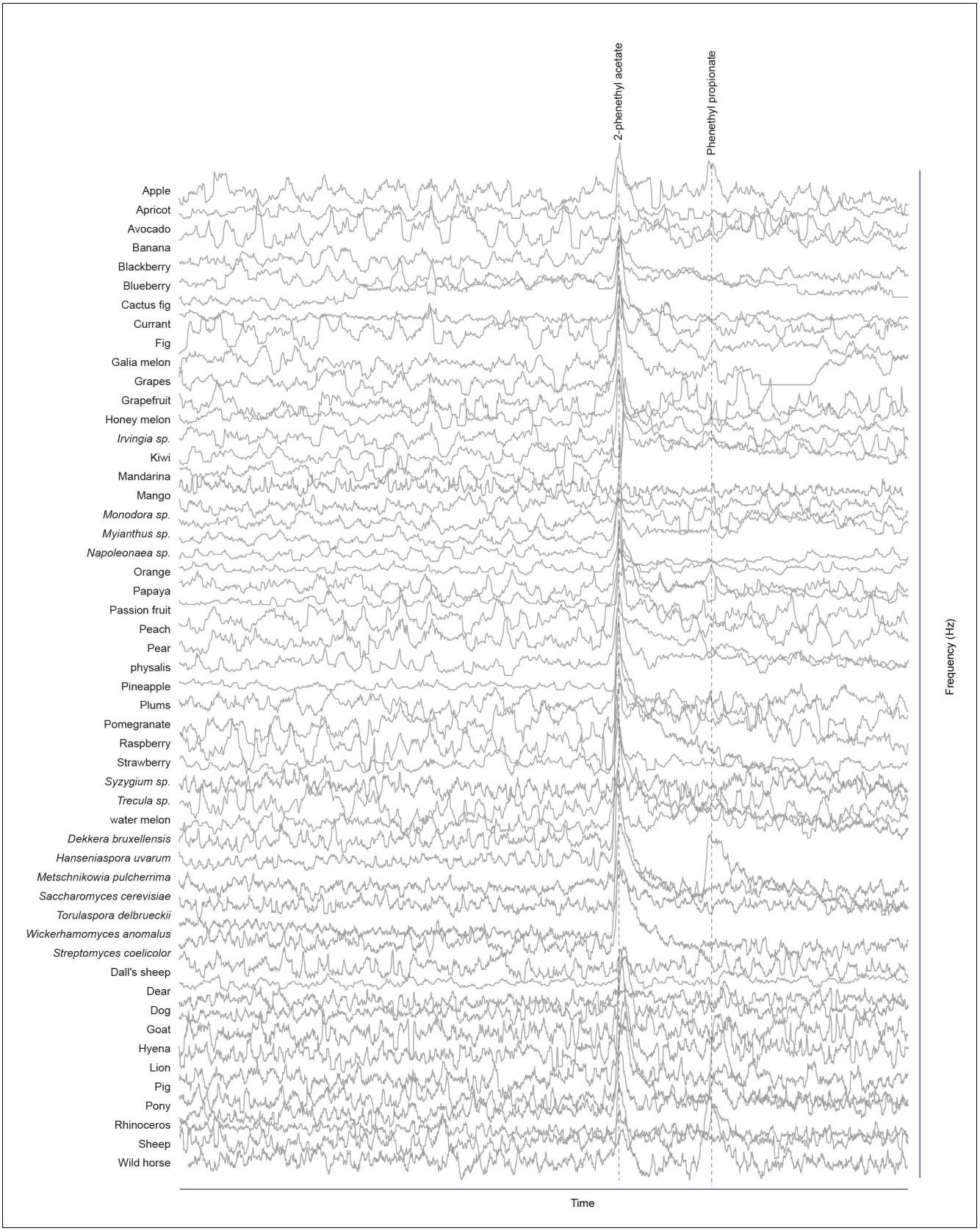

Figure 1—figure supplement 6. Responses of pb3B OSNs type to physiologically active compounds in different extracts.
DOI: 10.7554/eLife.14925.009

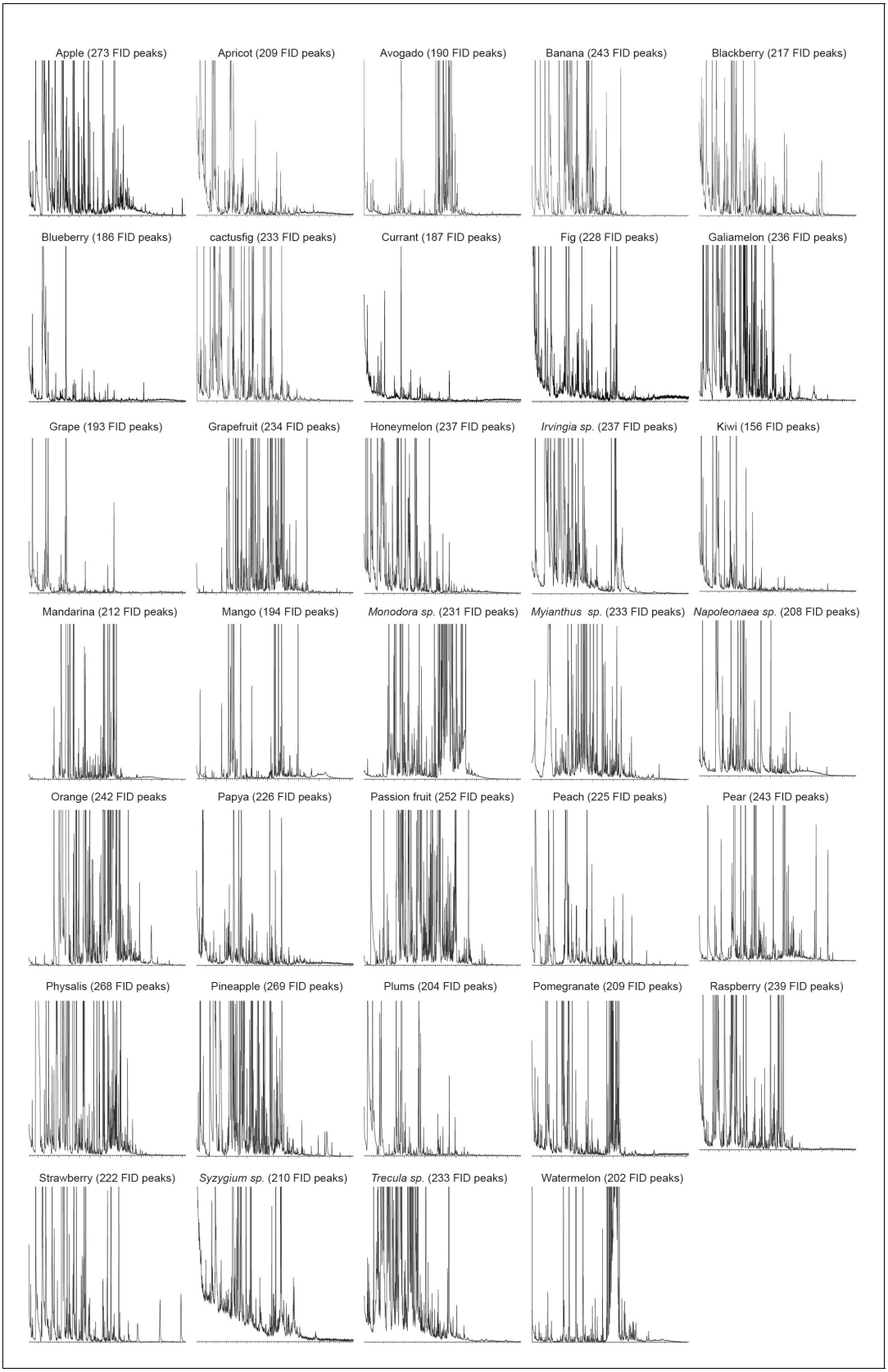

Figure 1—figure supplement 7. GC-MS chromatographs showing number of FID peaks in each fruit sample.
DOI: 10.7554/eLife.14925.010

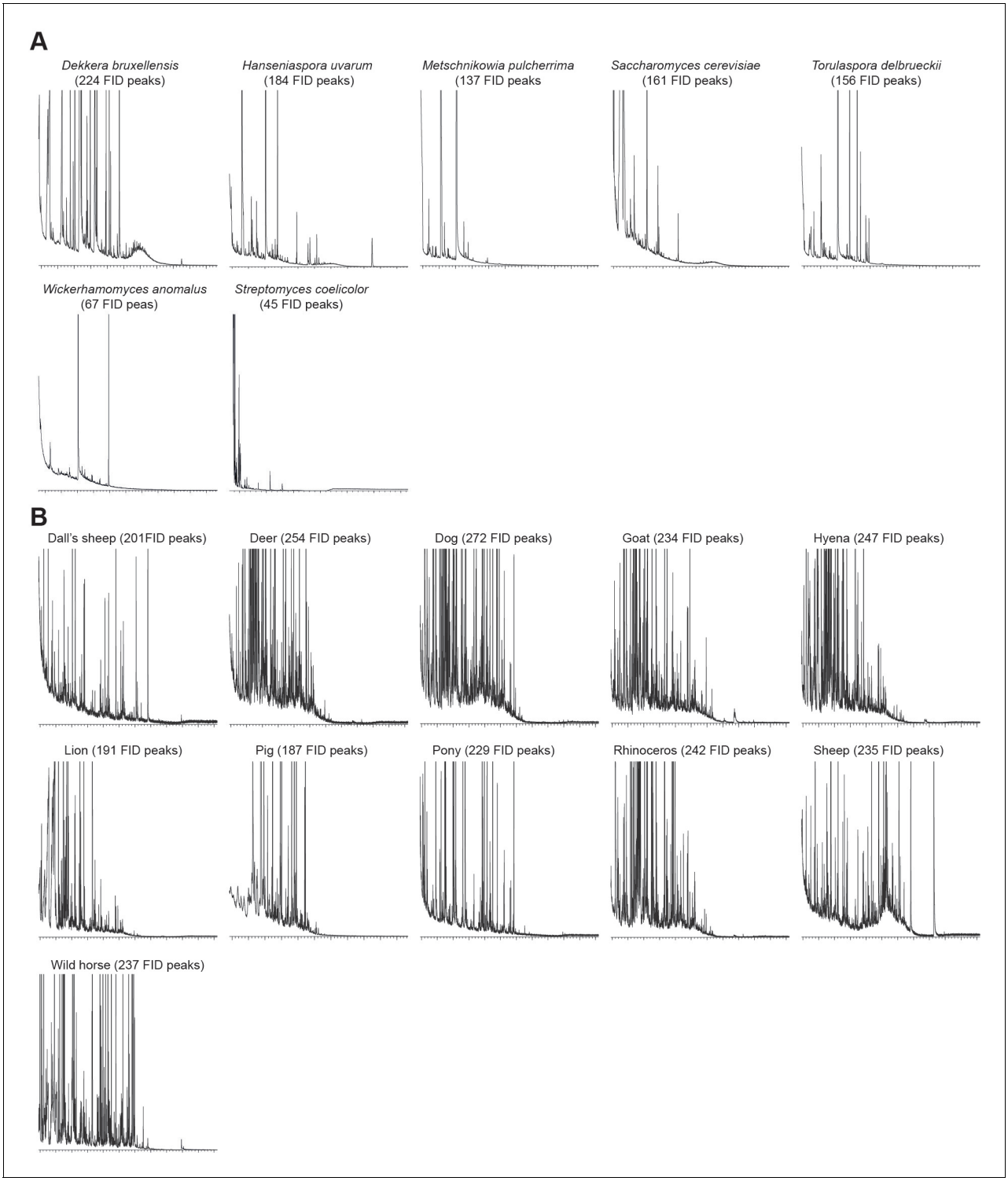

Figure 1—figure supplement 8. GC-MS chromatographs showing number of FID peaks in each microbial (**A**) and fecal (**B**) sample.
DOI: 10.7554/eLife.14925.011

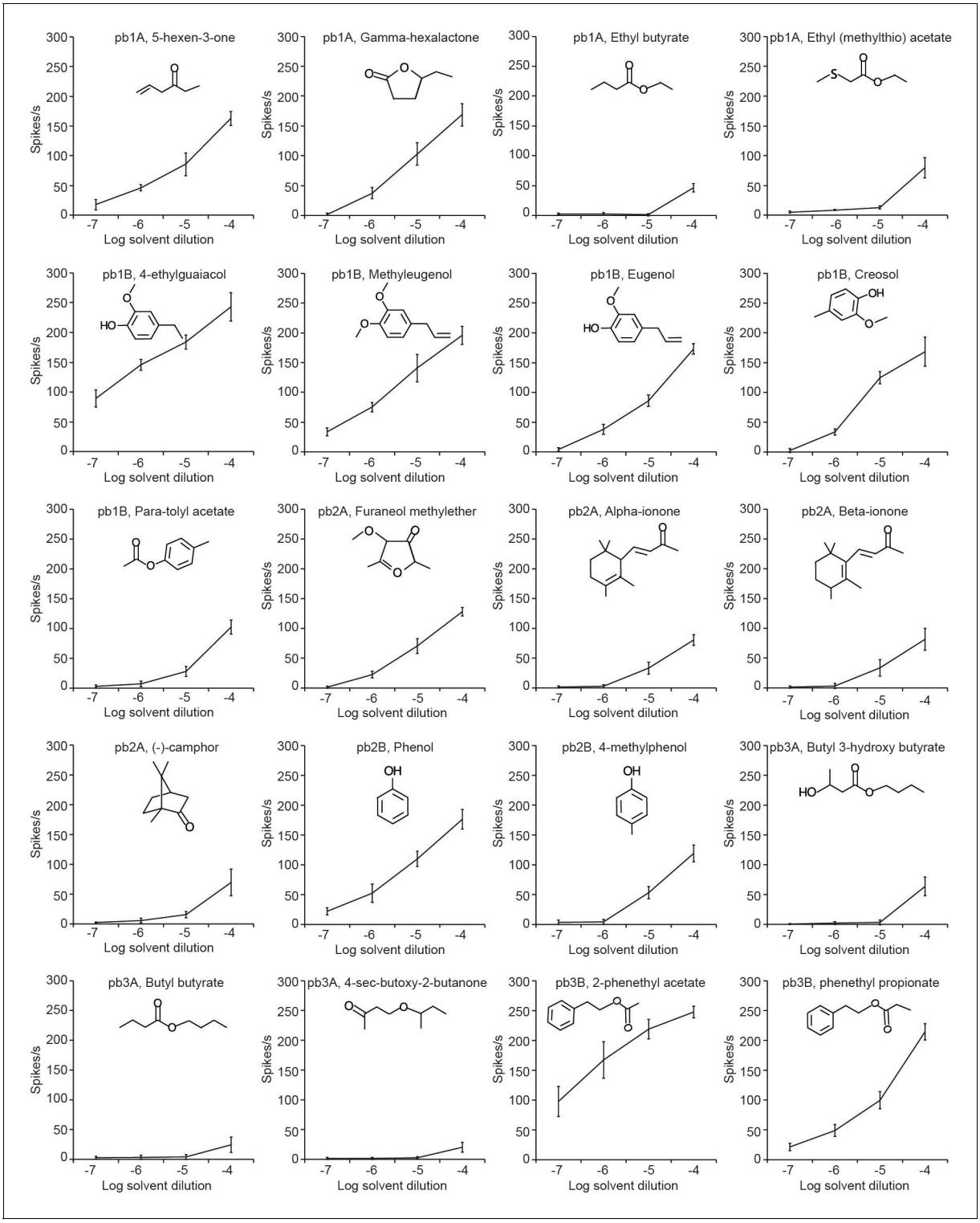

Figure 2. SSR dose-response curves for each MP-OSN stimulated with its physiologically active compounds (n = 5). Error bars represent SEM.
DOI: 10.7554/eLife.14925.013
The following source data is available for figure 2:

Source data 1. Raw data for all dose-dependency curves presented in ***Figure 2***.
DOI: 10.7554/eLife.14925.014

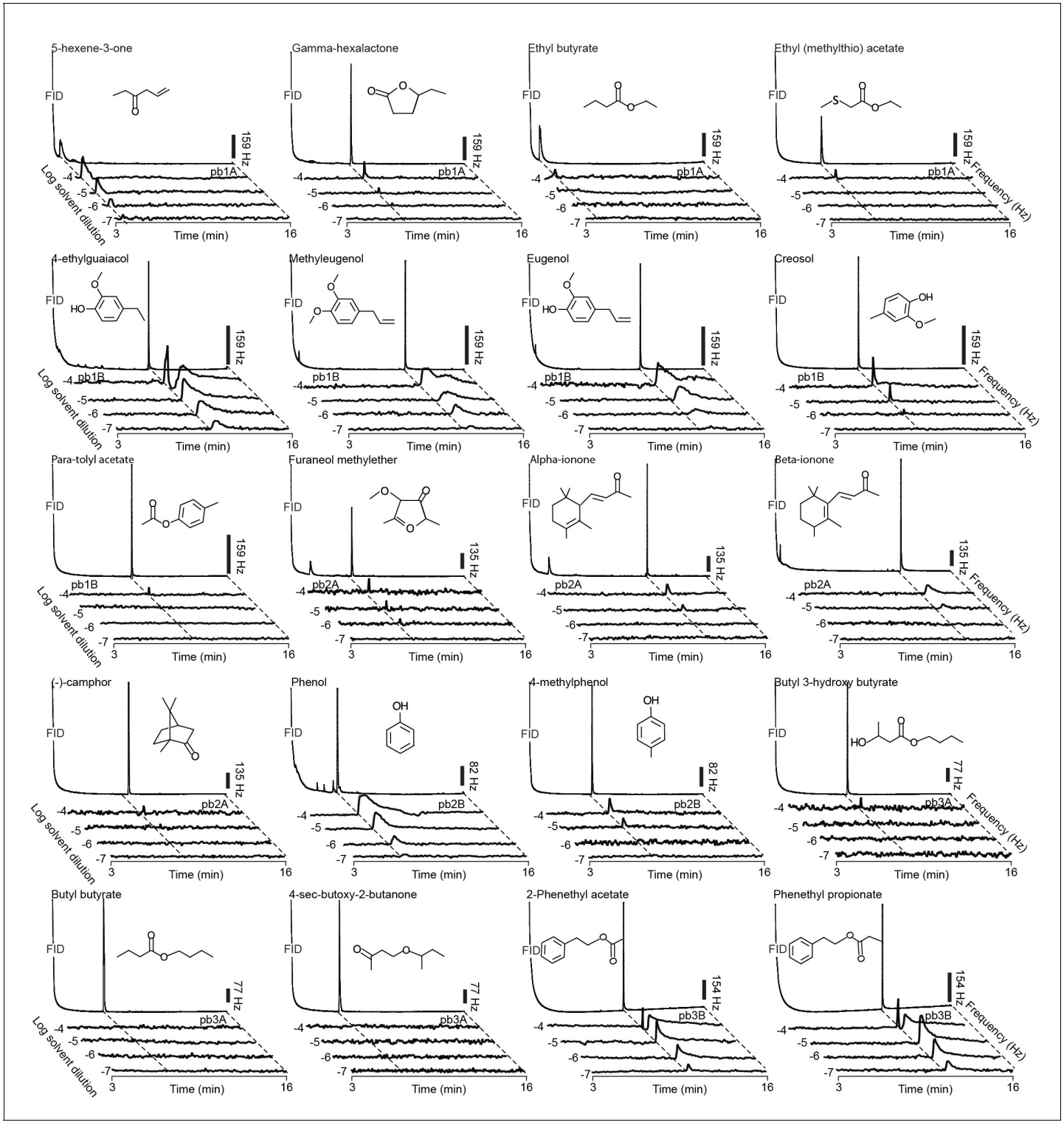

Figure 3. Representative GC-SSR dose-response traces for each MP-OSN stimulated with its physiologically active compounds (n = 3). Scale bars represent the neuronal firing rate [hz].

DOI: 10.7554/eLife.14925.015

The following source data is available for figure 3:

Source data 1. Raw data for all GC-SSR results presented in ***Figure 3***.

DOI: 10.7554/eLife.14925.016

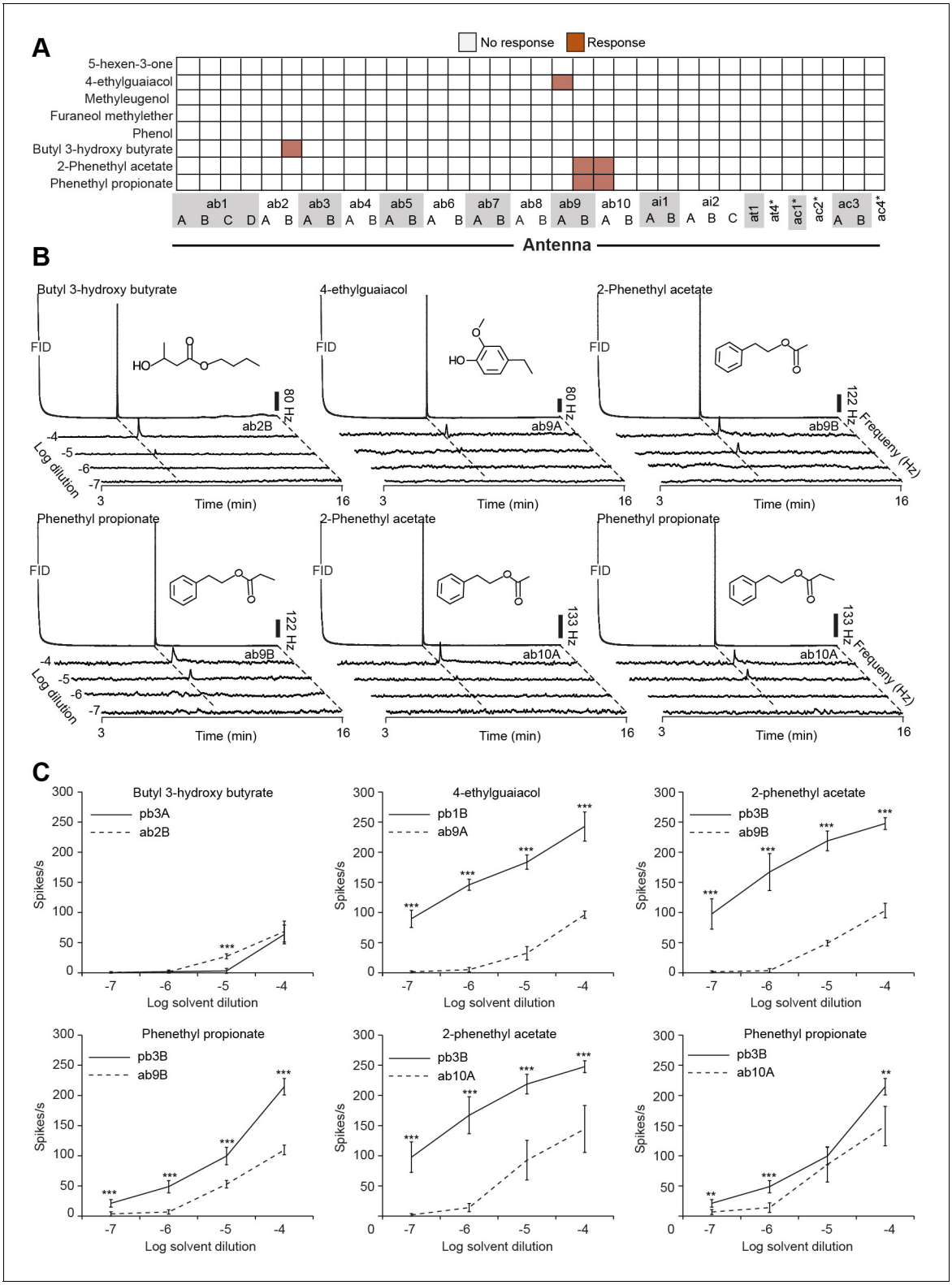

Figure 4. MP-OSNs are dedicated to detect specific chemical compounds. (**A**) Presence/Absence matrix of the GC-SSR responses of the MP-OSNs best activators across the Ant-OSNs (n = 3, dilution, 10^{-4} in hexane). Asterisks denote the total response of a sensillum type when spike sorting of OSNs failed. (**B**) Representative traces of GC-SSR dose response relationship from ab2A, ab9A, ab9B and ab10A OSNs (n = 3). Scale bars represent the neuronal firing rate [hz]. (**C**) SSR dose-response curves. Error bars represent SEM. The symbols ** and *** indicate statistically significant differences between OSN types with $p<0.001$, and $p<0.0001$, respectively (two-tailed Independent Samples T Test, n = 5).

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Figure 4 continued

DOI: 10.7554/eLife.14925.017

The following source data is available for figure 4:

Source data 1. Raw data of the comparison of antennal and palp OSN-responses to the best ligands of palp OSNs presented in ***Figure 4***.

DOI: 10.7554/eLife.14925.018

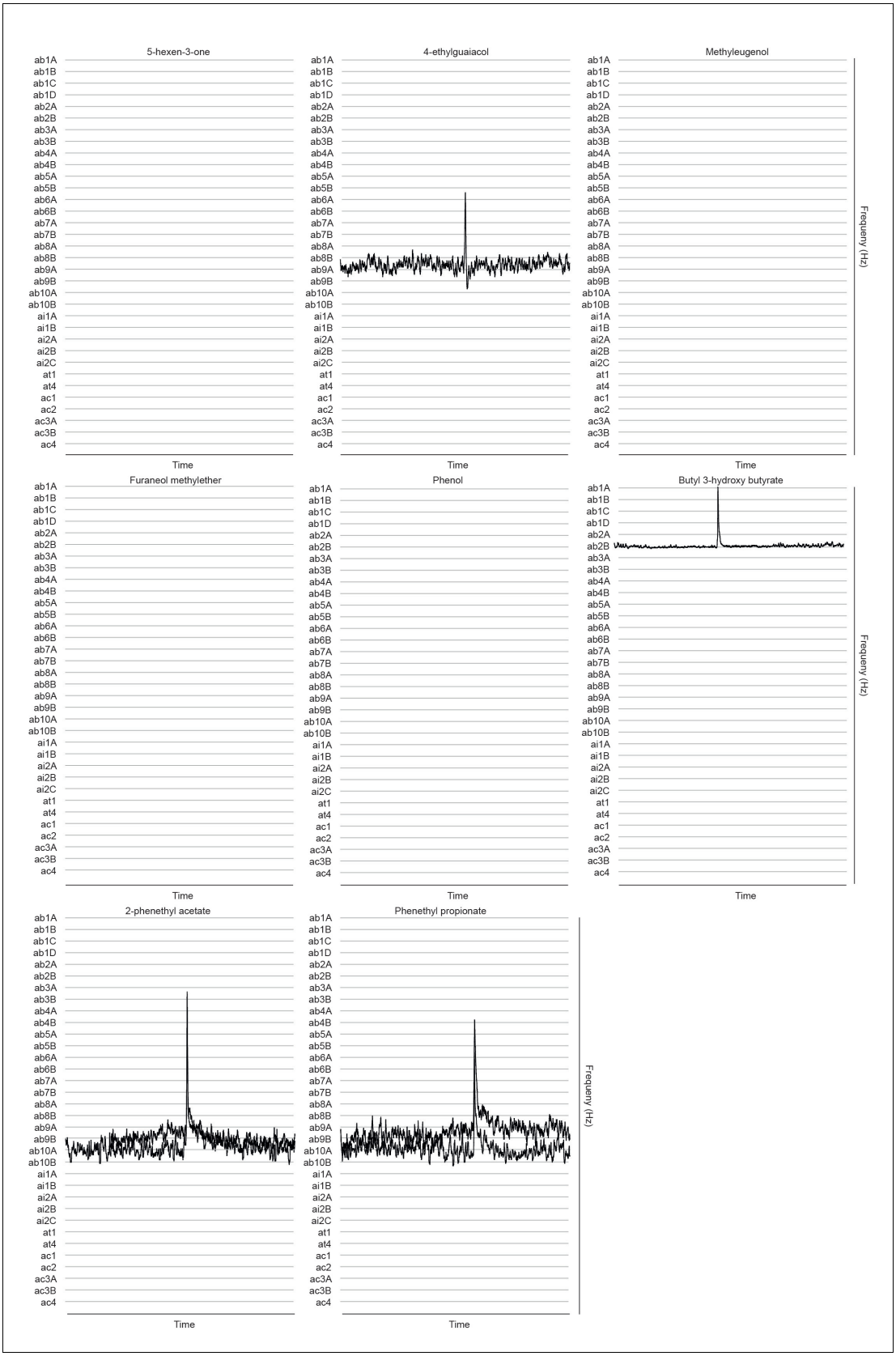

Figure 4—figure supplement 1. Responses of Ant-OSNs to palp best activators.
DOI: 10.7554/eLife.14925.019

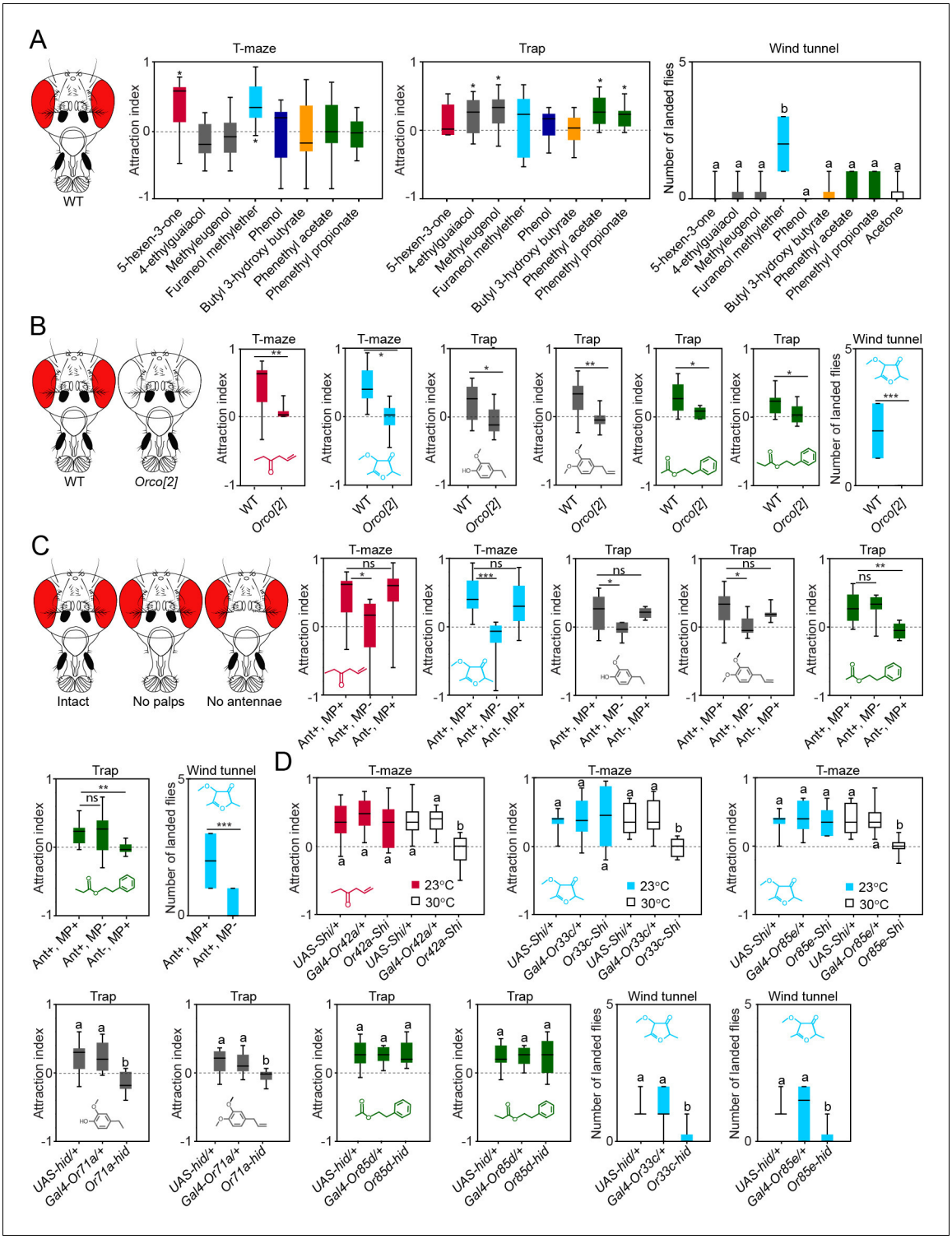

Figure 5. Contribution of the maxillary palp to the behaviors evoked by the palp best activators. (**A**) Behavioral responses of WT flies to the palp best activators (10^{-4} dilution used for trap and T-maze experiments, and 10^{-2} dilution used for wind tunnel experiments). For T-maze and trap assays, the symbol * indicates significant differences from the solvent control ($p<0.05$, Wilcoxon signed rank test, n = 10). For wind tunnel assays, different letters indicate significant differences between groups ($p<0.05$, Kruskal Wallis test with Dunn's multiple comparison, n = 10). (**B**) Behavioral responses of WT and *Orco[2]* flies to the behaviorally active compounds (10^{-4} dilution used for trap and T-maze experiments and 10^{-2} dilution used for wind tunnel experiments). The symbols *, ** and *** indicate statistically significant differences between the attraction indices of the genotypes with $p<0.01$, $p<0.001$, and $p<0.0001$, respectively (two-tailed Mann-Whitney U test, n = 10). (**C**) Behavioral responses of WT (Ant+, MP+), palp-amputated flies (Ant+,

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MP-) and antenna-amputated flies (Ant-, MP+) to the behaviorally active compounds (10^{-4} dilution used for trap and T-maze experiments and 10^{-2} dilution used for wind tunnel experiments). The symbols *, ** and *** indicate statistically significant differences between groups with $p<0.01$, $p<0.001$, and $p<0.0001$, respectively; 'ns' indicates no significant differences between groups (Kruskal Wallis test with Dunn's multiple comparison for selected groups, n = 10). (**D**) Behavioral responses of flies with a killed or silenced specific MP-OSN population, the corresponding parental lines, and WT flies. Different letters indicate significant differences between groups (Kruskal Wallis test with Dunn's multiple comparison). Black line: median; boxes: upper and lower quartiles; whiskers: minimum and maximum values.

DOI: 10.7554/eLife.14925.021

The following source data is available for figure 5:

Source data 1. Raw data of all behavioral experiments with *D. melanogaster* presented in ***Figure 5***.

DOI: 10.7554/eLife.14925.022

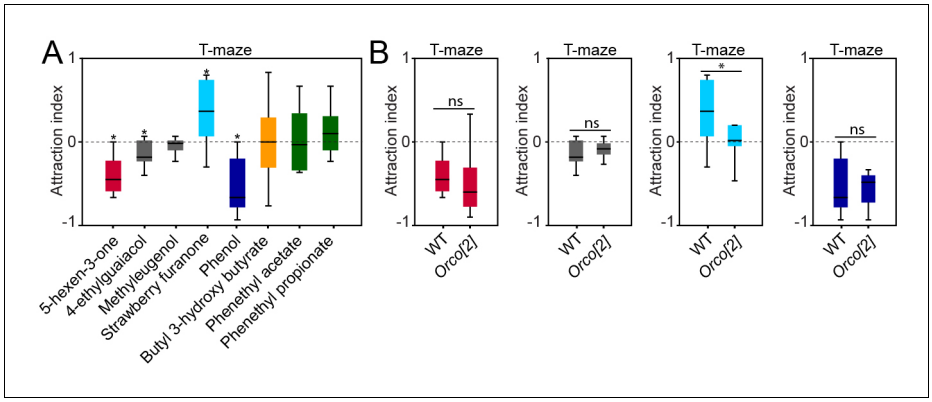

Figure 5—figure supplement 1. Behavioural effects of palp odors on WT and *Orco[2]* flies. (**A**) Behavioral responses of WT flies to the palp best activators at 10^{-2} dilution in T-maze experiments. The symbol * indicates that data are significantly different from the solvent control ($p<0.05$, Wilcoxon signed rank test, n = 10). Whiskers represent the minimum and maximum values. (**B**). Behavioral responses of WT and *Orco[2]* flies to the the behaviorally active compounds at 10^{-2} dilution in T-maze two-choice experiments. The symbol * indicates significant differences between groups with $p<0.01$ (two-tailed Independent Samples T Test, n = 10). 'ns' indicates no statistically significant differences between groups ($p>0.05$, two-tailed Independent Samples T Test, n = 10). Black line: median; boxes: upper and lower quartiles; whiskers: minimum and maximum values.

DOI: 10.7554/eLife.14925.023

The following source data is available for figure 5:

Figure supplement 1—Source data 1. Raw data of all behavioral experiments with *D. melanogaster* and palp activating odors at high concentration presented in ***Figure 5—figure supplement 1***.

DOI: 10.7554/eLife.14925.024

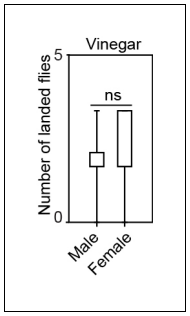

Figure 5—figure supplement 2. Behavioral responses of male and female WT flies to 10% vinegar in wind tunnel experiments. 'ns' indicates no statistically significant differences between groups ($p>0.05$, two-tailed Mann-Whitney U Test, $n = 10$). Black line: median; boxes: upper and lower quartiles; whiskers: minimum and maximum values.

DOI: 10.7554/eLife.14925.025

The following source data is available for figure 5:

Figure supplement 2—Source data 1. Raw data of wind-tunnel experiments performed with female and male *D. melanogaster* presented in ***Figure 5—figure supplement 2***.

DOI: 10.7554/eLife.14925.026

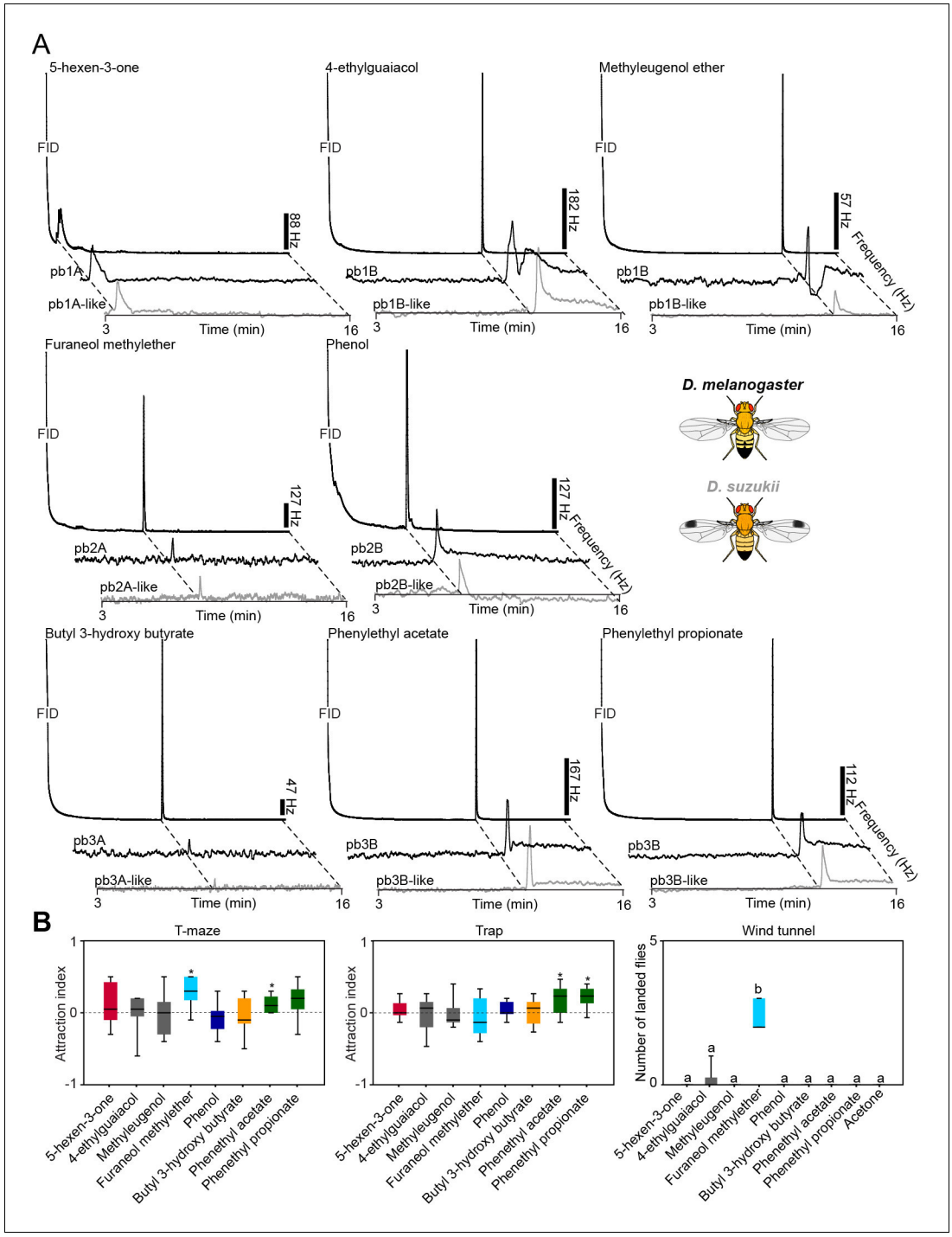

Figure 6. Organization, detection, and or genes of MP-OSNs are conserved in *D. suzukii*. (**A**) Representative GC-SSR traces from palp OSNs in *D. suzukii* and *D. melanogaster*, stimulated with the palp best ligands (dilution 10^{-4}) (n = 3). (**B**) Behavioral responses of *D. suzukii* to *D. melanogaster* palp best activators (10^{-4} dilution used for trap and T-maze assays, and 10^{-2} dilution used for wind tunnel experiments). For T-maze and trap assays, the symbol * indicates significant differences from the solvent control ($p<0.05$, Wilcoxon signed rank test, n = 10). For wind tunnel assays, different letters indicate statistically significant differences between groups ($p<0.05$, Kruskal Wallis with Dunn's multiple comparison). Black line: median; boxes: upper and lower quartiles; whiskers: minimum and maximum values.

DOI: 10.7554/eLife.14925.027

The following source data is available for figure 6:

Source data 1. Raw data of physiological and behavioral responses of *D. suzukii* presented in ***Figure 6***.

DOI: 10.7554/eLife.14925.028