

Pesticides and olive leaves in oregano – an aromatic but loaded culinary herb

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Introduction

In the Mediterranean kitchen oregano is practically indispensable as a seasoning herb in many dishes e.g. pizza or pasta sauces due to its strong, aromatic-herbal taste. This popular herb is usually used in dried, crushed form, but is also often part of herbal mixes and processed products. In a special project conducted between November 2018 and June 2019, CVUA Stuttgart analyzed commercial, crushed oregano with regard to different issues, including investigations into pesticide residues and fraudulent adulteration with foreign plant material.

Analysis and Results

A total of 41 samples of dried oregano (*Origanum vulgare* L.) from German retail, wholesale, and food processing companies were tested for over 750 different pesticides and contaminants. Twenty of these samples were checked morphologically with tweezers and a magnifying glass for foreign plant parts such as olive leaves.

Usually, dried oregano consists of crushed leaves with blossoms and the outermost parts of the stem of the *Origanum vulgare* L.. Orange-brown droplets of oil found on the surface of the hairy leaves contain the characteristic, aromatic essential oils of oregano (Fig. 1). The analyses conducted by CVUA Stuttgart substantiate that products sold on the market as „oregano“ don't always contain oregano alone. Four of the 20 samples (20%) analyzed for the presence of foreign plant parts were detected in some cases with high amounts of olive leaves (*Olea europaea* L.) and/or rockrose leaves (*Cistus* sp.). The detected amounts of foreign plant fragments varied between 24 to 65%. Two of the “oregano” samples, consisting of 58% and 65% foreign plant parts, could be best designated as “partially oregano”.

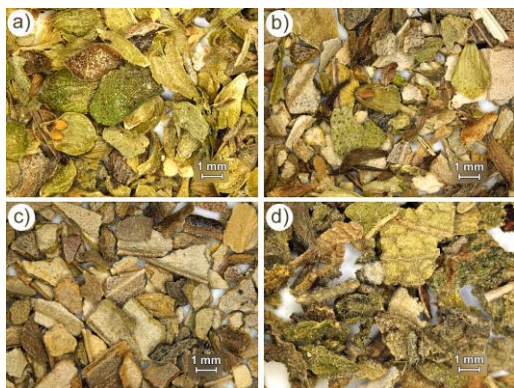


Fig. 1: Stereomicroscopic photos (10 x magnification) of:
a) crushed oregano (*Origanum vulgare* L.); **b)** sample labeled as „oregano“ (mixture of oregano and olive leaves (*Olea europaea* L.)); **c)** pieces of olive leaves; and **d)** pieces of rockrose leaves (*Cistus* sp.).

It is unlikely that the presence of olive and rockrose leaves at the time of cultivation and harvesting of oregano was unintentional, given the amounts of up to 65% and the basic differences in the plants' growth forms. It is much more probable that these were the result of an intentional admixture, with the purpose of maximizing profits. In other words: food fraud. Due to the significant adulteration of the oregano with olive and/or rockrose leaves, the effected oregano samples were judged to be fraudulent in terms of their identity and composition.

Regarding pesticides, all of the analyzed samples were found to contain a total of 38 different pesticide substances and perchlorate.

Literature

[1] CVUA Stuttgart; Oregano – an Aromatic but Loaded Culinary Herb. Part I: Pyrrolizidine Alkaloids; 2019

Herbicides (2,4-D, fluzifop, and pendimethalin) as well as insecticides from the substance class of pyrethroids (cypermethrin, lambda-cyhalothrin, and deltamethrin) were most frequently detected. All of the samples were also found to contain the contaminant perchlorate.

A total of 38 of the 41 samples (93%) were found to contain multiple residues. An average of 5.1 different substances was detected per sample. The relevant residue findings are presented in Table 1. Residue amounts exceeding the legally established maximum levels (MRL; including chlorate) or reference values (perchlorate) were found in 9 of the 41 samples (29 %). Three of these samples contained more than one exceedance of the MRL, however. In addition to the herbicide fluzifop (4 samples >MRL), the insecticide substances cyfluthrin (3 samples >MRL), pyriproxyfen (2 samples >MRL) and chlorpyrifos (1 sample >MRL) are also especially relevant.

Tab. 1: Residues of relevant pesticides and contaminants in crushed oregano; sample size: 41; alphabetical order

Substance*	Samples w/ residues (%)	Min (mg/kg)	Max (mg/kg)	MRL** (mg/kg)	No. >MRL**
2,4-D	8 (19.5 %)	0.006	0.011	0.10	-
Acetamiprid	7 (17.1 %)	0.005	0.10	3.0	-
Azoxystrobin	19 (46.3 %)	0.010	1.1	70	-
Chlorate	2 (4.9 %)	0.006	0.075	0.010	1
Chlorpyrifos	17 (41.5 %)	0.005	0.16	0.020	1
Cyfluthrin	5 (12.2 %)	0.046	0.24	0.020	3
Cypermethrin	17 (41.5 %)	0.013	0.42	2.0	-
Deltamethrin	11 (26.8 %)	0.029	0.29	2.0	-
Fluzifop	11 (26.8 %)	0.005	2.7	0.020	4
Lambda-Cyhalothrin	11 (26.8 %)	0.036	0.54	0.70	-
Nicotine	9 (21.9 %)	0.028	0.072	0.40	-
Pendimethalin	18 (43.9 %)	0.010	0.035	0.60	-
Perchlorate	41 (100 %)	0.035	1.7	0.20***	1
Pyriproxyfen	4 (9.8 %)	0.12	0.20	0.050	2****

* Only substances with MRL exceedances or frequent positive findings (n ≥ 5) are presented

** MRL = Maximum Residue Level

*** Reference value for perchlorate in leafy vegetables

**** MRL exceedances with consideration of percentage of olive leaves in oregano 1

The conspicuously frequent findings of herbicides, especially fluzifop, suggest that combating weeds in oregano cultivation sites is a challenge. This assumption is supported by earlier investigations on oregano, showing consistent, very high quantities of pyrrolizidine alkaloids (PA), which indicates an unintentional co-processing of PA-forming foreign plants with oregano and a widespread weed problem in oregano cultivation [1].

In contrast, the frequent insecticide findings in oregano are directly related to the above-mentioned problem of falsification. From the five out of six samples that exceeded the MRLs for insecticides two oregano samples were falsified by the presence of high quantities of olive leaves (58%, 65 %). It is noteworthy, that the respective substances belong to a range of common insecticides that are used intensively in olive groves for the reduction of quality and revenue losses resulting from the destructive olive fruit flies.

Conclusions

In light of the analyses performed by the CVUA Stuttgart on crushed oregano, the overall picture of the state of this popular culinary herb is most unsatisfactory. To improve the pesticide residue situation on oregano and prevent fraudulent adulteration, producers and traders should strengthen their own inspection of oregano batches in the realm of due diligence, before marketing and further processing the wares.

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