



Ülevaade Eesti päritolu maasikate referentsandmekogu loomise projektist

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Euroopa investeringud
maapiirkondadesse

Projekti tutvustus

- Tellija ja rahastaja Maaeluministerium
- Projekti pikkus 3 aastat
- Projekti eesmärk:

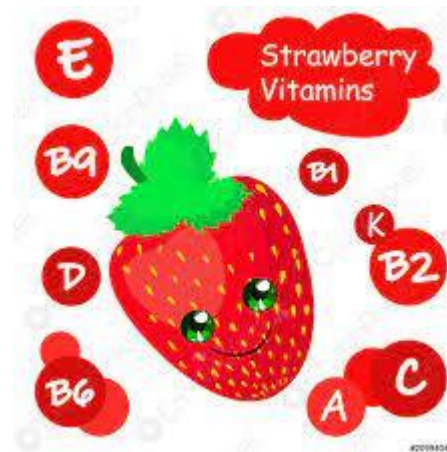
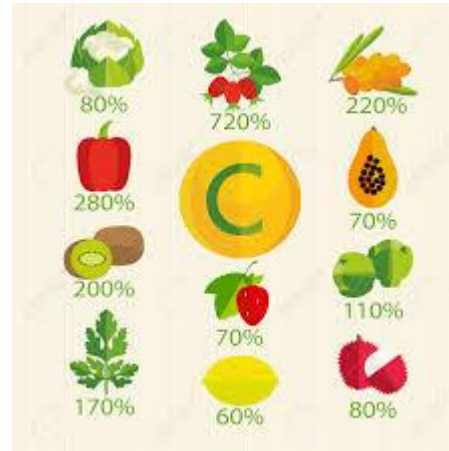
Luaa Eesti maasikaid iseloomustav andmekogu ja analüüsida võimalusi Eesti maasikate päritolumaa hindamiseks.



Sissejuhatuseks

Marjad sisaldavad:

- 🍓 vitamiine
- 🍓 bioaktiivseid aineid
- 🍓 antioksidante
- 🍓 fenoolhapet



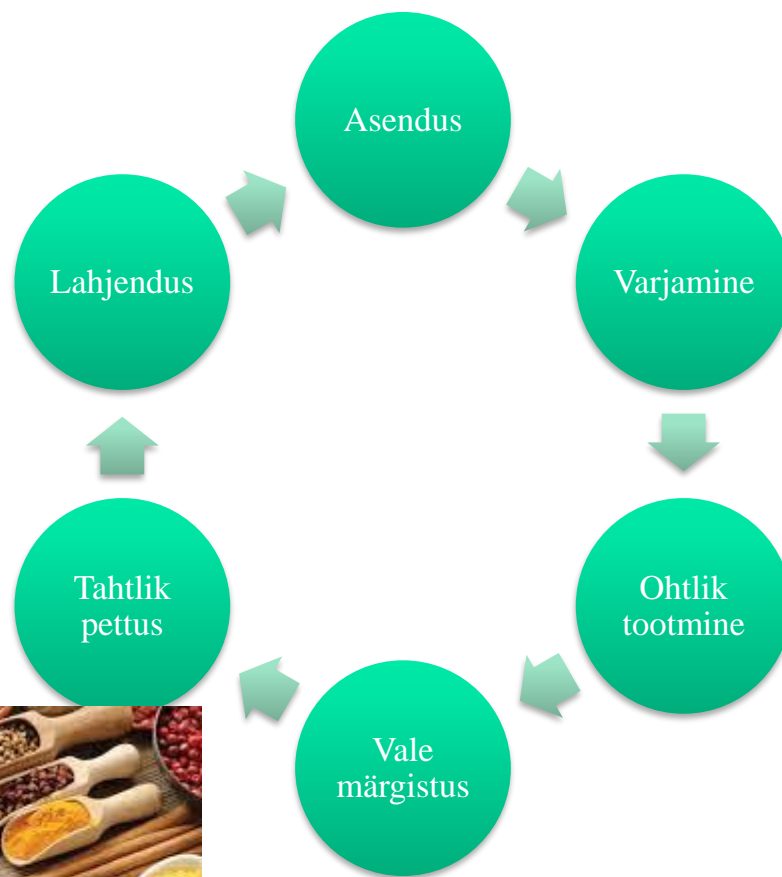
Pettused marjade ja nende toodetega

Marjade asendamine:

- 🍓 vähem väärtuslikega
- 🍓 teist liiki marjadega või puuviljadega
- 🍓 Toote lahjendamine
- 🍓 Lisa- ja värvainete kasutamine
- 🍓 Geograafilise päritolu kohta valetamine



Toidu pettus 1



Miks uurida maasikate päritolu?

Tootja kaitse seisukohalt:

- 🍓 Võistlus (kodumaine, välismaine)
- 🍓 Päritolutõend (tarbija usaldus)

Tarbija kaitse seisukohalt:

- 🍓 Toiduohutus (jälgitavus)
- 🍓 Ehtsus (saate selle, mille eest maksate)



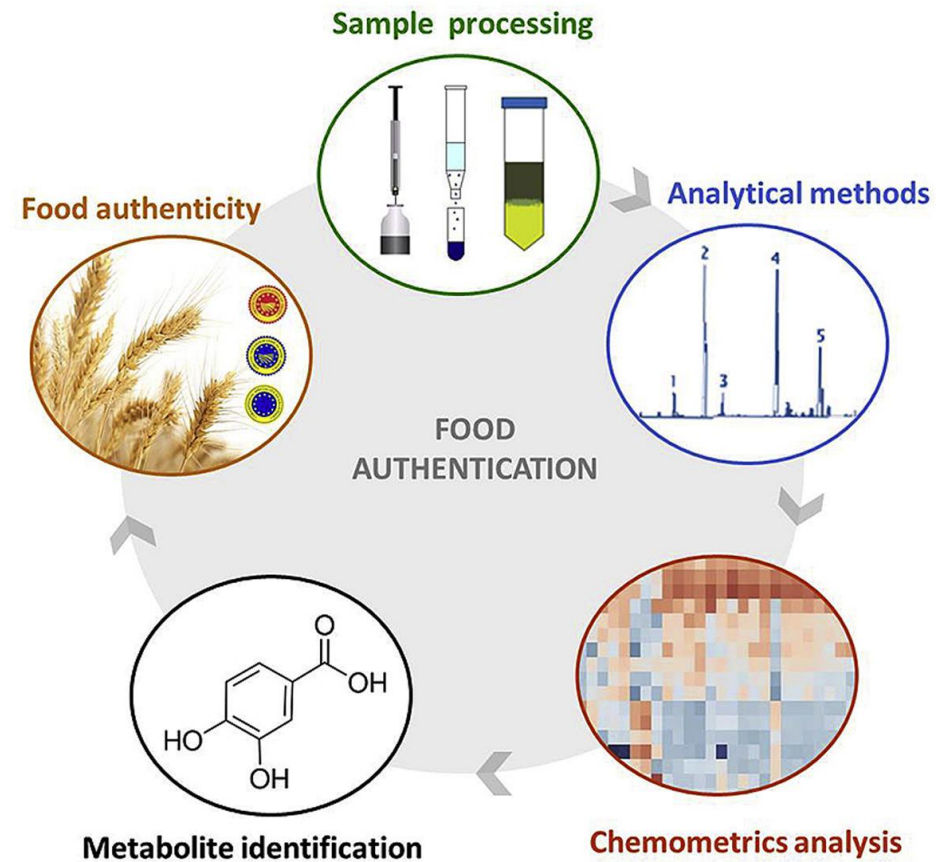
Millest alustada?

TABLE 1 Summary of mass spectrometry-based studies for determining the geographical origin of berries

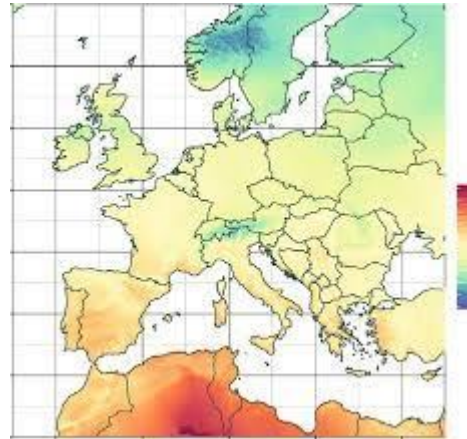
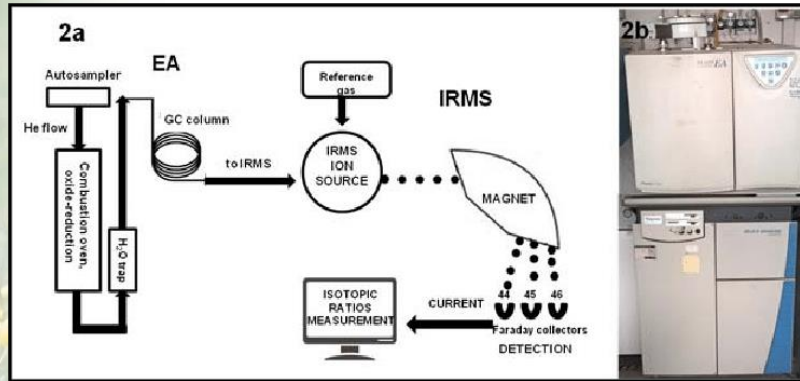
Berry species	Material type	Technique	Chemometric methods	Purpose of analysis	Reference
Strawberry, blueberry (<i>V. caesariense/corymbosum</i>)	Fresh berries	ICP-AES, IRMS	PCA, CDA	Geographical origin	Perez et al., 2006
Blueberry	Fresh berries	IRMS, SNIF-NMR	–	Geographical origin	Camin et al., 2009
Blackcurrant	Fresh berries, leaves, soil samples	IRMS	DA	Geographical origin	Li et al., 2013
Wolfberry	Dried berries	ICP-MS	PCA	Geographical origin	Balabanova et al., 2016
Wolfberry	Fresh berries	ICP-MS	PCA, LDA	Geographical origin	Zhang et al., 2017
Strawberry, raspberry, blackberry (<i>Rubus fruticosus</i>), blueberry, whitecurrant, blackcurrant, redcurrant	Fresh berries	IRMS, SNIF-NMR	PCA	Geographical origin	Perini et al., 2018
Wolfberry	Fresh berries	GC-IRMS + HS-SPME	PLS-DA, LDA	Geographical origin	Meng et al., 2019
Wolfberry	Fresh berries	IRMS, ICP-MS, HPLC-DAD-MS	PCA, CA, FSDA	Geographical origin	Bertoldi et al., 2019
Blueberry, bilberry	Fresh berries	IRMS, ICP-OED	PCA	Geographical origin	Klavins et al., 2021

Abbreviations: CA, cluster analysis; DA, discriminant analysis; FSDA, forward stepwise discriminant analysis; GC-IRMS, gas chromatography isotope ratio mass spectrometry; HPLC-DAD-MS, high-performance liquid chromatography diode array mass spectrometry; HS-SPME, headspace solid-phase microextraction; ICP-AES, inductively coupled plasma atomic emission spectroscopy; ICP-MS, inductively coupled plasma mass spectrometry; ICP-OED, inductively coupled plasma spectrometry with optical emission detection; IRMS, isotope ratio mass spectrometry; LDA, linear discriminant analysis; PCA, principal component analysis; PLS-DA, partial least squares discriminant analysis; SNIF-NMR, specific natural isotopic fraction-nuclear magnetic resonance.

Millest alustada?

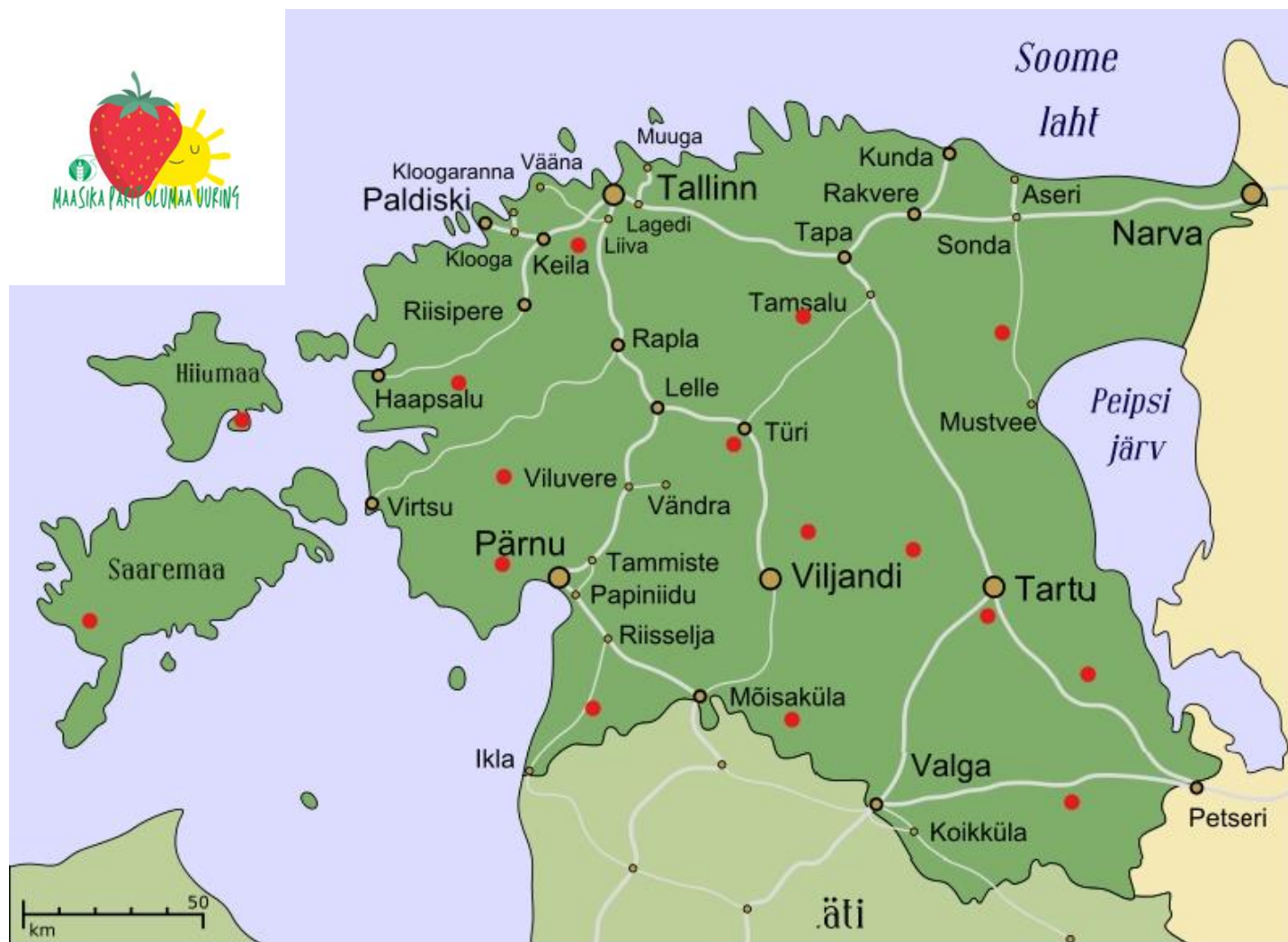


Valitud metoodika: isotoopide suhte massispektromeetria



- 🍓 CF-IRMS kõrgtemperatuuriline pürolüüs (töötemperatuur: 1010-1550 °C), millele järgneb samaaegne stabiilsete isotoopide suhete analüüs kahes eraldi massispektromeetris
- 🍓 Diskriminantanalüüs

Proovide kogumine

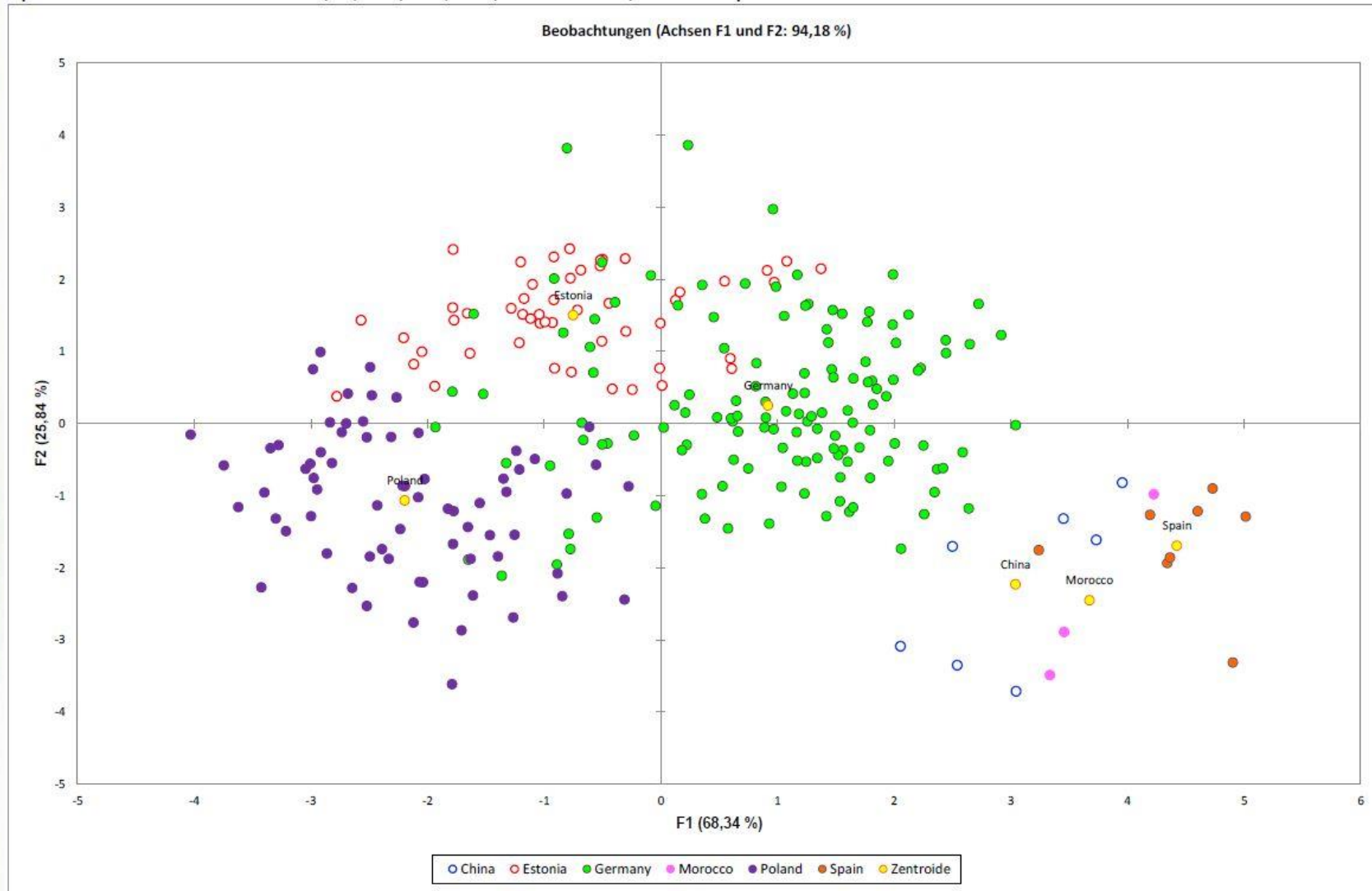


Esimesed tulemused

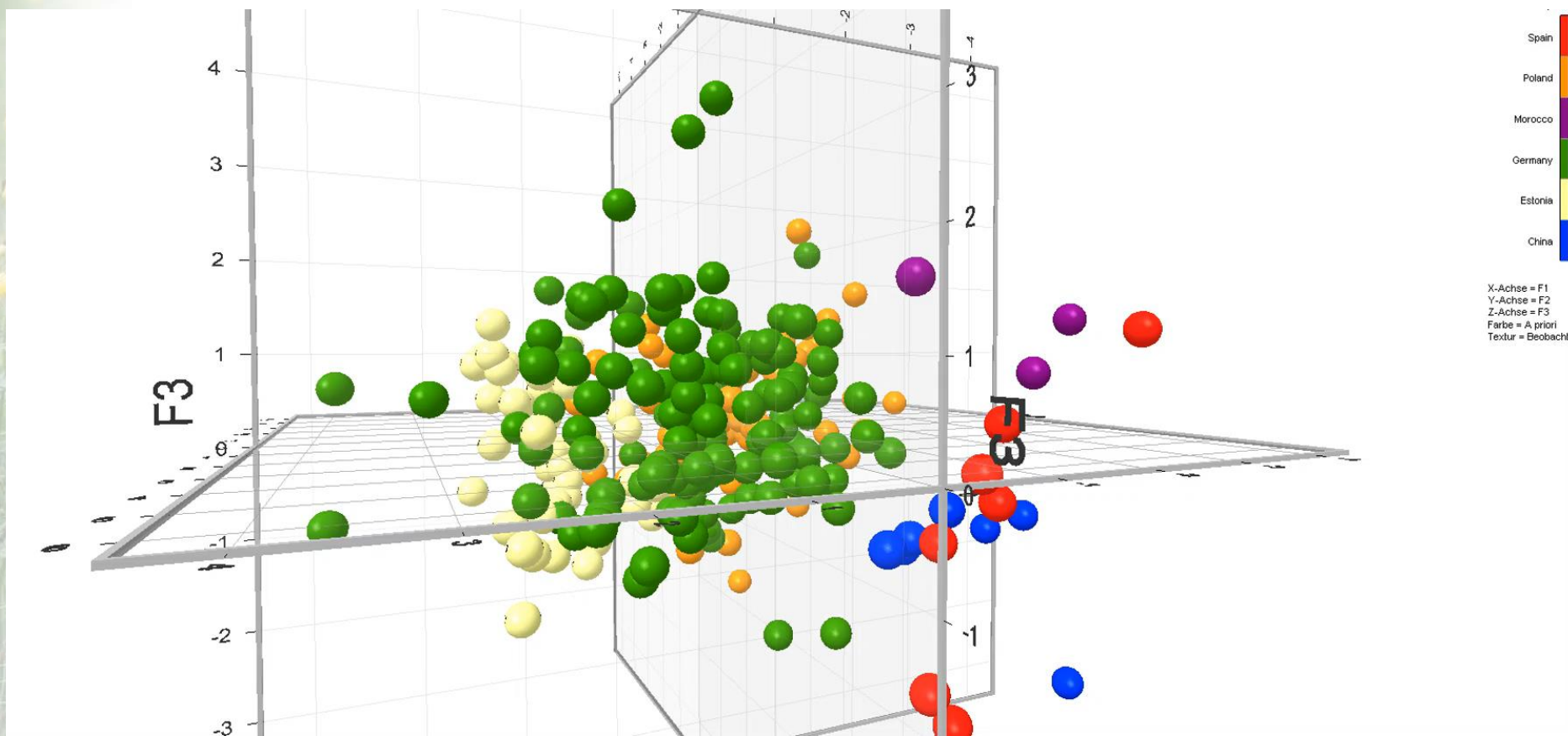
No.	Sample	Decl. / Farm	Tissue water D/H ⁺ [‰] v.s. vsmow	Tissue water 18O/16O [‰] v.s. vsmow	Kernels D/H _{org} ⁺ [‰] v.s. vsmow	Kernels 18O/16O _{org} ⁺ [‰] v.s. vsmow	Kernels 13C/12C ⁻ [‰] v.s. PDB	Kernels 15N/14N ⁻ [‰] v.s. Air	Kernels 34S/32S ⁻ [‰] v.s. CDT	87Sr/86Sr [ppm] [#]
1	Strawberries Ma 1-1	Estonia / Farm 1	-47.5 +/- 1.2	-2.5 +/- 0.2	-109.6 +/- 2.6	21.7 +/- 0.3	-27.3 +/- 0.1	3.8 +/- 0.1	-1.1 +/- 0.3	0.713 +/- 0.007
2	Strawberries Ma 1-2	Estonia / Farm 1	-48.5 +/- 1.0	-3.2 +/- 0.2	-110.4 +/- 2.5	21.9 +/- 0.3	-26.9 +/- 0.1	3.2 +/- 0.2	0.4 +/- 0.3	0.727 +/- 0.003
3	Strawberries Ma 1-3	Estonia / Farm 1	-49.4 +/- 0.7	-3.7 +/- 0.2	-118.0 +/- 2.4	21.9 +/- 0.3	-27.0 +/- 0.1	1.4 +/- 0.1	2.7 +/- 0.2	0.717 +/- 0.009
4	Strawberries Ma 2-1	Estonia / Farm 2	-55.8 +/- 0.8	-4.5 +/- 0.2	-121.1 +/- 2.8	21.9 +/- 0.3	-26.6 +/- 0.1	5.7 +/- 0.2	4.0 +/- 0.2	0.699 +/- 0.009
5	Strawberries Ma 2-2	Estonia / Farm 2	-55.1 +/- 0.8	-4.2 +/- 0.2	-123.8 +/- 2.4	21.7 +/- 0.3	-26.5 +/- 0.1	7.0 +/- 0.1	3.6 +/- 0.2	0.710 +/- 0.007
6	Strawberries Ma 3-1	Estonia / Farm 3	-45.0 +/- 0.8	-3.4 +/- 0.2	-106.2 +/- 2.5	23.3 +/- 0.4	-27.1 +/- 0.1	3.2 +/- 0.3	-6.7 +/- 0.2	0.715 +/- 0.009
7	Strawberries Ma 3-2	Estonia / Farm 3	-44.7 +/- 0.7	-3.3 +/- 0.3	-100.3 +/- 3.3	24.4 +/- 0.3	-26.7 +/- 0.1	2.8 +/- 0.2	-7.5 +/- 0.3	Not enough material
8	Strawberries Ma 3-3	Estonia / Farm 3	-47.9 +/- 0.8	-3.8 +/- 0.2	-107.4 +/- 2.5	23.1 +/- 0.4	-27.2 +/- 0.1	5.0 +/- 0.3	-8.2 +/- 0.2	0.707 +/- 0.002
9	Strawberries Ma 4-1	Estonia / Farm 4	-46.1 +/- 1.2	-4.0 +/- 0.2	-111.3 +/- 2.6	22.0 +/- 0.3	-28.1 +/- 0.1	4.2 +/- 0.2	4.9 +/- 0.3	0.711 +/- 0.016
10	Strawberries Ma 4-2	Estonia / Farm 4	-46.9 +/- 0.9	-4.1 +/- 0.4	-113.1 +/- 2.4	21.9 +/- 0.3	-27.2 +/- 0.1	4.7 +/- 0.2	4.0 +/- 0.2	0.706 +/- 0.010
11	Strawberries Ma 4-3	Estonia / Farm 4	-48.8 +/- 0.9	-4.8 +/- 0.2	-112.0 +/- 2.6	22.0 +/- 0.3	-27.3 +/- 0.1	5.2 +/- 0.2	3.2 +/- 0.3	0.698 +/- 0.005
12	Strawberries Ma 5-1	Estonia / Farm 5	-49.3 +/- 0.9	-4.4 +/- 0.3	-117.0 +/- 2.7	23.7 +/- 0.3	-27.3 +/- 0.1	5.5 +/- 0.2	5.9 +/- 0.2	0.724 +/- 0.008
13	Strawberries Ma 5-2	Estonia / Farm 5	-49.9 +/- 0.9	-4.4 +/- 0.2	-117.8 +/- 2.5	23.4 +/- 0.3	-27.2 +/- 0.1	4.6 +/- 0.2	5.3 +/- 0.2	0.724 +/- 0.015
14	Strawberries Ma 5-3	Estonia / Farm 5	-51.4 +/- 0.8	-4.6 +/- 0.3	-118.0 +/- 2.1	23.3 +/- 0.3	-27.0 +/- 0.1	3.0 +/- 0.1	5.4 +/- 0.2	0.695 +/- 0.004
15	Strawberries Ma 6-1	Estonia / Farm 6	-50.1 +/- 0.9	-4.5 +/- 0.2	-118.7 +/- 1.8	22.7 +/- 0.3	-26.3 +/- 0.1	3.7 +/- 0.1	2.8 +/- 0.2	0.696 +/- 0.014
16	Strawberries Ma 6-2	Estonia / Farm 6	-46.6 +/- 0.8	-4.5 +/- 0.4	-109.6 +/- 1.9	21.6 +/- 0.3	-26.6 +/- 0.1	4.9 +/- 0.1	3.7 +/- 0.2	0.707 +/- 0.013
17	Strawberries Ma 6-3	Estonia / Farm 6	-50.9 +/- 0.8	-5.5 +/- 0.3	-109.9 +/- 2.5	21.5 +/- 0.4	-27.4 +/- 0.1	4.9 +/- 0.2	1.9 +/- 0.2	0.727 +/- 0.014

Table 1: Stable isotope ratios of the strawberry reference samples from order no 468K1245-0920.

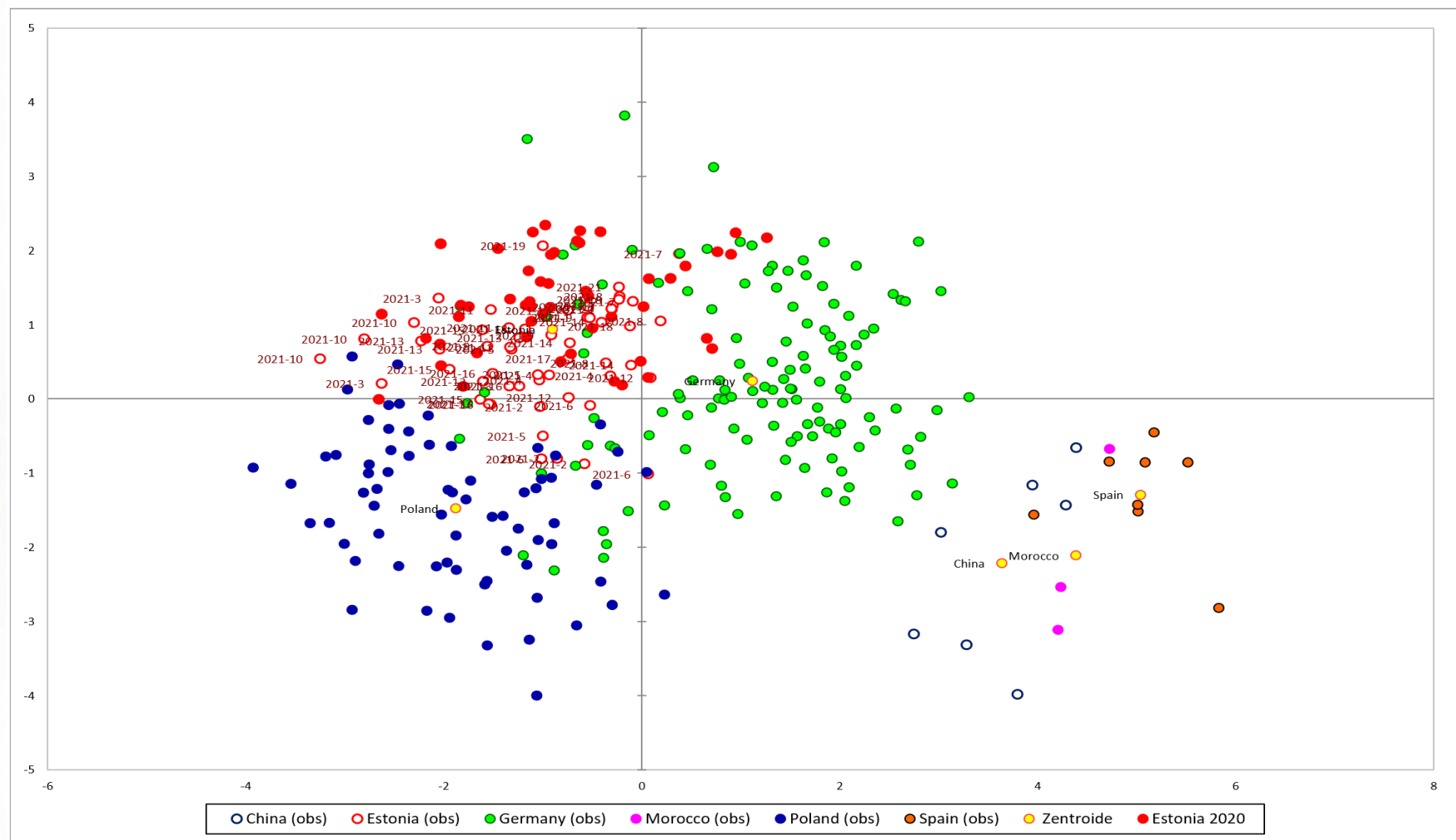
Esimese aasta tulemused 2020 a



Tulemused 2020 a. 3D



2020 ja 2021 a tulemused

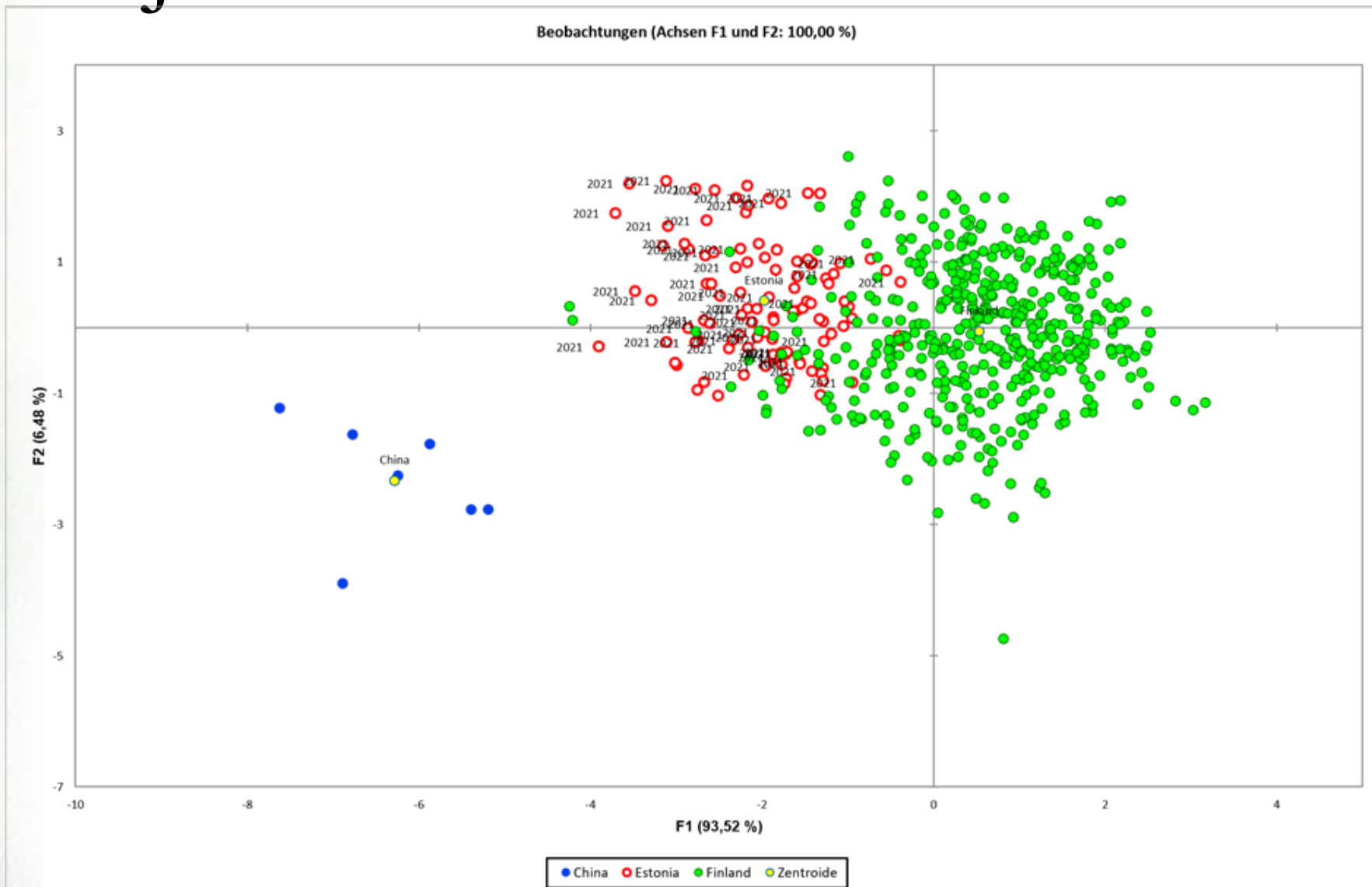


Tulemused

Eksisteerivad kattuvad alad Eesti, Poola ja Saksamaa vahel. Täpsemalt on praegu veamäär (kattuvus) Saksamaa/Eesti vahel 14 % ja Poola/Eesti vahel 5 % (joonis 3).

<u>from/ to</u>	<u>China</u>	Estonia	<u>Germany</u>	<u>Morocco</u>	<u>Poland</u>	Spain	<u>total</u>	<u>% correct</u>
<u>China</u>	7	0	0	0	0	0	7	100,00 %
Estonia	0	94	9	0	5	0	108	87,04%
<u>Germany</u>	10	20	94	0	9	0	133	70,68%
<u>Morocco</u>	0	0	0	3	0	0	3	100,00 %
<u>Poland</u>	0	3	2	0	64	0	69	92,75%
Spain	1	0	0	1	0	6	8	75,00%
total	18	117	105	4	78	6	328	81,71%

Eesti ja Soome tulemuste võrdlus 2021



Lisandväärtus: Maasikasortide määramine

- Teostasime taimeterwise ja mikrobioloogia laboris Eestis kasvatatavate maasikasortide genoomi analüüs SSR markeritega.
- Eesmärgiks oli määrata maasika sorte DNA põhjal.
- 2020/2021 a tulemused näitavad, et valitud praimeritega on võimalik maasikasorte analüüsida

Plaanid 2022 aastaks



- 🍓 maasikaproovide kogumine Eestis, Lätis, Leedus
- 🍓 Laborite külastused (Saksamaa, Soome)
- 🍓 Infopäeva korraldamine
- 🍓 Projekti lõpuseminar renoveeritud PMK hoones.
- 🍓 Projektis osalenud tootjate tänamine

