

may I ask you to
submit this paper
to any one in America
who has. If you
know of any work
treating of the
morphology of
the Citrus, kindly
give me its title
& author, so that
I may get it.

Do me the favor
of reading the enclosed
sheets, after you
have read the paper
you've faithfully
with many apologies

Prof.
Asa Gray.

G. W. Brown M.D.
Brigade Surgeon
Ind. Med. Dep't.

Etawah, North West
Prov. India -
20 August 1866.

Dear Sir

As you are one
of the Veterans
among botanists,
I take the liberty
to submit to
you a paper
on the Morphology
of the Citrus. I
am preparing
a work on the
cultivated oranges
& lemons &c. of
India - and thus,

in a slightly modified
form, but the
same in essence,
will form a chapter
in that work.

Before publishing
it, I should be
glad to have
your opinion
of it. Of course
most of it is a
speculation
founded on what
I take to be accepted
points. But the
greatest speculation
of all is that which

refers the different
parts to the same
receptacles of
some ancestral
cryptogam. I send
you the paper
in question by book
post registered.
May I ask you to
do me the favor
to return it in
a similar way.
Should you not
have paid any
special attention
to the structure of
the Citrus fruit,

agree with me in
this, but I am strongly
convinced that the
pulp whorl of the
citrus is only a
modification of an
inner kind whorl.

Also, the oil cells
of the kind have
disappeared, & have
been replaced by
the juice vesicles.

First the kind carpels
were distinct; then
their edges became
agglutinated; & finally
they formed a uniform
covering over the pulp,
as we see it in the
modern orange.

1/ To be read after
the paper on
Morphology of Citrus

Is the leaf an
expansion of the
bark?

If so, the buds at
the angles between
the crenations of the
Bryophyllum leaf
would suggest that
these angles are analogous
to the normal axillae
of leaves, & that the
crenations themselves
are only abortive
leaflets. Then the
crenations of the
Citrus leaf

can be taken as
~~analogous~~ ^{homologous} to those
of the Bryophyllum
leaf. This would
appear to follow
as a consequence.
If so, the oil cells
in the angles between
the crenations of
the Citrus leaf, would
point to their
being abortive buds.

Are the carpels
of a fruit modified
leaves? If so, the
rim of the Citrus
fruit repeats the
same oil cells of the
leaves - the large pinholes

representing the
larger angles, between
the crenations, with
the larger oil cells,
& the smaller ones,
the smaller.

Now we come to
the pulp whorl.
Does it consist
of an inner whorl
of carpels - originally
only an inner whorl
of rim carpels -
making of the whole
a sort of double fruit,
analogous to a double
flower? Probably
botanists will not

Curiously enough
the inner vesicle
of carpels of the
Rgle Marmelos
has no juice vesicles,
~~but the~~ but the
cells are there
like those of the
rind. They open inward
& secrete the gum
which fills the
carpel. The juice
vesicle of the Citrus
contains, sugar,
citric acid & Mucilage,
all these having
analogous compos^{ns}
to essential oil
of Citrus.

Stawak Gymnocardia ^{ind.}
20 Aug 1906

2/ Not so, the pulps
carpels - each
remained distinct
& closed like a
pea pod, with
their contiguous
sides slightly
adhering, but easily
separable, & the
oil cells became
transformed into
juice vesicles -
The dormant or abortive
buds of the leaf
edges, reappeared
as seed buds, & repeated
the double or triple
peculiarity of the
normal citrus buds.

The foregoing appears
sufficiently ~~convincing~~
I then ventured
a step further to
endeavour to account
for any possible
connection of the
oil cells with buds
at all, by speculating
that the oil cells
of the bark may be
after all only remnants
of the spore receptacles
in some ancient
cryptogam, from
which the *Citrus* may
have possibly been
evolved, & which

receptacles, no
longer being needed
as such, were turned
to another account
- oil cells. Nature
is full of examples
of adaptations
of the same organ
to various purposes.
So that the seeds,
the juice vesicles,
the oil cells of the
rind & leaves, the
terminal buds
would be all evolved
from the cryptogamic
spore receptacles
with their contained
spores.



Bonavia, E. 1886. "Bonavia, Emmanuel Aug. 20, 1886." *Asa Gray correspondence* 1–6.

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