GOAT COLOR GENETICS

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COLOR IS COMPLICATED!

PIGMENTS COME IN TWO MAIN TYPES

EUMELANIN IS BLACK-FLAT BROWN-BLUE

PHEOMELANIN IS TAN-RED-YELLOW-NEARLY WHITE
COLOR IS COMPLICATED

WHITE IS THE ABSENCE OF PIGMENT

REGIONAL, OR WHOLE GOAT

FIRST, IGNORE THE WHITE, DECIDE ON COLOR
THEN - CHARACTERIZE WHITE AREAS
COLOR - AGOUTI

*Agouti* locus controls the distribution of black-based and tan-based areas

Tan areas are expressed with one copy of a gene, so tan is dominant

General order of dominance is tan - striped patterns - black
AGOUTI LOCUS

most alleles vary in expression:
1. degree of “redness” - from deep red through tan, gold, to white
2. extent of black regions. Most patterns are consistent, some few are “hypervariable”
# AGOUTI LOCUS ALLELES

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AGOUTI LOCUS

white or tan, completely red to white
AGOUTI LOCUS

in Angoras, most reds fade
AGOUTI LOCUS

sable
AGOUTI LOCUS

bezoar  blackbelly
AGOUTI LOCUS

riedell
Agouti locus

some alleles are hypervariable
the “kolodzie” allele
Agouti locus

san clemente peacock

peacock/black&tan
AGOUTI LOCUS

black and tan  toggenburg  angel

striped grey
AGOUTI LOCUS

tan cheek  no pattern
EXTENSION LOCUS

Dominant black. Dominant, completely black. Angoras, maybe other African and Asian breeds.

Wild type. Neutral - allows expression of Agouti locus alleles.

Recessive red. Rare, with only one occurrence in colored Angoras.
AGOUTI - EXTENSION

Extension    Agouti
Dominant black ------- no expression

wild type------------- alleles expressed

recessive red-------- no expression
BROWN LOCUS

changes ALL black areas to brown. 

*dark brown*. dominant. born near black, becomes noticeably brown

*light brown*. dominant. light flat brown

*wild type*. - intermediate. allows black

*brown* - recessive. a rich medium brown
BROWN

dark brown
MOON SPOTS

pale or tan roundish spots on ANY background color. dominant.
DEPTH OF “TAN”

tan varies from red to white

appears to be polygenic, with a few single loci important as well

red
gold
pale/cream
white spotting

adds white in various patterns

each pattern is likely a separate gene
ANGORA WHITE

completely white, covers even dominant black. Goats with one dose can have small spots of color.
BELT

clean crisp white encircling barrel
dominant
PIEBALD SPOTTING

minimal is white blaze, feet. maximal is colored patches around eyes. usually large “round” spots. recessive
FLOWERY

small white specks on body, neck.less on legs, face, back. dominant.
ROAN

white hairs mixed in to colored ones. usually more on body, less on legs and head. dominant.
FROSTED

roan ears and muzzle. dominant.
common in Nubian, Pygmy.
TICKING

small colored spots that grow into white areas, usually by one year old.
dominant.
ragged white areas, usually on head and ears, around eyes, then on body. Varies from nearly colored to nearly white. dominant.
CALICO

small and large spots on white
EYE COLOR

blue eyes/ marbled eyes are dominant to normal brown eyes

some brown based goats have somewhat lighter eyes than black based goats
ANGORA
ANGORA CASCADE

Dominant white or not: *Extension* next

Dominant black or not: *Agouti* next

“red” (red to white) or not

striped or not

solid black
ANGORA CASCADE

any of these with brown
ANGORA STRATEGIES

Angoras - white is tough to eliminate!

Angora white is epistatic, dominant

most Agouti information is white or tan
colored cropouts from registered whites are useful

look for colored spots on white goats - weak evidence that Angora White is heterozygous
ANGORA STRATEGIES

“striped” goats hide no information:
- do not have *Angora white*
- do not have *white or tan*
- few surprises if mated to striped mates
black goats can be *Dominant black* or *no pattern* at Agouti.

*Dominant black* x striped can yield white, “not quite white,” or red kids
ANGORA STRATEGIES

quickest outcross to whites is *Dominant black*

surest outcross to whites is a dark striped or recessive black
ANGORA STRATEGIES

selection:
dark reds will take time
  (notice tan trim color on stripes)

nonfading blacks are easier
most spotting patterns are of little use, and most are dominant.

On average, do not use spotted bucks for breeding.
NONANGORA STRATEGIES

goats heterozygous for *no pattern* at *Agouti* are generally darker and “brighter” than homozygotes

goats heterozygous for two different patterns end up with the tan areas of both patterns
NONANGORA STRATEGIES

most white spotting is dominant, and heterozygotes are more crisply marked than homozygotes

mate spotted goats to nonspotted goats to produce goats that are not excessively white