

Exploring Sour Belgian Beer Styles

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What we are going to talk about

- Characterize Lambics and Flanders Reds at a very high level
- Key sour beer process aspects
- Key sour beer characteristics
- Key aspects of souring microorganisms
- Production tips

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The Primary Characteristics

Lambic

- Barnyard, goaty, earthy, horsey, horse blanket, fruity, rhubarb, honey
- Sour, lactic, apples, light fruits, puckering, medium to high tartness, not sharp
- Cider-like or vinegar notes are flaws
- Not enteric, presence can indicate young beer

Flanders Red

- Complex intense fruitiness, low spicy phenols
- Sour acidic, acetic; ranges from complementary to intense
- Often acidic tannic bitterness
- Long dry finish
- Prickly acidity

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Lambic Family Process

- All are based on the same basic beer, different styles are the result of late additions and/or blending.
- Only BJCP styles to use aged hops
- Overnight in the coolship
 - Then transferred to wood containers
 - Many sizes of containers

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Lambic Family Process

- No "wood character" from the wood
 - Typically oak or chestnut vessels
 - Typically old or very old
- Spontaneously fermented, no pitched yeast or other micro-organisms
 - Gets micro-organisms from the wood
- Never racked off lees until packaging

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Coolships – Traditional Cooling



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Fermenting in the Wood



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Fermenting in Plastic



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Aging in the Glass



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Aging in the Glass



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Flanders Red Process

- Typical "modern" wort production
- Pitched yeast may be a mixed culture
- Secondary aging in large wooden tunns for years
- Many commercial examples are sweetened
- Typically a blended product

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Flanders Red Tuns



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Key Sour Beer Characteristics

- Sourness comes from organic acids:
 - Acetic acid, vinegar – sour, sharp, pungent
 - Lactic acid, like sour milk – sour, tart, tangy
 - Isobutyric/butyric acids – rancid butter, cheese, fruit/berries, fecal
 - Isovaleric acid – sweaty, moldy cheese, rancid, dirty socks, locker room, fecal

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Key Sour Beer Characteristics

- Esters – formed from alcohol and acid
 - Ethyl acetate – vinegary, solvent-like, hot, sharp, nail polish remover
 - Ethyl lactate – soft, tart, buttery, fruity
 - Ethyl Isobutrate – fruity, citrus, strawberry
 - Ethyl Isovalerate – sweet, apple, pineapple

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Key Sour Beer Characteristics

- Lesser players
 - 4-ethyl phenol – barnyard, medicinal, horse stable
 - 4-ethyl guaiacol – clove, spicy, smoke
 - Tetrahydropyridines – horsey, mousy
 - Malic acid – from fruit,
 - Possible malolactic fermentation
 - Aldehydes – green apple, oxidation

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Key Souring Microorganisms

- Many organisms involved, major players include strains of
 - *Acetobacter*
 - *Brettanomyces* – yeast
 - *Enterobacter*
 - Lactic acid bacteria
 - *Saccharomyces* – yeast

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Acetobacter

- Produces acetic acid and/or ethyl acetate
- Acetic acid is a sharp sour
- Major player in Flanders Red
- Minor player (undesirable) in Lambics
- Requires oxygen to grow
- May produce a pellicle

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Brettanomyces

- Major role in both Lambic and Flanders Red
- Can ferment starches and sugars that *Saccharomyces* can not ferment
- Superattenuating yeast, but always leaves just a little sugar unfermented
- Works better at lower pH, after *Saccharomyces* has dropped the pH
- *B. bruxellensis* produces horsey and cherry notes

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Brettanomyces

- Works with or without oxygen
- Produces lactic acid
- Produces acetic acid but only in the presence of oxygen
- Produces isovaleric acid
- Breaks down isoamyl acetate - banana
- May produce a pellicle

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Brettanomyces

- Ethyl acetate
- Ethyl lactate
- 4-ethyl phenol
- 4-ethyl guaiacol
- Tetrahydropyridines

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Enteric Bacteria

- Flavors and aromas
 - Sweet, Honey, Fruity, Vegetable, Fecal
- Produces both lactic and acetic acids
 - Produces majority of acetic acid in lambics
- Poor alcohol tolerance
- Intolerant of even regular beer pH levels

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Lactic Acid Bacteria

- *Pediococcus*
 - *P. damnosus* is the most common strain
 - Tolerates hops
- *Lactobacillus*
 - Tolerance of hop acids varies by strain
 - Grows best around body temperature

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Pediococcus

- Aggressive lactic acid producer
- Produces the majority of lactic acid in lambics
- Does not produce CO₂
- Works poorly in presence of oxygen, oxygen nearly toxic
- Grows very slowly if at all
- May be ropey/slimy

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Lactobacillus

- Works with or without oxygen, prefers low levels
- May produce CO₂
- May produce:
 - Diacetyl
 - Acetic, isovaleric, and isobutyric acids
 - Tetrahydropyridines

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Fermentation Progression (first appearance)

Organism	Lambic	Flanders Red
<i>Enterobacter</i> and <i>Kloeckera</i>	3-7 days	None
<i>Saccharomyces</i>	3-4 weeks	1 day
<i>Lactobacillus</i>	None	1 week
<i>Pediococcus damnosus</i>	3-4 months	3-4 weeks
<i>Brettanomyces</i>	8 months	8 months

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Production Tips

- Modern sanitizers have no problem controlling souring organisms on clean surfaces
 - If you end up with cross contamination you likely have sanitation problems even with your non-sour beers
- When in doubt you can use heat to sanitize durable items
 - Heated dry/sanitize in the automatic dish washer can be used for hoses, metal parts
 - Be careful with glass carboys, they can break with thermal shocks
 - Boiling water in kegs works very well
- Use alternate plastic stuff for sour beers

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Production Tips

- Do not disturb the pellicle, it protects the beer from oxygen
- For lambics, whole hops age faster than pellets – I age them in paper bags in the attic
- Sour beers really do take years to be ready, there is no good quick method

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Lambic Ideas

- Traditionally pilsner malt, unmalted wheat, aged hops; some use a turbid mash
- Extract: I use a combination of
 - Light dry malt extract
 - Wheat dry malt extract
 - Maltodextrin – for the *Brettanomyces*
- Do not rack until time to package the beer

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Lambic Ideas

- You can collect microfloral from commercial lambic bottles
 - Real lambic is live and not Pasteurized
 - Not likely to get the early stuff that dies in ethanol
- Just pour bottle degrees into some sterile wort
 - Sanitize the bottle lip with vodka

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Flanders Red Ideas

- Roughly a Vienna/Oktobertfest grist
- A normal ale type of primary fermentation
- Racked off lees before aging
- Secondary in carboy, ParaFilm® plastic film instead of an airlock
- To match some of the commercial examples try artificial sweeteners prior to packaging

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