INTRODUCTION

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Beginnings

Suppose the morning news ran the headline: *Millions of Five-Eyed Insects with Barbed Stingers Invade the United States!*

Would we laugh, or would we run for cover?

Sounds a bit far-fetched perhaps, but that is how it happened. In the early 1600s, along with European settlers, the honey bee invaded the portion of North America now known as the *United States*. In truth, the honey bee invaded more than once. And, as did the people new to the land, this insect spread westward. In doing so, it became a sign of the times—often alerting the peoples who then inhabited the land that the Europeans were on their way.

The honey bee did not cross the Rocky Mountains, however. Instead, honey bee colonies were carried around the Rockies by ship. They made landfall with the Gold Rush in California during the early 1850s.

The European honey bee, *Apis mellifera,* is such an established part of the American landscape today that we find no surprise at seeing a worker visit flowers in fields and gardens. Yet, chances are good that honey bees would not be here were it not for the European settlers who first carried their colonies across the Atlantic a few centuries ago.

In the relatively short period of time since these introductions, the honey bee has gained wide recognition. Today, this insect pollinates wildflowers, garden and ornamental plants, and agricultural crops in all fifty states of the United States. In addition, the nonnative honey bee has been named a state insect in approximately twenty states.

Recognition goes well beyond this appreciation, however. Our understanding of the degree to which the honey bee has become essential for life as we know it in contemporary America continues to grow. The emergence of what we refer to as *Colony Collapse Disorder* is an exceptional wake-up call. The ongoing potential for colony losses has brought to light for all of us the fundamental degree to which we depend on the honey bee for pollination as well as for stores of honey and other resources. Yet, even though our dependence has increased since the early introductions, we have not made life easy for the honey bee.

The nonnative honey bee is now a state insect in close to twenty of the US states. The number of states with honey bee designations has increased over the time during which I have put this book together, a trend that well may continue.

We have reduced the diversity of both habitat and bee, introduced pests and pathogens, filled the air with an ever-new array of herbicides and pesticides, and placed high-fructose corn syrup along with an ever-changing mix of chemical treatments inside the beehive. As a result of these and other impacts, more so than perhaps ever before, the honey bee now depends on us.

The focus of this book is the honey bee worker. Although she does not work alone, it is the worker that we see in our gardens. It is the worker that pollinates many of the fruits and vegetables that nourish us as well as many of the plants whose leaves, flowers, and fragrances delight us year after year. It is the worker that gives us such resources as honey, beeswax, pollen, royal jelly, and bee venom. It is the worker that inspires us today, just as she inspired those who came long before us.

This exploration of form and function in the honey bee worker is an attempt to answer, in particular, some of the questions that occupied my mind during the years in which I kept bees. In essence, as noted in the Preface, these questions might be summed up in one:

How does the honey bee worker do what she does?

The material is presented in four main sections. The first, *Honey Bee 101*, contains information about how we have come to describe the honey bee and honey bee development. The three sections that then follow are organized on the basis of honey bee anatomy: *The Head*, *The Thorax*, and *The Abdomen*. These sections reflect the design of insects generally; the three body parts are exquisitely adapted and specialized in the insect we know as the *honey bee*.

Even though I have organized the material into sections based on insect anatomy, overlap in the material presented has been unavoidable. The functions I have sought to understand and describe are indeed connected to the form of the head, thorax, and abdomen; yet, all too often they cannot be so neatly confined to a particular body part, structure, or region.

A typical honey bee colony during a nectar flow contains not only thousands of workers but also an egg-laying queen and hundreds of drones. The queen and the workers are female, and the drones are male. All of these bees—the workers, the queen, and the drones—are needed to ensure that the honey bee colony survives and thrives. So, although I focus on the worker in these pages, please keep in mind that she is part of a colony and part of the land. Through her activities, the worker

Native Pollinators

The populations of native pollinators in the United States have long exhibited declines. The trends in their numbers are inversely correlated with trends in number of people and degree of habitat disturbance. As we have changed the land and its capacity, we have reduced the diversity of not only plants but also their pollinators, among which are bees, butterflies, hummingbirds, and bats. Information about most of the native species that play a role in pollinating plants in the United States is incomplete at best. We do not have good taxonomic knowledge or ecological understanding of many of these native species—even as they continue to decline.

Bumble bees visit anemone (left), clematis (middle, lower left), and comfrey (right) in my yard. Similar to the honey bee, the bumble bee belongs to the Family Apidae. Its genus name is *Bombus*, whereas the honey bee considered here, *Apis mellifera*, is a representative of species in the genus *Apis*. Much of what we can do to help the honey bee will also benefit native pollinators.

A typical honey bee colony contains three types of bees—worker (left), queen (middle), and drone (right). All three types play necessary roles in the life of the colony.

reflects the intricate and dynamic makings of a marvelous organic whole. It cannot be otherwise. I have included comparative information about the queen and drone at times, and I have placed additional supplementary material in frames, such as the one provided on the facing page.

When friends and others have learned of my work on a book about the honey bee, almost invariably they show enthusiasm. Many immediately tell me that they *love* Sue Monk Kidd's *The Secret Life of Bees*. When I explain that I, too, love her book but that this book, *Honey-Maker*, is focused more on the bee's form and how it enables the bee to function in necessary ways, they start asking questions about why the honey bee is in trouble.

I begin to tell them about introduced mites and other species, pesticide impacts, reductions in habitat and genetic variation, stresses such as those imposed from being transported all over the country to do pollination, and so on. The list is long and they soon interrupt with the question, "Is *that* what your book is about?"

I again say, "No. It is a book about the honey bee, especially the worker and how she does her work." Yet, in a way, maybe that *is* what this book is about. If we understood the honey bee as an organism totally dependent on what takes place both inside and outside the beehive, as a species that is so embedded in the ecological system of which it is a part that it cannot help but reflect what happens there, and as an insect that functions as part of a whole in a colony that absolutely requires interaction with what we often refer to as the *natural world*, then perhaps the honey bee would not be in quite so much trouble these days.