

Metadata form of Silva Fennica

This form is designed for writing the elements of metadata, which are used in the description of research materials such as data and codes. The form is based on the work done in the Work Group “Description of research materials” under the Finnish Open Science Coordination.

Item	Description	Responsible
Name of the data / code	Nose4Wood dataset on performance of dogs to discriminate and detect <i>Cronartium pini</i> in line-up and field tests	Väätäjä, Heli
Author & ORCID	Väätäjä, Heli, 0000-0003-3324-9497, Vinblad, Sanna, 0009-0009-1131-6143, Kaitera, Juha, 0000-0003-2549-7001, Piri, Tuula, 0000-0001-8690-3726, Männistö, Minna, 0000-0001-9390-1104, Mäkitalo, Kari, 0000-0002-7950-7618	Väätäjä, Heli
Authors' affiliation(s)	Lapland University of Applied Sciences, https://ror.org/047h64h89 Natural Resources Institute Finland, https://ror.org/02hb7bm88	Väätäjä, Heli
Owner of the material	Väätäjä, Heli, 0000-0003-3324-9497, https://ror.org/047h64h89 Vinblad, Sanna, 0009-0009-1131-6143, https://ror.org/047h64h89 Kaitera, Juha, 0000-0003-2549-7001, https://ror.org/02hb7bm88 Piri, Tuula, 0000-0001-8690-3726, https://ror.org/02hb7bm88 Männistö, Minna, 0000-0001-9390-1104, https://ror.org/02hb7bm88 Mäkitalo, Kari, 0000-0002-7950-7618, https://ror.org/02hb7bm88	Väätäjä, Heli
Publisher	Zenodo	Väätäjä, Heli
Funder	European Regional Development Fund (ERDF) Lapland University of Applied Sciences, https://ror.org/047h64h89 Natural Resources Institute Finland, https://ror.org/02hb7bm88	Väätäjä, Heli
Description	This dataset includes data from scent discrimination testing of dogs that were trained to discriminate and detect <i>Cronartium pini</i> in line-up tests indoors with control samples, and in the field conditions in living plants. It describes the background of the dog-handler teams, the sample types used in the training and testing including both target scents and control samples, the results of the last indoors scent discrimination testing carried out as line-ups, and results of the field tests. Dataset is output from Nose4Wood project. The related publication describes the methodology and testing.	Väätäjä, Heli
Methods	<p>Preparation of samples for training and indoor scent discrimination testing</p> <p>The samples for training and indoors line-up testing were prepared as follows. Aeciospores, young sporulating and old sporulated lesions carrying <i>C. pini</i> aecia were collected in June 2021 (Fig. 1), and leaves of <i>Paeonia lactiflora</i> Pall., <i>Impatiens balsamina</i> L., <i>Melampyrum sylvaticum</i> L., <i>Euphrasia</i> sp. and <i>Rhinanthus minor</i> L. carrying uredinia or telia of <i>C. pini</i>, were collected in July-August 2021 and August 2022. Aeciospores were dusted aseptically into glass jars, while lesions with aecia were split into 1-2 cm segments. Leaves with <i>C. pini</i> uredinia or telia were separated from rest of the leaf material aseptically directly to glass jars. Rust material was collected in total of 91 glass jars.</p> <p>The fungal material was divided into small petri dishes (ø 3.3 cm) stored in airtight glass jars at -20°C. Spores were divided into jars using an artist's pencil. Segments of 0.5-1.0 cm were cut from the lesions, while 1.0 cm²</p>	Väätäjä, Heli, Vinblad, Sanna, Kaitera, Juha, Männistö, Minna

pieces were cut from big leaves of *Paeonia* and *Impatiens* with scissors and whole leaves of smaller leaves of the other plant species were picked up with tweezers. The surfaces and used equipments were autoclaved or sterilized with alcohol and hands were covered by Akro Eco disposable gloves to minimize addition of human or other contaminating smells to samples and jars.

Healthy Scots pine shoots and leaves of above-mentioned plant species and of *M. pratense* L. were used as controls. Leaves of *Melampyrum*, *Betula*, *Salix*, *Sorbus* and needles of Norway spruce carrying fruiting stages of other rusts, *C. tussilaginis* f.sp. *melampyri* Boerema & Verh., *Chrysomyxa ledi* (Alb. & Schwein) de Bary, *Melampsoridium betulinum* (Fr.) Kleb., *Gymnosporangium cornutum* Arthur ex F. Kern and *Melampsora epitea* Thümen coll., were also used. In addition, a number of other biotic and non-biotic control objects were used.

Selection and preparation of areas for *in vivo* testing

A young severely injured Scots pine stand infected by the host-alternating life-cycle form in Kolari, Western Lapland (67°20'N, 23°47'E), was selected for field testing. In the stand, eight 100 m² groups of infected trees and their rust infections were marked in mid-June 2022 based on sporulating aecia on branches and stems, resinous stem lesions, dead tops or dead trees at a height below 2 m. Ten plant sample plots of 0.25 m² of which 8 included infected alternate hosts and two were healthy, were marked in the stand in August 2022.

A young Scots pine stand severely infected by the autoecious life-cycle form of *C. pini* was selected in Pudasjärvi, Northern Ostrobothnia (65°22'N, 27°00'E). The stand was a pine-dominated sub-xeric heath forest, where only a few *M. pratense* grew. Aeciospores had infected Scots pine and inoculations on susceptible alternate hosts, *P. lactiflora* and *Vincetoxicum hirundinaria* Medicus, had been negative confirming the life-cycle of the rust previously. In the stand, *C. pini* infections were marked in trees in four 1 ha size groups in mid-June 2023.

Scent discrimination in line-up testing indoors and *in vivo*

The ability of the dogs to discriminate *Cronartium pini* from different sample types was tested in scent discrimination tests organized as line-up tests indoors. The final scent discrimination tests were carried out in the end of the one-year training period. Test of each dog consisted of 48 jars distributed into 12 line-up rows. Each line-up row included 0-1 target scents and 3-4 control scents. A total of nine target samples were used in the last test (except for dog TR_D01, see research data), each on its own row, to be discriminated from the control samples. The rest of the rows contained only non-target samples. The distance between the stations in each line-up row was 60-80 cm depending on the testing environment. Results were recorded by researchers.

In vivo testing of *C. pini* on Scots pine was done in four sample areas of the autoecious life-cycle form in Pudasjärvi (65°22'N, 27°00'E) on June, 26th, 2023 and in two sample areas of the heteroecious life-cycle form in

	<p>Kolari (67°20'N, 23°47'E) on August, 6th, 2023. Testing on alternate hosts of <i>C. pini</i> was performed in six sample areas on August, 6th, 2023 in Kolari (67°20'N, 23°47'E). The testing of <i>C. pini</i> was performed in 900 m² areas on pine for both life-cycle forms and in 2500 cm² areas on alternate hosts for the heteroecious life-cycle form.</p> <p>The maximum <i>in vivo</i> testing time was 30 minutes per dog in all pine stands and 15 minutes in plots with alternate host plants. Forest pathologists acted as field test evaluators, recording the dogs' findings based on the handlers' responses. For <i>C. pini</i>, all findings on Scots pines reported by the handler were visually inspected and identified on-site during the test. For <i>C. pini</i> on alternate hosts, each dog had three plots (0.5×0.5 m) from which all plants were collected and their leaves checked for rust diseases (<i>C. pini</i>, <i>Coleosporium tussilaginis</i> f.s.p <i>melampyri</i>) and powdery mildew using stereomicroscope (Wild) in the laboratory. Findings were recorded as false positive or true positive identifications. Additionally, evaluators made their own notes based on visual inspection during the test, such as the dogs passing by diseased trees (false negatives).</p> <p>Data analysis</p> <p>Data was analyzed with methods used for measuring conservation dogs' ability to detect and discriminate the target species: precision (proportion of all alerts targeted toward a true target, positive predictive value), sensitivity (proportion of targets found relative to the total targets available, true positive rate), and effort (time spent searching a unit area or transect). In addition, for indoors scent discrimination tests specificity (true negative rate), and accuracy were calculated. All test results were collected in tables. Performance measures were calculated for individual dogs and averaged (mean) over all dogs. The results from scent discrimination and search tests in the field were analyzed for each test separately.</p> <p>A link to the article in Silva Fennica (when published to accompany the research data in Zenodo with this document).</p>	
<i>Variables</i>	<p>TR_D01 – TR_D09 identifier for an individual dog <i>C.pini</i> = <i>Cronartium pini</i> CF = Heteroecious life-cycle form PP = Autoecious life-cycle form TP = True positive TN = True negative FN = False negative FP = False positive</p>	Väätäjä, Heli
<i>Author keywords</i>	<p>scent detection, scent discrimination, dog, canine, scent detection dog, conservation dog, Scots pine, <i>Cronartium pini</i>, rust fungus, performance, efficiency, forestry, pathogen</p>	Väätäjä, Heli
<i>Vocabulary keywords (community standard)</i>	<p><i>Cronartium pini</i> (gd.eppo.int/taxon/ENDCPI)</p>	Kaitera, Juha
<i>Discipline</i>	<p>Applied animal behaviour science, Forestry, Plant pathology, Rust disease</p>	Zenodo

<i>Type of material</i>	research data	Vääätäjä, Heli
<i>Language</i>	eng	Vääätäjä, Heli
<i>Time range covered</i>	Line-up testing indoors: 2022-10-01 (TR_D01), 2022-12-10 (TR_D02, TR_D03), 2023-01-29 (TR_D04, TR_D05) Field tests: 2023-06-26 (Pudasjärvi) and 2023-08-06 (Kolari)	Vääätäjä, Heli
<i>Geographic region</i>	Indoors testing: FI Field tests: FI-12, FI-10	Vääätäjä, Heli
<i>Version</i>	1.0.0	Vääätäjä, Heli
<i>File format(s)</i>	.xlsx	Vääätäjä, Heli
<i>Availability of the materials (open, embargo, registration, limited, registration required)</i>	open	Vääätäjä, Heli
<i>Justification for access restrictions</i>		
<i>Licence</i>	Creative Commons Attribution 4.0 International	Vääätäjä, Heli
<i>Connections with other research materials</i>		
<i>Access to the connected research materials</i>		
<i>Codes only: hardware/ software requirements for running the code</i>		
<i>Connections to other products of research</i>		
<i>Personal data</i>	No	Vääätäjä, Heli
<i>Confidential or secret data</i>	No	Vääätäjä, Heli
<i>Publication date</i>	2025-10-01	Zenodo
<i>Preservation policy</i>	Material is preserved permanently.	Vääätäjä, Heli
<i>Permanent identifier (PID)</i>	10.5281/zenodo.17145211	Zenodo