Setting a New Zealand Honey Standard for Monofloral Varieties of Honey Produced in New Zealand

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A consultation paper for the
Bee Products Standards Council

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Summary

The New Zealand standard for honey quality and integrity is currently based on two criteria: moisture content and reducing sugar levels. Honey is a major export product for New Zealand and high value is attributed to the various monofloral varieties of table honey produced in this country. The industry is looking to develop a robust standard to protect the integrity of these varieties. Criteria beyond moisture content and reducing sugars exist for evaluation and monitoring of monofloral honeys. These can be found in the Codex Alimentarius, in the legislation of other countries, and in reviews undertaken by honey industry organisations such as the International Honey commission.

The Bee Products Standards Council wants the industry to establish standards and the purpose of this consultation is to seek feedback. Failure to set robust standards could see standards being imposed by regulators, here or overseas.

This consultation paper describes the options available. Feedback is requested from industry stakeholders on the options.

1 Background

The Bee Products Standards Council (BPSC) has recognised the need for a commercial table honey standard for monofloral varieties to maintain the value and integrity of NZ table honey in the world market. New Zealand exports significant volumes of clover, honeydew, manuka/kanuka and thyme honey.

The honeys from New Zealand native plants are of significant value domestically from the in-bound tourist industry. The honey industry is a profitable industry with about 200 diverse stakeholders, including honey producers and manufacturers of honey products, who will be affected commercially by the proposed standard. In considering the development of standards the BPSC also recognises that if the industry does not develop and implement robust standards the industry is at risk from the imposition of standards by regulators here or in offshore markets.

Another significant consideration is cost, speed and simplicity of any tests that will accompany the standards. While a wide range of tests are available internationally these may come at significant costs and the BPSC recognises the need to keep testing costs at a level appropriate to the value of the product. A particular issue is the need to set requirements for the composition of manuka honey.

2 Introduction

2.1 International standard for honey

The World FAO food code, the Codex Alimentarius[1] contains the international standards for honey. The standard has guidance relevant to this consultation about how honey may be designated. The relevant clauses are:

6.1.5 Honey may be designated by the name of the geographical or topographical region if the honey was produced exclusively within the area referred to in the designation.

6.1.6 Honey may be designated according to floral or plant source if it comes wholly or mainly from that particular source and has the organoleptic, physicochemical and microscopic properties corresponding with that origin.

6.1.7 Where honey has been designated according to floral or plant source (6.1.6) then the common name or the botanical name of the floral source shall be in close proximity to the word "honey".

6.1.8 Where honey has been designated according to floral, plant source, or by the name of a geographical or topological region, then the name of the country where the honey has been produced shall be declared.

The international standard also contains mandatory requirements for the following attributes:

- sugar content (sum of fructose, glucose and sucrose)
- moisture content
- insoluble solids content
- contaminants

[1] http://www.codexalimentarius.net/web/standard_list.jsp CODEX STANDARD FOR HONEY (CODEX STAN 12-19811)

Voluntary application is also provided for the following attributes:

- acidity
- diastase activity
- hydroxymethylfurfural (HMF) content
- electrical conductivity.

2.2 New Zealand and Australian standard for honey

The Australian and New Zealand honey standard is defined by Food Standards Australia New Zealand (FSANZ)[2] and is based on the Codex standard (see Appendix 1) with requirements for moisture and sugars only (reducing sugar content). The standard defines honey as a product, but has no reference to floral varieties within the product.

The issue at hand is how to work within these international and the Australian and New Zealand standard to develop a workable commercial standard for the NZ industry for **monofloral table honeys**.

2.3 Standards in other countries

In developing a New Zealand standard it is useful to have an understanding of how other countries have approached this. This section outlines the approaches in the European Union and North America. In considering these standards it is important to recognise the differences in products in different countries e.g. a very refined product from U.S.A. and that this will determine the standards that are developed. In this regard there are significant differences between the EU and North American approaches to standards.

European Union

The EU complies with the standards set out in the Codex and the near identical European Honey Directive[3]. Under the Directive when placed on the market as honey or used in any product intended for human consumption, honey must meet criteria based on the following:

- Microscopic analysis (including pollen)
- Sugar content
  - Fructose and glucose content (sum of both)
  - Sucrose content
- Moisture content
- Water-insoluble content
- Electrical conductivity
- Free acid
- Diastase activity and hydroxymethylfurfural content (HMF) determined after processing and blending

The standards do vary significantly by variety and these are shown in Appendix 2.

Germany has one of the most comprehensive legislations in the world due to adoption of not only the mandatory standards in the Codex but also many of the voluntary attribute standards. The UK follows Germany in the adoption of honey standards.

[2] http://www.foodstandards.govt.nz/thecode/foodstandardscode/index.cfm#_two STANDARD 2.8.2 HONEY

[3] http://www.agriculture.gov.ie/media/agriculturеie/farmingsectors/horticulture/CD110-2001_honey.pdf

Canada
In Canada honey production and exportation is regulated by the Canadian Food Inspection Authority under legislation in the Honey Regulation of the Canadian Agricultural Products Act. Under the Act honey is:

a. graded (Grades I, II, III) according to mandatory standards on
    - moisture
    - water insoluble solids
    - flavour
b. classified by colour according to standards relating to Pfund measurement, and
c. classified by "kind" (ie floral origin) according to standards on
    - Reducing sugar content
    - Sucrose content
    - Ash (mineral) content
    - Acidity

USA
Like Canada, the USA grades its honey. The relevant legislation is the USDA Standard for Grades of Extracted Honey (1985). Under this Act honey is:

a. graded (A, B, C, substandard) to comply with standards on
    - water insoluble solids (and therefore by default moisture content)
    - flavour & aroma
    - clarity
b. colour designated according to standards relating to Pfund and optical density measurements

2.4 The purpose of this consultation

The purpose of this consultation is to:

- present to the honey industry the proposed profile and criteria for monofloral table honeys developed by the BPSC
- seek feedback from industry stakeholders on the proposed standard, and
- recommend modifications to the standard as may be appropriate.

2.5 Your views are sought

The consultation seeks your feedback on:

- the use of appearance, pollen and organoleptic criteria as principles for differentiating monofloral varieties
- the suitability of the range of values used for each floral type.
- alternative means for differentiating floral honeys
- how should the proposed system be administered
- how should compliance be managed
- what, if any, penalties should be imposed for non-compliance.
- any other matters you wish to comment on with regard New Zealand standard for monofloral table honey.

This document contains a number of questions that have been prepared as guidance on the feedback.

The attached document "**Advice to submitters and template**" has been provided to provide guidance on the format and process for submissions.

3 NZ honey profiles and minimum criteria

In 2002 the BPSC convened a meeting of ten industry representatives with specialized knowledge of New Zealand table honey to finalise the definitions of New Zealand mono-floral honeys. The BPSC has developed profiles of the following properties of honey from 11 New Zealand plant sources:

a. organoleptic - aroma and flavour,
b. physicochemical - appearance as determined by a Pfund measurement,
c. microscopic - a pollen profile with the following specified:
    - minimum frequency % of characterising species, and
    - total pollen count per 10 g sample.

Each characteristic is defined by a range of values that is normal for this honey type.

Analysis based on pollen count is seen by the BPSC as a key component of any New Zealand standard. Analysis of the pollen content of honey, termed melissopalynology, is used to determine the source of honeys, particularly the geographical origin of honeys (based on the characteristic flora of different regions and pollen count).

The profile and criteria are shown in Table 1 followed by a discussion of each in the following sections.

Table 1. N.Z. honey profiles and minimum criteria for monofloral "Varieties"

Key Characteristics	Appearance		Pollen		Organoleptic		Notes
Variety	**Colour**	**Pfund Colour Measurement mm**	**Minimum Frequency % of Characterising Species**	**Total Pollen Count (No of pollen grains per 10 g honey sample) Range**	**Aroma**	**Flavour**	
Clover	Light pale gold	0 –60mm	45% a	Mean 100,000 s.d. 90,000	Herbal dry grass.	Clean mild, sweet, delicate	
Honeydew * (Beech)	Medium dark amber	87.2 mm s.d. 10.5			Musky	Complex, treacly, malt extract.	See note below
Kamahi	Light to pale yellow	42 average s.d. 11.5	60%	Mean 185,000 s.d. 66,800	Intense, musky, Quite complex Dominate aroma	Very clean rich and sweet distinctive aftertaste, Buttery texture	Dominant aroma
Manuka/Kanuka	Dark cream to dark brown	84 mm 11.8mm s.d.	70%	Mean 517,000 s.d. 280,000	Damp earth, heather, aromatic	Mineral, slightly bitter, tangy.	Thixotropic in liquid state
Nodding Thistle	Colourless to pale lemon			Low pollen count	Perfumed floral blossom, intense.	Intense floral flavour,	Dominance of fructose, Slow natural granulation.
Pohutukawa	Off- white	Pure 0 –5 Blends 5 – 30	20%	No available data	Musky, damp leaves, salty (almost seaweed) but pleasant)	Clean earthy sweet butterscotch Scenty	Very rapid granulation, days in comb, hours in tank
Southern Rata	Colourless to Pale cream	16.4mm s.d. 8.6mm	45%	Mean 123,000 s.d. 35,900	Heady aromatic	Sweet, distinctive, mildly salty Scenty	
Rewarewa	Amber to red	92.9mm s.d. 9.2mm	10%	Mean 112,800 s.d. 101,900	Light aroma mild mixed fruit	Clean sweet smoky malty	
Tawari	Light	23 mm s.d. 8.8mm	To be determined	Low pollen count	Rich perfumed musk/incense/sandalwood orange peel/liquorice	Clean musty rosehip syrup, very sweet golden syrup	High in moisture Doesn't fully Granulate
Thyme	Amber	105 mm	20%	3,000- 8,000 Thyme pollen grains per 10g honey sample	Pervasive very aromatic	Resinous aromatic herbal, very strong	Very unique, dominant aroma
Vipers Bugloss (Blue Borage)	Light Pinkish Brown	21.7 mm s.d. 9mm	45%	Mean72,000 s.d. 38,700	Initial floral, bouquet when fresh	Clean tasting mildly herbal	Texture oily texture

* Beech Honey Dew Honey is not a floral honey so that the main "certifiable" criteria for it are that it should have an Electrical Conductivity >800micro Siemens/cm at 20`C &20% DM soln and for "high grade" > 1000uS/cm. Mean 1260 uS/cm s.d.250.It should not crystallise. Sooty mould hyphae & ascospores often present

4 Allowable characterising species for certain floral types

In order to determine the total pollen count, the first step is to determine the plant species (the characterising species) whose pollen can be counted for the honey to be classified as monofloral. The allowable characterising species will need to be defined for each floral type. The Codex standard requires that a floral honey has to come "*wholly or mainly from that particular source".*

Some honeys have become accepted as "monofloral" in the consumer's eyes even though there are a number of species which contribute to the attributes of that honey. For example when a consumer refers to the common name "Clover" honey, they are not specifying that it is from White Clover (*Trifolium repens*) and it may in fact come from a range of genus/species known as clover. It is important to note that a "common name" has a recognised legal definition being name by which the food is generally known[4].

Question 1. Do you agree with the principle of defining the species which can contribute to a monofloral variety?

4.1 Clover

Clover is a very broad term. There are a number of characterising species that could be defined for clover:

1. *Trifolium repens* alone
2. Red, White, Subterranean, Alsike and Strawberry clovers
3. *Mellilotus* spp.

Question 2. What species do you consider should be recognised as characterising species for clover honey?

4.2 Vipers bugloss/blue borage honey

Common names have been used for the species that contribute to this honey: Borage and Vipers Bugloss. However, these plants are botanically quite different and defined as:

- *Echium vulgare* (aka vipers bugloss and blue borage).
- *Borago officinalis*. (aka borage).

Echium vulgare is one species but with two common names. Borage is a cultivated plant unrelated to *Echium*, but given the common name "borage".

Question 3. What species do you consider should be recognised as characterising species for this honey?

4.3 Manuka/kanuka

Until the mid 1980's the two *Leptospermun* species commonly called manuka were *Leptospermum scoparium* (manuka*)* and *Leptospermum ericoides* (kanuka*)*. However, after much debate and following taxonomic revision in the 1980s *L. ericoides* was revised to *Kunzea ericoides* i.e. a new genus. However, the taxonomic revision was not based on pollen attributes. The pollen of manuka and kanuka cannot be distinguished. Similarly the honey from each is virtually indistinguishable by colour and organoleptic properties.

[4] http://www.foodstandards.govt.nz/thecode/foodstandardscode/index.cfm#_two

The common name “manuka” still includes both *Leptospermum scoparium* and *Kunzea ericoides* (kanuka). The profile in Table 1 includes both manuka and kanuka as the characterising species.

Question 4. Do you consider that these two species should be separated or combined for this honey?

5 Total pollen count

Pollen coefficients (number of pollen grains per 10 g of honey) are calculated by counting under a microscope the number of grains in a defined volume and weight of honey. These are presented in Table 1 for each monofloral honey except for Nodding Thistle, Honey dew, Pohutakawa and Tawari.

Question 5. Do you consider that using pollen coefficients to define a monofloral variety is an effective tool?

5.1 Manuka/kanuka pollen

A mean and standard deviation have been proposed for the pollen count from manuka/kanuka. This is because similarities between manuka and kanuka pollen make definite identification unreliable [1].

Question 6. Is the total manuka/kanuka pollen count proposed accurate for manuka honey?

5.2 Honeys with low, or no pollen count

Nodding thistle and Rewarewa, have no to very low pollen count, which limit its use as a positive means of identification because it may be under-represented. Other attributes e.g. colour enable Nodding thistle and Rewarewa to be distinguished.

Question 7. Should pollen still be used for identification of these floral sources?

5.3 Other honeys

Pollen counts have been proposed for Clover, Kamahi, Southern Rata, Thyme and Vipers Bugloss. and Tawari. Pollen counts for Pohutakawa will need to be established.

Question 8. Is the total pollen count proposed for these honeys accurate?

6 Colour and colour measurement

New Zealand honeys have distinctive colour, and colour is a readily available technical measure and an additional tool for identification of floral varieties. In particular colour may useful as a part of a range of criteria to specify monofloral honeys which have low or no pollen count. Table 1 contains the colour measurements to be used to define the monofloral varieties.

Question 9. Recognising New Zealand’s geographic differences, do you consider that using colour measurement to define a monofloral variety is an effective tool?

Question 10. Are the colour measurements proposed for these honeys accurate?

7 Organoleptic profiles

Organoleptic profile is a well recognised tool for specifying monofloral honeys, and most New Zealand honeys have characteristic and intense flavours and aromas, and these are specified in Table 1. Characteristic organoleptic profiles can be generated by only a small percentage of the required species. Also if it is used as part of a standard it would be important to have independent testing and this is not currently available. For these reasons organoleptic profile is unlikely to be the main determinant for a monofloral variety

Question 11. How do you consider organoleptic profiles can best used to specify monofloral types?

8 Other profiles and criteria

8.1 Hydroxymethylfurfural (HMF) content

HMF is easy to measure and is identified as a voluntary measure in the Codex standard. In order to be used for New Zealand monofloral honeys, a profile would need to be generated as per Table 1, through studies being carried out across all honeys. In the view of the BPSC if HMF were to be incorporated it would be linked to a colour measurement, since HMF confers its own colour and is an indicator of increasing age and heat application, both of which also supply colour adding compounds. This would need to be differentiated from the natural colour of the honey in question.

Question 12. Do you consider that a measure of HMF could be useful in the profile?

8.2 Criteria for defining manuka monofloral table honey

Manuka honey contains commercially valuable additional compounds, with health properties and so these compounds could be used to define the manuka floral type [2].

A number of measure have been proposed for these compounds including for example unique manuka factor (UMF) and methylglyoxyl.

Two scenarios are possible:

1. Using UMF or methylglyoxyl instead of some or all of the attributes in Table 1.

   Under this scenario any brown honey that has a UMF/ methylglyoxyl rating could be called manuka. By combining a little manuka of a high unique antibacterial activity with a lot of another, perhaps similarly coloured honey e.g. honeydew, Rewarewa, the resultant honey may meet the UMF/ methylglyoxyl criteria but would fail the “wholly or mainly” test in the Codex standard. It would be unacceptable for a national honey standard to not meet Codex requirements.

   In addition, the implication that only UMF/ methylglyoxyl manuka is actually manuka would exclude honey based largely on manuka but without a UMF rating.

2. Using UMF or methylglyoxyl in addition to the attributes in Table 1.

   There are a number of consequences of this position:

   - it would exclude from consideration honeys that contained Kanuka and other floral species from labeled as a monofloral honey, where they could be detected by pollen analysis;
   - since the UMF content of ecotypes of manuka is variable, some manuka honey could be excluded;
   - the UMF assay has not always been reliable but the techniques are being refined;

- There are other leptospermums which have UMF effect e.g. the Australian *L. polygalifolium* [3]. This supplementation of New Zealand honey with honey from other countries may undermine any future country of origin labeling initiatives.

This consultation document proposes that where honeys contain commercially valuable additional compounds, this is outside the scope of this standard, which applies to table honey.

Question 13. Do you agree that measures for additional benefits such as UMF are outside the scope of monofloral table honeys?

8.3 Criteria in the Codex Alimentarius and European Directive standards

In 2002 the International Honey Commission (IHC), which was formed in 1990 to revise the methods and standards for honey, undertook a review of the quality standards specified under the Codex and the European Honey Directive [4]. As a result each standard was revised such that:

a. limits for existing mandatory criteria were re-determined, and
b. new voluntary criteria were identified, analysis methodology specified, and limits assigned.

The review also gave recommendations as to which quality criteria would best be served as mandatory standards and which should be made voluntary by participating honey trade partners. The resulting amended standard criteria are listed in 2.3. In addition the review identified and presented methods and criteria for the determination of the botanical origin of honeys. Many of these are under consideration by BPSC (see Table 1). Others include:

- fructose and glucose levels (specifically fructose:glucose ratios)
- electrical conductivity
- volatiles profiling
- flavonoid profiling

These new criteria, and recommended methods for analysis, are summarised in 8.4 – 8.6 below. In order for these criteria to be used for New Zealand monofloral honeys, a profile would need to be generated as per Table 1, through studies to be carried out across all honeys. It is worth noting that many of these techniques are expensive to carry out in a routine manner, and the BPSC recognises the need to keep testing costs at a level appropriate to the value of the product.

8.4 Fructose:glucose ratios

Fructose and glucose determinations are mandatory measures in the codex standard that are easily adapted to present as a ratio. Preferred methodology has yet to be finalised within the standard but many simple analytical techniques exist.

8.5 Electrical conductivity

Electrical conductivity is easy to measure and is one of the voluntary measures in the Codex standard. The preferred methodology for this analysis is yet to be finalised, however, regardless of technique it is considered by many to be the fastest method for routine honey control. Furthermore a significant database of values for many international monofloral honeys has been established.

8.6 Volatiles and flavonoid profiling

Aroma compounds (volatiles) and flavonoids are easily extracted with organic solvents for quantitative analysis; however, solvent extraction may not represent the most suitable method for routine testing as it is too time consuming. Other methods being developed that show promise include

- Dynamic head space analysis
- Solid Phase Micro Extraction (SPME)

8.7 Moisture content

Moisture content is not presented as a useful method for floral origin analysis in the IHC review. However, as one of the mandatory criterion for honey quality in the Codex standard it represents another attribute for consideration for monofloral honey authentication.

8.8 Insoluble solids

As for 8.7

8.9 Diastase and Invertase activity

Diastase is the enzyme in honey that converts starch to dextrins and sugars. Invertase is the enzyme in honey that converts sucrose to glucose and fructose. Nectar source has an influence on the relative amounts of each of these enzymes and simple assays exist for their quantification.

Question 14. Do you consider that one or more of the measures below could be useful in the profile?

fructose: glucose levels	electrical conductivity	volatiles profiling
enzyme activity	moisture content	insoluble solid content

9 Location and botanical composition

The New Zealand industry has an extensive data base of sites used for honey collection, through the compulsory registration of apiary sites. Such sites may have specific botanical composition that could be used as an aid to defining a monofloral honey. Using location as a surrogate for botanical composition could in the future exclude supplementation with honeys from other countries e.g. *L scoparium* honey from mainland Australia and Tasmania. However, confidentiality of sites could potentially be an issue.

Question 15. Do you consider that location would be useful as a criterion for defining monofloral honeys?

In the Codex standard, Clause 6.1.8 states *"Where honey has been designated according to floral, plant source, or by the name of a geographical or topological region, then the name of the country where the honey has been produced shall be declared."* Defining honey by location may also be a step towards country of origin labeling.

Question 16. Do you have a view on country of origin labeling?

10 Implementation of the standard for monofloral varieties

It is not possible to identify the floral source of a honey with absolute certainty, and the most reliable identification is likely to come from a combination of methods, including skilled organoleptic assessment.

Consideration needs to be given to how a standard will be used and implemented. Below in questions 17 - 20, we seek your submission on how the standards should be implemented and administered.

For example:

1. The standard could be used mainly where there are disputes about the origin of the honey either in New Zealand or in an off-shore location. A sufficiently simple standard could also be used routinely and voluntarily for quality measurements.

2. Will there be an audit regime developed for the industry?

3. What will determine non-compliance with the standard?

    - Will it be necessary to achieve all 3 specifications – Appearance, Pollen, Organoleptic (except where pollen is not present) – or,
    - 2 out of 3 of these specifications? For each type of honey some aspects are more relevant than others.

4. Should a fourth specification – Physicochemical – based on the criteria and methods described in Section 8, be included to add further robustness to the standard? An example of how all these criteria can be combined can be found in descriptive sheets for a variety of European monofloral honeys developed by the IHC in 2004 [5]. As an example Appendix 3 shows the descriptive sheet for Eucalyptus honey.

    In addition there are logistical issues. For example organoleptic and appearance categories require standards to test against and agreed library samples will need to be held in an appropriate independent facility.

5. How should the implementation and management of these standards be funded?

Question 17. What are your views on how the proposed standards should be implemented and administered?

Question 18. Do you have a view on how compliance should be managed?

Question 19. What, if any penalties should be imposed for non-compliance?

Question 20. Is there anything else the BPSC should be considering in relation to standards for monofloral table honey?

11 References

1. Mildenhall, D.C. and Tremain, R. *Pollen analysis of New Zealand honeys*. Institute of Nuclear and Geological Sciences, Wellington 2005/006.

2. Stephens J. M. C.; Molan P. C. Clarkson B. D. *A review of Leptospermum scoparium (Myrtaceae) in New Zealand.* 2005. New Zealand Journal of Botany **43**: pp 431–449

3. Yao et al., *Flavonoids, phenolic acids and abscisic acid in Australian and New Zealand Leptspermum honeys*. 2003. Food Chemistry **81**: pp 159-68

4. Bogdanov, S. and Martin, P. *Honey authenticity: a review*. Swiss Bee Research Centre, 2002 : pp1-22

5. Persano Oddo, L. and Piro, R. *Main European monofloral honeys: descriptive sheets*. 2004. Apidologie **35**: pp38 - 81

Appendix 1. The New Zealand Honey Standard

STANDARD 2.8.2 HONEY

Purpose
This Standard defines honey and sets certain compositional requirements for the product.
This Standard also makes the word 'honey' a prescribed name for the purposes of this Code.

Table of Provisions
1. Interpretation
2. Composition of honey
3. Prescribed name

Clauses

1. Interpretation
In this Code - **honey** means the natural sweet substance produced by honey bees from the nectar of blossoms or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which honey bees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature.

2. Composition for honey
Honey must contain -
(a) no less than 60 % reducing sugars; and
(b) no more than 21 % moisture.

3. Prescribed name
The word 'honey' is a prescribed name.
Issue 53 2 Standard 2.8.2

prescribed name means a name by which a food is defined or described in a Standard, and is declared in this Code to be a prescribed name.

Appendix 2. EU Honey Directive - COMPOSITION CRITERIA FOR HONEY

When placed on the market as honey or used in any product intended for human consumption, honey must meet the following composition criteria:

1. Sugar content	
1.1. Fructose and glucose content (sum of both)	
— blossom honey	not less than 60 g/100 g
— honeydew honey, blends of honeydew honey with blossom honey	not less than 45 g/100 g
1.2. Sucrose content	
— in general	not more than 5 g/100 g
— false acacia *(Robinia pseudoacacia)*, alfalfa *(Medicago sativa)*, Menzies Banksia *(Banksia menziesii)*, French honeysuckle *(Hedysarum)*, red gum *(Eucalyptus camadulensis)*, leatherwood *(Eucryphia lucida, Eucry- phia milliganii), Citrus* spp.	not more than 10 g/100 g
— lavender *(Lavandula* spp.), borage *(Borago officinalis)*	not more than 15 g/100 g
2. Moisture content	
— in general	not more than 20 %
— heather *(Calluna)* an baker's honey in general	not more than 23 %
— baker's honey from heather *(Calluna)*	not more than 25 %
3. Water-insoluble content	
— in general	not more than 0,1 g/100 g
— pressed honey	not more than 0,5 g/100 g
4. Electrical conductivity	
— honey not listed below, and blends of these honeys	not more than 0,8 mS/cm
— honeydew and chestnut honey and blends of these except with those listed below	not more than 0,8 mS/cm
— exceptions: strawberry tree *(Arbutus unedo)*, bell heather *(Erica)*, eucalyptus, lime (*Tilia* spp.), ling heather *(Calluna vulgaris)*, manuka or jelly bush *(leptospermum)*, tea tree *(Melaleuca spp.)*	
5. Free acid	
— in general	not more than 50 milli-equivalents acid per 1 000 grammes
— baker's honey	not more than 80 milli-equivalents acid per 1 000 grammes
6. Diastase activity and hydroxymethylfurfural content (HMF) determined after processing and blending	
(a) Diastase activity (Schade scale)	
— in general, except baker's honey	not less than 8
— honeys with low natural enzyme content (e.g. citrus honeys) and an HMF content of not more than 15 mg/kg	not less than 3
(b) HMF	
— in general, except baker's honey	not more than 40 mg/kg (subject to the provisions of (a), second indent)
— honeys of declared origin from regions with tropical climate and blends of these honeys	not more than 80 mg/kg

Appendix 3. Example laboratory sheet

Eucalyptus honey (208 samples; 1692 data)

Melissopalynological parameters		Unity	Mean	St. Dev.	Limit of confidence 95%		Number of data	Countries								
Data	228				Min.	Max.										
Specific pollen		%	94.8	5.9	83.1	100.0	118	[1] GR $_{9}$	[2] I $_{109}$							
Pollen absolute number		PG/10 g $\cdot 10^3$	269.6	136.7	90.0	540.6	110	[1] GR $_{9}$	[2] I $_{101}$							

Physicochemical parameters		Unity	Mean	St. Dev.	Limit of confidence 95%		Number of data	Countries								
Data	1464				Min.	Max.										
Color		mm Pfund	54.2	9.4	41.0	71.0	113	[1] GR $_{9}$	[2] I $_{104}$							
Electrical Conductivity		mS/cm	0.48	0.06	0.37	0.60	163	[1] F $_{38}$	[1] GR $_{9}$	[2] I $_{108}$	[1] P $_{8}$					
Specific Rotation		$[\alpha]^{20}_{D}$	−13.3	2.3	−17.8	−9.0	121	[2] I $_{121}$								
pH			4.0	0.2	3.7	4.3	144	[2] I $_{136}$	[1] P $_{8}$							
Free Acidity		meq/kg	19.4	5.3	10.5	29.9	91	[2] I $_{82}$	[1] P $_{9}$							
Lactones		meq/kg	3.3	2.4	0.0	8.0	82	[2] I $_{82}$								
Total Acidity		meq/kg	22.0	4.5	14.8	31.0	82	[2] I $_{82}$								
Water		g/100 g	16.0	1.0	14.0	17.9	52	[1] GR $_{9}$	[2] I $_{29}$	[1] P $_{14}$						
Diastase (*)		DN	25.5	4.8	16.0	35.1	117	[2] I $_{106}$	[1] P $_{11}$							
Invertase (*)		U/kg	155.3	28.7	99.5	208.2	75	[2] I $_{75}$								
Proline		mg/kg	528	147	330	827	33	[2] I $_{33}$								
Fructose		g/100 g	39.1	2.2	34.7	42.3	71	[1] F $_{12}$	[2] I $_{59}$							
Glucose		g/100 g	33.0	1.9	29.1	35.5	70	[1] F $_{12}$	[2] I $_{58}$							
Sucrose		g/100 g	1.1	0.9	0.0	3.0	81	[1] F $_{12}$	[2] I $_{57}$	[1] P $_{12}$						
Fructose + Glucose		g/100 g	72.0	3.3	65.4	76.8	70	[1] F $_{12}$	[2] I $_{58}$							
Fructose / Glucose			1.19	0.09	1.01	1.36	70	[1] F $_{12}$	[2] I $_{58}$							
Glucose / Water			2.14	0.15	1.88	2.43	29	[2] I $_{29}$								

(*) only for fresh honeys