Part 4A

General: About *Hosta* Species Morphology

By W. George Schmid ®2006 for the Hosta Library

Most hosta cultivars develop into beautiful, rounded, dome-shaped mounds. It is rare to see this in the natural habitat. In gardens, hostas receive extraordinary care, attention, and protection. In short, they are babied almost as much as real human babies. If you do not believe this, ask a gardener, who goes out at midnight with a flashlight stumbling all over the garden searching and destroying slugs and caterpillars making a meal out of his precious hostas. *Hosta* species growing in their natural habitat have no such protective luxury. In the wild, if an animal considers hostas a good meal (like some of our rabbits and deer do), the leaves wind up to be fodder. Nevertheless, that gives more light to a tiny seedling underneath, which now has a better chance to grow. Wild hostas have to grow in a spot where, at the beginning, their tiny seed sprouted. If the habitat is suitable, they might make it to maturity, if it is not, the plant will succumb. It is survival of the fittest. Wild hostas grow in groups called *populations*. A population may consist of thousands of individual plants growing next to each other or maybe just three or a half dozen, here and there, spread over a large area. There is great diversity in such populations. There are mature plants and seedlings and the leaves (something gardeners love to see) are not at all uniform as in our cookie-cutter cultivars. This variability has to be reckoned with when identifying and describing *Hosta* species. That is why botanists and taxonomists resort to a multitude of characters and they always give a range of data to circumscribe a species. I have listed the "seen" attributes in Table 1. Many microscopic and "unseen" features must also be determined. That is why botany is a science.

***H*. Hybrid Planted at the Rock Garden Pond**
Uni. of British Columbia ● Photo by W.G.Schmid 1989

How to Identify a Species?

Recognizing hosta cultivars is relatively easy. Many experienced gardeners use visual markers to recognize and identify cultivars. Expert gardeners can tell you what the name of a cultivar is by just looking at it. Many hosta cultivars have distinct features that allow such recognition on close examination. Notwithstanding, a few experts have remarked that a cultivar is distinct only if it can be "name-called" from, say, six ─ others say 10 ─ feet away. That is possible with a cultivar that has very well defined and visually obvious and unique features. Who could miss H. 'Praying Hands' for example? Unfortunately, many cultivars "look" similar and to tell them apart from 10 feet away is almost impossible. While the Cultivated Code (ICNCP) requires a cultivar to be distinct in its characteristics, many similar looking cultivars have been named and registered so recognition, even up close, is often a "game of dice." These visual recognition factors are termed macromorphological characters, i.e., the form and structure of a given plant. The "macro" is added because we are dealing with features that can be visually recognized: Plant shape and size, leaf characteristics, venation (veining), primary and secondary colors and color effects, variegation, leaf shape and surface, scape length, scape foliation and posture, flower morphology and other, highly visual characters.

H. venusta **Maekawa**
Showing Lamellar Ridges

Micromorphology is rarely used for cultivar identification. It requires microscopes, electron microscopes, and other visual aids or instrumentation that can reveal "internal" plant markers normally hidden from human sight. These include cell structure, pollen shape, and other minuscule and/or internal features. Recently, RAPD-DNA analysis, studies of genome size and pollen research (palynology) have revealed additional markers that are useful in identification. Thus, recognizing and circumscribing a *Hosta* species is much more involved. During the infant days of botany and taxonomy (see Part 1), botanists primarily used macromorphological limits to circumscribe a species. This system of classification aids in the rapid identification of species because of obvious (and occasionally weighted external characters). Its principal goal is identification but frequently it may also convey natural relationships. Occasionally, a botanist will give added importance to certain characters, i.e., they are weighted more than others are, so that a particular trait stands out among all others. Unjustly called "one-character taxonomy," it is useful. For example, Maekawa used the lamellar, parallel ridges (see illustration) found along the scapes of *H. capitata*, *H. minor*, *H. nakaiana,* and *H. venusta* to place them in section *Lamellatae*. Admittedly, this sectional classification is based on this single, but very prominent character. However, in conjunction with it, many other qualitative and quantitative characters serve to circumscribe the species of the genus *Hosta*. For delimiting the species, I have used the following characters in my book.

Table 1: Characters in *Hosta* Species Macromorphology

Excerpted from W. George Schmid: *The Genus* Hosta – *Giboshi Zoku*; 1991) 59 morphological characters (33 quantitative and 26 qualitative with 70 variables).

Rhizome (RH)

RHS = structure
RHS1 = short, erect
RHS2 = creeping
RHS3 = stoloniferous, wide ranging

Petiole (PT)

PTL = length
PTW = width
PTC = coloration
PTC1 = green
PTC2 = purple dotted, entirely or in part

Leaf blade (LF)

LFL = length
LFW = width
LFB = length from tip to broadest part of leaf blade
LFN = number of principal nerves
LFU = surface of principal nerves below
LFU1 = glabrous, smooth
LFU2 = papillose, rough
LFS = surface condition
LFS1 = shiny, polished
LFS2 = dull, opaque

Scape (SC)

SCB = diameter at base
SCR = diameter at raceme (at first fertile bract)
SCL = length
SCC = coloration
SCC1 = green
SCC2 = purple dotted full length
SCC3 = purple dotted lower half
SCC4 = purple dotted upper half
SCP = direction, posture
SCP1 = straight, erect
SCP2 = arching, inclined
SCP3 = prostate, supine
SCS = surface
SCS1 = terete, smooth
SCS2 = ridges, parallel costal elevation
SCG = branching
SCG1 = absent, no consistent branching
SCG2 = consistent branching

Raceme (RA)

RAL = length (from first fertile bract)
RAN = number of flowers

Bracts; sterile (ground bracts) (BG)

BGN = number
BGL = length (first ground bract)
BGW = width (first ground bract)
BGC = coloration (ground bracts)
BGC1 = green
BGC2 = whitish-green
BGC3 = whitish-purple
BGI = insertion (ground bracts)
BGI1 = amplexicaul, stem-clasping
BGI2 = projected from scape, leafy
BGN = shape (ground bracts)
BGN1 = linear-lanceolate
BGN2 = boat-shaped, keeled
BGN3 = leafy, straight
BGN4 = leafy, undulate

Bracts; fertile (first flowering bract) (BF)

BFL = length (first flowering bract)
BFW = width (first flowering bract)
BFC = coloration (first flowering bract)
BFC1 = green
BFC2 = whitish green
BFC3 = whitish purple
BFC4 = green with purple markings
BFN = shape (first flowering bract)
BFN1 = linear-lanceolate, flat
BFN2 = boat-shaped, keeled
BFN3 = broadly ovate, flat
BFN4 = lanceolate, revolute, rolled under
BFW = withering condition after anthesis (first flowering bract)
BFW1 = withering, within 2–3 days after anthesis
BFW2 = withering within 2–3 week after anthesis
BFW3 = not withering, remaining fresh until dormancy
BFB = large, leafy initial bud bract
BFB1 = absent
BFB2 = present

Capsule (CP)

CPL = length
CPW = width
CPR = length/width ratio
CPC = coloration
CPC1 = green
CPC2 = green with purple markings
CPC3 = pruinose, light green to grey green
CPP = posture on scape
CPP1 = hanging down, pendant
CPP2 = held horizontally

Pedicel (PD)

PDL = length
PDD = diameter
PDC = coloration
PDC1 = green
PDC2 = purple dotted, purple

Bud (BD)

BDS = shape (before opening)
BDS1 = ovoid, pointed or sharply pointed
BDS2 = ovoid, club-shaped
BDS3 = ball-shaped, capitate, blunt
BDC = coloration (before opening)
BDC1 = green, remaining green at opening
BDC2 = green, turning white or purplish white at opening
BDC3 = green, remaining green but with purple markings

Flower (F)

FTL = length (from pedicel to lobe tip)
FLN = length of narrow tube
FDN = diameter of narrow tube
FLI = length of inflated tube
FDI = diameter of inflated tube
FLL = length of inner lobe
FWL = width of inner lobe
FLX = length of outer lobe
FWX = width of outer lobe
FLR = ratio of inner lobe to outer lobe length
FWR = ratio of inner lobe to outer lobe width
FLA = length of transparent lines
FCS = cross section of narrow tube
FCS1 = grooved
FCS2 = round or hexagonal, not grooved
FLC = coloration of inner perianth lobe
FLC1 = Type A, colorless, white
FLC2 = Type B, homogeneous color
FLC3 = Type C, striped
FLC4 = Type D, colored center field
FPS = shape of perianth
FPS1 = bell-shaped
FPS2 = funnel shaped
FPS3 = spider-flowered
FST = length of stamens
FST1 = equal to or shorter than lobe tips
FST2 = projected beyond lobe tips
FSP = stamens length pairing
FSP1 = equal length
FSP2 = 3 long and 3 short
FAC = anther coloration
FAC1 = yellow, whitish yellow
FAC2 = uniformly purple dotted, from light to dark
FAC3 = bi-color anthers, one locule yellow, one purple; or non-uniform, graduated pattern or purple markings

Nowadays (in 2006), systems of circumscribing species are based not only on macromorphology, they also encompass cladistics, which is a system of classification based on the phylogenetic relationships and evolutionary history of groups of organisms, in our case hostas. Phylogeny promises to be a way to investigate the evolutionary relationships of all organisms, living and extinct, a worthy goal indeed. *Phylogenetic systematics* is the way biologists reconstruct the pattern of events that have led to the distribution and diversity of life on Earth including all past and present life forms. Trying to understand the history of all life is, of course, a pretty tall order. To bring a comprehensible arrangement to past and existing life forms, the organisms must be classified into groups. According to phylogenetic researchers, this classification, in order to be meaningful, must reflect the evolutionary history of life. Nomenclature based on phylogeny is *incompatible* with our long-established and

functional Linnaean botanical nomenclature, the system we use now to name all plants, including hostas. For this reason, some scientists aim to replace our current nomenclature system based on the Linnean System (See Part 1). There are numerous arguments going on between traditional taxonomists (particularly botanists) and the proponents of phylogenetic systematics. Who will win this "battle" is still indeterminable but horticulturists and gardeners will continue to use a nomenclature that identifies individual species, varieties and cultivars.

H. kikutii **Maekawa**
Pointed Flower Bud Typical of This Species

Currently, taxonomists classify all plants into ranks of taxa according to the *International Code of Botanical Nomenclature* (ICBN). In Part 1, I have given a tabular arrangement of all the taxonomic ranks above the genus *Hosta.* Thus, the ICBN has nothing to do with phylogenetic classification. This system does not use ranks at all and to reflect this, a new code has been written, called the Phylocode, which stands for *Phylogenetic Code of Biological Nomenclature*. The development of the Phylocode grew out of recognition that the current Linnaean system of plant nomenclature, as based in the ICBN, is not well suited to govern the naming of *clades*, the basis of cladistics. The term *clade* (pl. *clades*) derives from the Greek *klados*, meaning branch. A clade defines as group of organisms whose members share features derived from a common ancestor. These features must be similar in structure and evolutionary in origin, but may not necessarily have the same function, for example the flippers of a seal and the hands of a human. A clade must include the most recent common ancestor of all those organisms and all of the descendants of that common ancestor. It is extremely important to realize that "all" is an absolute requirement.

For the purpose of my species treatment as part of the Hosta Library, I leave the Phylocode behind and use the Linnean concept represented by the ICBN. This is a system all of us are familiar with, whether scientist, horticulturist or gardener. This is good enough for the well-known British taxonomist associated with The Herbarium at the Royal Botanic Gardens at Kew, and consequently good enough for me. Horticultural nomenclature is based on the ICBN and I doubt that the Phylocode can replace it. As Dr. Brummitt puts it: "A classification according to phylogeny is possible but is incompatible with the Linnaean system and would have

a different structure without orders, families, genera etc. If such a system is considered desirable, it cannot replace the Linnaean system but should be parallel with it. But whereas the Linnaean classification would be based on observable facts, a purely phylogenetic classification would be usually based largely on unverifiable suppositions." As Dr. Brummitt so aptly states, the Linnean system we now use grew out of a desire and necessity to classify and identify plants. On the other hand, phylogeny deals primarily with evolution. At this point, all I can do is paraphrase Rudyard Kipling's famous verse: "Oh, taxa are taxa, and clades are clades, and never the twain shall meet." For the near future, our traditional *Hosta* nomenclature is safe and my species treatment is based upon it.

H. montana **(cultivated at right) and Cultivars (*H.* 'Sagae' in Back)**
Satake Garden, Higashi-Hiroshima City, Hiroshima-ken (June 1999)

On to the "Nitty-Gritty"!

In this Part (Part 4A), I discussed species identification in general. In the following parts, detailed information is provided about the various species attributes that make up a species description. Table 1 shown earlier is quite complicated. As I stated earlier, it must be so to serve botanists and taxonomists. I used the data in Table 1 to help me identify and check *Hosta* species appearing on herbarium sheets, in the printed literature, in the wild, and in gardens. For general use, I have adopted a more simple way of describing species for the species sheet. It does not go into the

minute details required by the Table 1, but simplifies things. Here are the simplified key features used in the Hosta Library species descriptions:

Part 4B-1) Plant size (for an individual on a single rhizome)
Part 4B-2) Rhizome and roots

Part 4C-3) Petiole size, color, and characteristics
Part 4C-4) Leaf size range, shape, surface texture and coloration
Part 4C-5) Venation; number of vein pairs, aspect and prominence

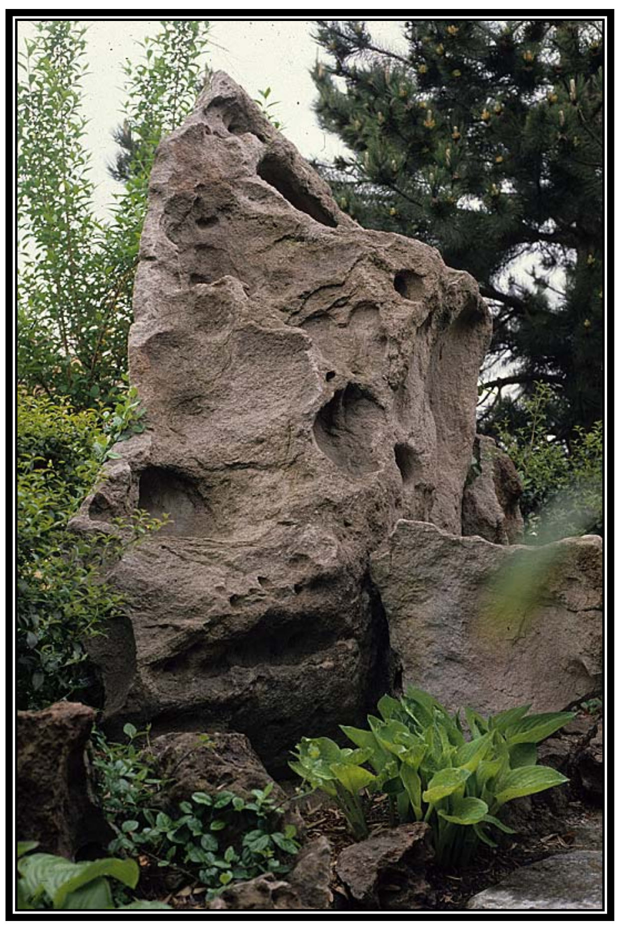
Part 4D-6) Scape, sterile and fertile bracts, size, number and aspect
Part 4D-7) Sterile bracts size, number, and aspect
Part 4D-8) Fertile bracts size number, and aspect
Part 4D-9) Raceme size, aspect, number of flowers

Part 4E-10) The *Hosta* Flower: Size, type, bearing, shape, aspect
Part 4E-11) Lobes (tepals) interior coloration
Part 4E-12) Anther coloration,

Part 4F-13) Capsules shape and aspect
Part 4F-14) Fertility

PLEASE NOTE

Each one of the above parts is accessible by a link from the *Hosta* Species Home Page; just click on the link depending on what part of the *Hosta* morphology is of interest.



Hostas (unidentified) ►
In Dr. Sun Yat-Sen Classical Chinese Garden Vancouver, BC, Canada W.G.Schmid Photo ● 1989