NATURE'S GEOMETRY

SUCCULENTS

OVER 600 PICTURES!

RUSSEL RAY

"Beauty is in the eye of the beholder."
Molly Bawn, by Margaret Wolfe Hungerford, 1878

Nature's Geometry: Succulents

**Russel Ray
Double R Creations & Photographic Art
russelrayphotos@gmail.com
Blog at russelrayphotos2.com**

Book Design: Russel Ray

**Text & Photographs: Russel Ray except where noted.
Printed and bound in the United States by BookBaby.**

ISBN 978-1-54398-837-6

Cereus hankeanus

FIBONACCI NUMBERS IN NATURE 1

We will use only the first eleven numbers in the Fibonacci sequence:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89

They are all we need to show how beautiful and universal nature's geometry is.

When we look at the number **1**, it seems to be logical that it exists in nature— **1** plant, **1** flower, **1** bug. If something exists, then by definition there has to be **1**. What is beautiful here is that where Mother & Father Nature could use **2** or more of something, only **1** shows up. This can be seen in cacti where many spines can originate out of **1** areole; the most I have counted in **1** areole is 23 spines! There also are many succulents that have spines.

Euphorbia ferox

2

Lithops katasmontana

Pleiospilos simulans

Two is an easy number to find because Mother & Father Nature know that pairs are cool. On this page we see the plump leaves of *Lithops katasmontana* and *Pleiospilos simulans*, always in pairs.

3

The number **3** is where Mother & Father Nature start to shine because it's easy to make triangles, stars, and pentagons. Who doesn't like the beauty of triangles, stars, and pentagons? In the picture below of the areoles on my *Pachypodium lamerei*, each with **3** spines, it's easy to visually connect the points of the spines and see a triangle.

Pachypodium lamerei

5

Now we'll see how Mother & Father Nature took those 3's and turned them into 5's to get better and more beautiful triangles, stars, and pentagons. The *Asclepiadaceae* family is my favorite for beautiful stars because the flowers are big, beautiful, and unique.

Edithcolea grandis var. grandis

Tavaresia barklyi

8

The higher numbers are more difficult to find, which makes them more fun *to try to find*, and much more satisfying when you actually *do* find them. Let's explore 8, beginning with the plants themselves.

Astrophytum asterias 'Super Kabuto'

Astrophytum hybrid

Astrophytum asterias var. nudum

13

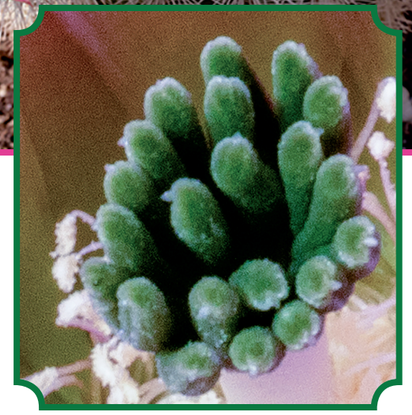
Ferocactus hamatacanthus

Echinocactus platyacanthus

Ariocarpus fissuratus

21

Echinocereus bonkerae



When I see complex flowers, I seem to have a natural tendency to start counting. Here I found **21** green doohickeys (my Texas upbringing) at the center of this beautiful flower.

34

I have been studying Fibonacci numbers since April 1973, and I started studying them in nature that summer when two friends and I went on a tour of the states west of the Mississippi River as our high school graduation present to ourselves.

Flowers with a lot of petals always have piqued my interest. I have a lot of *Echinopsis huascha* hybrids in my gardens, and once the flowers have closed permanently, I like to remove them for disassembly, all in the name of unpaid research.

Echinopsis huascha

55

My home abuts a San Diego Open Space Preserve. In addition to a few billion rabbits and ground squirrels, there are billions of acres of *Carpobrotus edulis*, perhaps at the top of my *Least Favorite Plants* list. It is what I call an invasive weed, far worse than the Kalanchoe Twins (*K. daigremontiana* and *K. delagoensis*). However, for the purposes of my research here, I love it!

I accidentally climbed over the fence and confiscated two yellow and three purple flowers. Then I proceeded to disassemble them to see how many petals they had. I was fairly certain they had more than **34**. Could I get to **55**? Results are below the pictures.

52 petals

55 petals

55 petals

56 petals

58 petals

89

It is well known in the Fibonacci world that daisies have **13**, **21**, **34**, **55**, or **89** petals, depending on the species. Sunflowers and dahlias also are found with **89** petals. I have not found **89** in the world of succulents, but I would be willing to bet that it's there among the stamens of some of the larger flowers, specifically *Carnegiea gigantea* but also echinopsis and epiphyllum.

Carnegiea gigantea

Echinopsis oxygona

Epiphyllum sp.

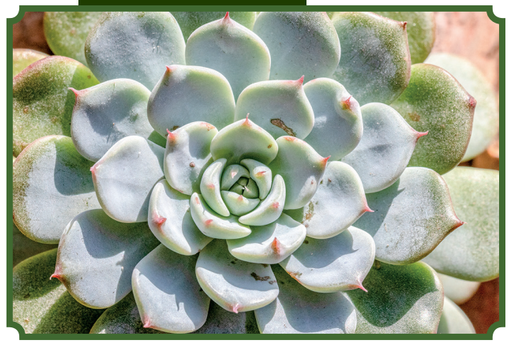
Parodia magnifica

Phyllotaxis

Sempervivum 'Blue Ice'

Agave victoriae-reginae

Echeveria colorata



Agave attenuata f. variegata

Squares

I have found only one plant in nature that is anywhere close to resembling a square. It's a pretty one. We will discover, though, that squares are going to be very important to us in the upcoming pages.

Pseudolithos cubiformis

Triangles

Your mission, should you decide to accept it, is to find all of the triangles in these five pictures. You're on your own.

Pilotus exaltata

Tradescantia pallida

Spirals

Cycad sp.

"After watching Russel's presentation on nature's geometry in succulents, I'll never look at plants the same way again."—Merrilee 'Annie' Morgan, Program Chair, Palomar Cactus & Succulent Society, Escondido, California.

ISBN 978-1-54398-837-6