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Herbivores and Plant Volatiles: Part 3 — Egg Parasitoids, An Introduction

by Emmett L. Williams, Ph. D. and George F. Howe, Ph. D.

Figure 1. Adult elm leaf beetle, showing the typical holes it eats in an elm leaf. Photograph by Clemson University — USDA Extension Slide Series. Image no. 1435074.

We discussed in Part 2 (Williams and Howe, 2005) the "destruction" of beet armyworm herbivores by wasp parasitoids, *Cotesa marginiventris*. In field and laboratory studies, Ruberson and Whitfield (1996) found that the wasps were also able to act as an egg parasitoid of the beet armyworm:

> . . . *C. marginiventris* is capable of ovipositing in *S. exigua* eggs and of successfully developing and emerging from host larvae hatching from stung eggs. (p. 296)

Using cotton plants as hosts for the beet armyworm herbivore, these researchers (p. 299) speculated that the female parasitoid wasps may have been attracted to the plants by volatiles, which were emitted because of the feeding larvae, and simply "... exploited the egg masses." Another possibility suggested was that the plants may have released volatiles since there might have been ". . . some minor disruption of the leaf cuticle resulting from oviposition . . ." (p. 299). Also Ruberson and Whitfield concluded that more study is necessary to determine what drew the wasps to the herbivore egg masses.

There are wasps that are exclusively egg parasitoids, and in this article some of these will be examined together with the volatiles released from plants that attract them to the eggs.

A small wasp and field elms

A major enemy of the field elm, *Ulmus minor*, is the elm leaf beetle, Xanthogaleruca luteola. The adult beetle eats holes in elm leaves while feeding (Figure 1), but the greatest damage to the tree is done by larval feeding which "...skeletonizes the foliage..." (Dalhsten, 2003a), essentially defoliating the tree.

The gravid (pregnant) female beetle removes "...some plant tissue from the undersurface of a leaf with its mouthparts" (Meiners and Hilker, 2000; p. 222). It never completely bites through the elm leaf structure, but only scratches the surface by gnawing shallow, rough grooves. Using "glue" (secretion) from its oviduct, the beetle attaches its eggs to the scratched groove (see Figure 2).

Oomyzus gallerucae, the wasp which parasitizes the beetle's eggs, is attracted to them on field elms by volatiles emitted from the tree. The analysis of these volatiles has revealed more than 40 compounds, most of which are terpenoids (Weigner et al., 2001; p. 499). Whether "the cue that calls the wasp" includes all of the released volatiles, or a specific mixture of certain compounds, or just one substance, is not known.

Eggs of the elm leaf beetle are the only host of this wasp parasitoid (Hilker and Meiners, 2002; p. 188). These small wasps may parasitize 50-90% of the eggs in a cluster in addition to host-feeding on other eggs, essentially destroying the entire egg cluster (Dahlsten, 2003b).

When researchers inflicted mechanical damage, such as scratching the leaves to simulate the beetle's roughening and grooving action, the wasp parasitoid was not attracted. Once the mechanical scratches were coated with beetle oviduct secretion, however, the leaf released attractive volatiles (Meiners and Hilker, 2000; p. 221). Even unaffected plant parts, close to the leaves containing egg masses, emit volatiles in a total-system response to beetle oviposition (Wegener et al., 2001; pp. 511, 512).

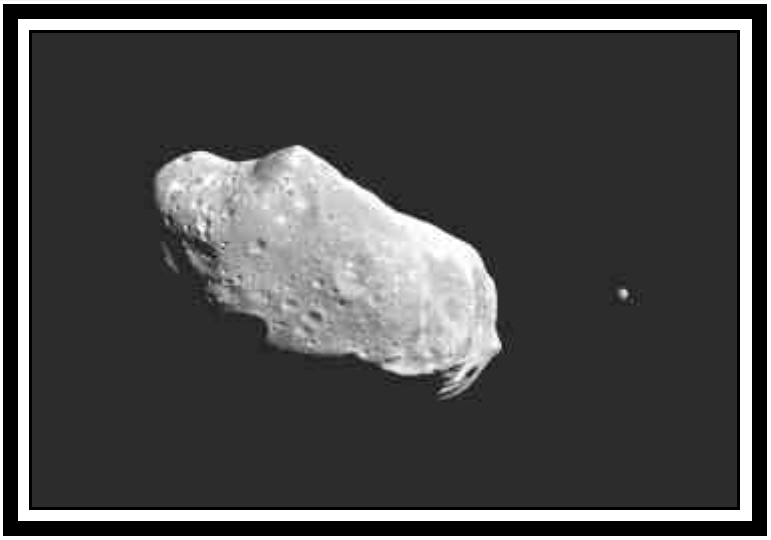
... continued on p. 6

Contents

The Asteroid Belt: Indications of Its Youth

by Jonathan Henry, Ph.D.

Asteroids are chunks of rock and dust mostly between the orbits of Mars and Jupiter. Some asteroids have other orbits, such as the near-earth asteroids whose orbits carry them relatively close to earth. Conventional theory says that asteroids are debris that did not coalesce into a planet when the solar system formed. Therefore the age of the asteroids must be the age of the solar system, commonly believed to be some 4.6 billion years.



This is the first full picture showing both asteroid 243 Ida and its newly discovered moon to be transmitted to Earth from the National Aeronautics and Space Administration's (NASA's) Galileo spacecraft — the first conclusive evidence that natural satellites of asteroids exist. Ida, the large object, is about 56 kilometers (35 miles) long. Ida's natural satellite is the small object to the right. This portrait was taken by Galileo's charge-coupled device (CCD) camera on August 28, 1993. (Photo and caption by NASA)

Difficulties with naturalistic origins theory

According to conventional theory, Jupiter's gravitational tug kept primordial debris from coalescing and forming a planet. According to Lissauer and Stewart (1993; pp. 1061, 1088), this theory does not really work. These authors indicate that to theorists the asteroid belt is a "problem" (p. 1080), with current theory "headed towards the dustbin of history" (p. 1081). This type of difficulty has led theorists to speculate that "asteroid belts might not be a common feature among planetary systems otherwise much like our own" (Lissauer and Stewart, 1993, pp. 1081-1082).

The asteroid belt is emptying rapidly

Even if formation of the primordial asteroid belt could be explained, there is the problem of how a Jovian protoplanet could clear the belt of debris so as to make it appear as it does today. Though the asteroid belt was once more massive (Chapman and Davis, 1975, p. 553), early Space Age probes showed that it is emptying faster than expected (Lissauer and Stewart, 1993, p. 1081; Robbins and Jeffreys, 1988, p. 124; Beatty, 1994, p. 26).

Opinion used to be that collisions among asteroids are rare, but the 1991 discovery of impact grooves on Gaspra showed that collisions are more frequent than once believed (Veverka et al., 1993, p. 72; Asphaug, 2000, p. 53; Hartmann, 1991, p. 289). Asteroidal collisions form dust which spirals into the sun or, in the case of very small particles, is ejected from the solar system (Kerker, 1974, p. 97). Frequent attrition of asteroids by collision implies a relatively young age for the asteroid belt.

Recent discoveries impose tighter age constraints

Further, the Yarkovsky effect, a non-gravitational force that sunlight exerts on asteroids, moves them into near-earth orbit faster than had been expected (Chesley et al., 2003, pp. 1739, 1741). The maximum expected lifetime of near-earth asteroids is of the order of a million years, after which they collide with the sun (Farinella, 1994, p. 315). This raises doubts that asteroids originated 4.6 billion years ago, 4600 times more than the near-earth asteroid lifetime.

Asteroid "moons" pose an even more serious age constraint. Tidal effects limit the lifetime of an asteroid's moon to about 100,000 years (Binzel and van Flandern, 1979, p. 905). This fact and the difficulties of "moon" capture led some astronomers to doubt the existence of asteroidal moons (Tedesco, 1979, p. 905). The Galileo probe sighted Ida's moon Dactyl in 1993 (Asphaug, 2000, pp. 51-52), confirming this age constraint, which is less than one ten-thousandth the conventional age of the solar system.

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Letters

I feel very fortunate to have found your organization. For the last four, maybe five, years, I have been fascinated with the creation vs evolution debate. I was a staunch evolutionist growing up, including my time in university. After I became a Christian, I was an old-earth creationist believing that God began the Big Bang knowing exactly what would happen afterwards.

But after a time, I realized that I could not rectify the fact that I was disregarding a part of the Bible; the very Book that gave me my knowledge of Christ and salvation. For me, if I could ignore one part, then I had to be able to ignore the rest. It was all or nothing. So I made a decision to take it all on faith; that creation happened exactly as described in Genesis.

Since that time, I have read many books and articles, watched documentries, and become involved in this debate, as a hobby. I search through Archeology subscriptions and creationist "e-zines" whenever I can. I am currently working on a Masters in Biblical Creation Apologetics for my own personal interest, not to become involved in Ministry so much (though this is definately not ruled out).

I thank you and the Creation Research Society Inc. for its work in this field.

— Marc Serra

A Half Century of Indoctrination: A 1942 Evolution and Eugenics Survey

by Jerry Bergman, Ph.D.

Understanding the creation-evolution controversy today requires a knowledge of the ideas that predated the modern controversy. Part of this history perspective includes understanding the views of teachers in the past. One claim which is often heard is that, as a result of the 1925 Scopes trial, few secondary school teachers taught Darwinism. For example, Branch (2005) recently claimed that after the Scopes trial, "Under the pressure of legislation, administrative decree, and public opinion, evolution quickly disappeared from textbooks and curricula across the country." Was this actually the situation?

A survey

Unfortunately, a shortage of good studies exists in the United States, both before and in the aftermath of the Scopes trial, to determine the validity of the statement that this trial had the effect of preventing the teaching of evolution. One of the best studies, though, completed in 1942, indicates that the situation was quite different than G.S. Simpson's (1997) claim that "one hundred years without Darwin are enough," as well as Dobzanski's (1973) assertion that "nothing in biology makes sense except in the light of evolution."

The survey authors stressed that it was critically important for both "social and political" reasons to teach "the genetic inequality of human beings" in biological science classes.

The survey (Riddle et al., 1942) was mailed in the winter of 1939 / 1940 to teachers at nearly 16,000 secondary schools throughout the United States. The 59-item questionnaire was designed to evaluate the state of biology instruction in the United States. A major concern of the authors was to determine the amount of both evolution and eugenics which was typically being taught in the nation's high schools. The list of schools utilized was considered to be fairly complete, reaching almost all schools except those with very small or nonexistent biology programs. Of the 16,000 questionnaires sent, 3,186 usable responses were obtained: 2,900 from public, 99 from parochial, and 184 from private schools (pp. 7-8).

Teaching eugenics

The survey authors stressed that it was critically important for both "social and political" reasons to teach "the **genetic inequality** of human beings" in biological science classes (p. 66; emphasis added). After stating that it was "highly desirable to learn the extent to which" eugenics was being taught in high schools, Riddle et al. (1942) bemoaned the fact that teaching this important "principle is banned in communist Russia," indicating that, in a free society "this important principle is taught" more often.

The authors of this study were openly trying to convince society that both eugenics and non-theistic evolution were not being taught as widely as they should be, and that it was important that both of these ideas be taught as fact. For example, it was found that only 39 schools emphasized evolution, and only 31 emphasized eugenics. This compares with 67 that emphasized the environment; 52, nutrition; 53, insects; 21, the scientific method; 13, photosynthesis; and 13, biological principles. The subject that was emphasized the most, by far, was health and hygiene (397), followed by physiology (263).

With respect to the teaching of eugenics, the survey showed that 2,191 schools taught this view, and only 360 did not teach eugenics. Fewer teachers from parochial schools replied (only 68.7%, compared to 87.9% of teachers in public schools), indicating that parochial schools were less likely to teach eugenics. The author concluded that "genetic inequality of human beings is taught by 85.9 percent of public, 64.7 percent of parochial, and 87.1 percent of private school teachers" (1942, p. 76).

Religious schools were less likely to accept eugenics, evidently due to their religious view that all humans descended from Adam and Eve. The author was encouraged by the percent of schools that *do* teach eugenics, but concluded that its teaching does not have the impact that it should have. One reason was because a real understanding of eugenics requires instruction in genetics which, Riddle et al. propounded, was not often given its proper place in biology. As a result, he concluded that biology instruction in America did not succeed in teaching "our youth this **scientific truth** of prime importance to social and political thinking" to the level that he felt was ideal (p. 67; emphasis added).

Teaching evolution

The authors of the study were also concerned about what they considered inadequate teaching of organic evolution. To illustrate this, they noted that 3.4% of the teachers who returned the questionnaire failed to check even one item on the evolution section of the survey (3.2% of public school teachers, and 9.9% of the parochial school teachers; p. 69). Of the public schools, only 109 omitted teaching evolution entirely, 15 openly denied that evolution was true, but a whopping 458 taught organic evolution as fact.

In addition, 1,374 taught evolution as a "principle underlying plant, animal, and human" origins (p. 70). Only 79 taught evolution as applying to subhuman organisms, 892 as a scientific *hypothesis*, and 418 as an inference only. Thus, over half of the teachers surveyed taught evolution either as a fact, or as the principle fundamental to biological "origins" (p. 71).

These data indicate that the common claim that after the Scopes trial evolution was infrequently taught, at least until evolution was reintroduced after the successes of the Soviet space program, is false. Although evolution was taught as fact by the majority of schools in the 1940s, and presumably since then, around half of all Americans still do not accept the evolutionary explanation of origins, indicating that they have not been convinced.

Although the authors admitted that there were flaws in the questionnaire (especially the problematic return rate), the study did indicate that, at the time, a significant portion of schools were teaching evolution as fact, especially in larger cities. The authors concluded that these results were not as impressive as they first appeared because naturalistic evolution was often adulterated with theism.

For example, it was noted that some teachers taught human-animal evolution "plus Divine Creation," a situation the author did not believe was science but was instead "theology." Furthermore, some teachers who stated that they taught evolution as a scientific hypothesis pointed out its lack of conflict with religion — citing theistic evolution, which the study's main author concluded was inappropriate. Only pure, atheistic evolutionary naturalism was acceptable.

It was for this reason that they concluded that the principle of evolution (defined as atheistic or non-theistic evolution, where God had no role in the process) was being taught "in notably less than half of the high schools in the United States." The authors concluded that "the principle of organic evolution, seriously affected and restricted by the religious views of individuals and communities, is taught to one or another extent by about 50 percent of the teachers who replied to this questionnaire" (p. 76). They maintained that teaching non-theistic evolution is "essential" to effective biological instruction, and encouraged teachers, administrators, and others to remedy what the authors considered to be a serious problem.

They maintained that teaching non-theistic evolution is "essential" to effective biological instruction ...

Opposition to evolution teaching

The most common reason that evolution was not being taught was community opposition. The second most common reason was the biology teacher's personal beliefs (208 out of 843 teachers did not teach evolution according to the authors' definition), indicating that they were creationists and did not accept evolution. Also, 381 did not teach evolution for a number of other reasons. Since the study focused on teaching evolution, the authors listed a large number of reasons why people did not teach it as fact. Many teachers stated reasons such as it was taught as a theory only, or it was not taught dogmatically.

Several respondents claimed that they did not teach evolution due to their study of science. Others claimed that they saw no reason for introducing evolution, which they considered to be a "controversial subject." Another said evolution "seems relatively unimportant in helping individuals to live better," and it was "not much value to tenth grade students." Another said evolution was "unimportant until more scientific 'facts' are produced."

A number of teachers felt that the time could be better used to teach in other areas: "who cares about evolution, my students don't; other topics are more important" (p. 74). One teacher stated "if taught as hypothesis and not fact would be little opposition anywhere" (p. 74). Another said that "controversial subjects are dynamite to teachers." Also, 11% felt that it was not important, 8.5% felt the pupils were too young, and 7% doubted the truth or accuracy of evolution (p. 75).

Many of those surveyed cited religious reasons for not teaching evolution: "do not stress due to religious groups" (p. 73), and there was "no point in bringing up as controversial issues" (p. 74). One respondent stated that evolution was not taught because the "teacher's place is not to break down what homes and churches have taught; besides only a theory, not a fact" (p. 74). Others stated that they did not teach evolution due to the "bigoted ignorance of parents" (p. 74). The authors concluded that those who stated that they doubted the "truth of evolution" indicated that there had been "inadequate biological training."

The reason Riddle et al. (1942) concluded it was critical to teach evolution was because the theory has immediate personal and social significance. Obviously referring to eugenics, he emphasized this by stating that "in an advanced country, in the twentieth century, there is incongruity and shame in the fact that many educational doors are locked against its intelligence, its personal, and its social implications" (p. 75).

New surveys are critically important to determine what changes have occurred during the past sixty years in the teaching of

eugentics and evolution. Today, it is likely that very few teachers, if any, would support the teaching of eugenics, yet the attitudes toward teaching evolutionary naturalism would probably be very similar to those expressed in this 1940s survey.

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Speaking of Science

Commentaries on recent news from science

The Evolution of Irreducible Complexity

It must be open season on Intelligent Design (ID). Yesterday, *Nature* tried putting on a defense with a new missing link claim from the University of Oregon (Dalton, 2006), and *Science* has printed a story to tackle ID's offensive line, irreducible complexity (Anonymous, 2006). The Discovery Institute immediately jumped to the match, with Mr. Irreducible Complexity himself, Michael Behe, leading the charge (Behe, 2006). Behe stood his ground without a flinch, calling this the "lamest excuse yet to answer the challenge irreducible complexity poses for Darwinian evolution."

On both counts the Darwinists are fighting tanks with feather pillows. In both cases also, they only give the press their side of the story, and the other side is forbidden access to respond. For their bluff, bluster, fluff and froth, and for the silly idea that molecules planned ahead to be pre-adapted for later function, the reporters at University of Oregon win *Stupid Evolution Quote of the Week*:

> Thornton's group then showed that the ancestral receptor also responded to a far more ancient hormone with a similar structure; this made it 'preadapted' to be recruited into a new functional partnership when aldosterone later evolved. 'The stepwise process we were able to reconstruct is entirely consistent with Darwinian evolution,' Thornton said. 'So-called irreducible complexity was just a reflection of a limited ability to see how evolution works.'

O ye of little faith, they cry, can ye not see how the unguided hand of evolution hath wrought these wonders? The incorrigibility of Darwinian fundamentalists knows no bounds. But what will they say when they have to fight real intellectual armies in public view instead of straw ones? Pull down the Bamboozle Curtain and public perceptions will change really fast.

Anonymous. 2006. Evolution of 'irreducible complexity' explained. *EurekAlert* (published online, 6 April). www.eurekalert.org/pub_releases/2006-04/uoo-eo040406.php

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Dalton, R. 2006. The fish that crawled out of the water. *news@nature.com* (published online, 5 April). www.nature.com/news/2006/060403/full/060403-7.html

Reviewer Stunned by Author's Hand Waving

David Nicholls (2006) appears to have suffered whiplash from a line in a book he was reviewing in *Science,* titled *Power, Sex, Suicide: Mitochondria and the Meaning of Life*, by Nick Lane (Oxford, 2006). Though he liked the book in general, he said this about Lane's explanation for how the first cell got its power generator:

> The author is **less convincing** when he turns to the **origin of life** (at least he is not afraid to deal with big topics). Citing the work of Mike Russell and Alan Hall, Lane states that in order to **generate a primitive cell** from an iron sulphide vesicle '**all that the cells need to do** to generate ATP is **to plug** an [proton translocating] **ATPase through the membrane**.' Any bioenergeticist who has followed the **elucidation of the extraordinary structure and mechanism of the mitochondrial ATP synthase** over the past decade will **pause at the word** "all," because the **ATP synthase — with its spinning rotor massaging the surrounding subunits to generate ATP — is without doubt the most amazingly complex molecular structure in the cell.** (emphasis added.)

After that, Nicholls had mostly praise for the rest of the book. If a pro-Darwinist, convinced evolutionist is this surprised that a colleague would treat the "most amazingly complex molecular structure in the cell" so dismissively, what are the rest of us supposed to think?

This is the perpetual bad habit of evolutionists. It will prove their downfall. As the gap between life's complexity and evolution's explanations continues to grow, evolution is going to look more and more like Wiley E. Coyote clinging by fingernails and toenails to both sides of a rapidly-widening canyon.

Nicholls, D.G. 2006. Cell biology: energizing eukaryotes. Science 311:1869.

... continued on p. 9

Part 3 – Egg Parasitoids

...continued from page 1

It is likewise thought that the induced volatile compounds are produced de novo by the plant.

Research continues in an effort to find the composition of the substance in the beetle oviduct secretion that "triggers" the field elm to emit volatiles that attract *O. gallerucae* (Hilker and Meiners, 2002).

A sucking stink bug

If you have ever stepped on a stink bug or crushed one with your fingers, you will realize why this creature received its name. The scent emitted by the crushed bug is extremely unpleasant and downright obnoxious. Specifically, we discuss the southern green stink bug (Figure 3), *Nezara viridula* and one of its enemies, *Trissolcus basalis*, its egg parasitoid.

N. viridula is thought to have originated in Ethiopia (Squitier, 2005). It will damage ". . . cotton, grains, soybeans and other legumes, tomatoes and other solanaceous crops, sweet corn, sunflower, cole crops, cucurbits, fruit and nut crops" (Weeden et al., n.d.). Additionally,

> The . . . bug has piercing-sucking mouthparts. The mouth consists of a long beak-like structure called the rostrum. Salivary fluid is pumped down the salivary duct and liquefied food is pumped up the food canal. All plant parts are likely to be fed upon, but growing shoots and developing fruit are preferred. (Squitier 2005)

The eggs of this bug are very small (width of ~0.03 in.; see Figure 4). Thus, a tiny parasitoid likely would be effective in parasitizing this bug's egg mass. *T. basalis*, a "[m]inute black wasp with downward elbowed antennae and a flattened abdomen" (Weeden et al., n.d.) prefers to parasitize the eggs of *N. viridula*. The wasp has been introduced into many regions throughout the world because of its efficiency in parasitizing the egg masses of the southern green stink bug. It is, however, more effective in some crops and less successful in others such as soybeans.

Figure 2. Elm leaf beetle eggs attached to the underside of an elm leaf. Photograph by John A. Wiedhass, Virginia Tech. Image no. 1627056.

Some studies indicate that *T. basalis* females are attracted to volatiles emitted by the stink bugs themselves (Salerno et al., 2002; Mattiacci et al., 1993). Such volatiles are referred to as "kairomones" — substances released by one species that benefit members of another species, such as parasites. In this case it is a signal that attracts *T. basalis*. Perhaps the wasp parasitoid reacts by knowing that where there are female stink bugs, there may be egg masses available.

This paper, however will center on volatiles produced by plants to "call" or signal wasp parasitoids (Wolfrom, 1992). Such an emitted plant volatile is known as a host-induced "synomone" — a substance released that is favorable both for the emitter (plant) and the receiver (wasp parasitoid) in this instance (Colazza et al., 2004; p. 47).

Employing two leguminous vegetable plants, broad leaf beans (*Vicia faba*) and French beans, (*Phaseolus vulgaris*), Colazza et al. (2004) found that feeding damage by the stink bug alone did not attract the tiny wasps with any greater frequency than undamaged leaves. The wasps were

Figure 3 (top). Southern green stink bug nymph, recently hatched from an egg, on a cotton leaf. Photograph by Ronald Smith, Auburn University. Image no. 1858083.

Figure 4 (bottom). Southern green stink bug egg mass on underside of cotton leaf. Photograph by Ronald Smith, Auburn University. Image no. 1858081.

"...more attracted to volatiles from feeding-damaged leaves carrying an egg mass . . ." (p. 49). Volatiles released from southern stink bug egg masses on a nylon screen did not attract *T. basalis*. Therefore, the researchers concluded that the wasps were attracted by induced volatiles from leaves having egg masses. There was a total-system response by the plant, since leaves without egg masses also released volatiles to attract the wasp. As this study is in its infancy, the composition of the elicitor associated with stink bug oviposition and the specific mechanism of action are not yet known (p. 51).

Pines and sawflies

In the larval stages, various species of sawflies throughout the world can defoliate many types of conifers. We consider this particular species, the introduced pine sawfly (see Figure 5), *Diprion pini*, its laying of eggs (oviposition) on the Scottish pine, *Pinus sylvestris*, and the response of the tree to this activity. The sawfly oviposition induces the needles of the tree to release volatiles that attract a very small (~0.06 inch in length) wasp egg parasitoid, *Chrysonotomyia ruforum*. In theory, the advantage to the plant in attracting an egg parasitoid would be that the parasitized larvae would do less damage than larvae already feeding before the plant emits volatiles to attract a parasitoid.

Prior to depositing her eggs, "The sawfly female slits the pine needle tangentially (along its length) using her sclerotized [hardened] ovipositor valves . . ." (Hilker et al., 2002; p. 456). She then deposits the eggs along the incision, coating them with an oviduct secretion and another greenish secretion that covers the row of eggs. These secretions likely "glue" the eggs in place, as well as possibly camouflaging the row (see Figure 6).

Mechanical damage or a slitting action to mimic the sawfly incision caused the pine needles to release mono- and sesquiterpene volatiles that did not attract *C. ruforum* (Mumm et al. 2003; p. 1235; Hilker et al., 2002; p. 457). Mumm et al. (2003) noted that neither mechanically damaged needles nor damaged needles coated with oviduct secretion caused any qualitative change in the mono- and sesquiterpene volatiles emitted by the Scotish pine (p. 1246). The only change in the composition of the volatile mixture released from damaged needles coated with oviduct secretion was a quantitative increase of the sesquiterpene, (E)-β-farnesene (p. 1245). Likewise, in a system-wide response to *D. pini* oviposition, this change in the amount of (E)-β-farnesene was detected in the volatiles released by adjacent needles not containing egg masses.

These results indicate that the wasp egg parasitoid, *C. ruforum*, can detect this increase in the amount of this sesquiterpene and find the egg masses of *D. pini* on the needles!

An overview

Future work may cause researchers to modify many of the present conclusions concerning the mechanism employed by plants in the release of defensive volatiles. It is clear, however, that the "vegetative state" of many plants is not one of passive resistance to herbivory and damage caused by other pests. Plants can defend themselves by attracting enemies and parasites of attacking organisms. Some plant volatiles can even kill small creatures who feed on them.

We have discussed mainly how plants attract wasp parasitoids to destroy a herbivore or its eggs. This complex relationship between the plant and a herbivore or its eggs is "finely tuned" and is not likely the result

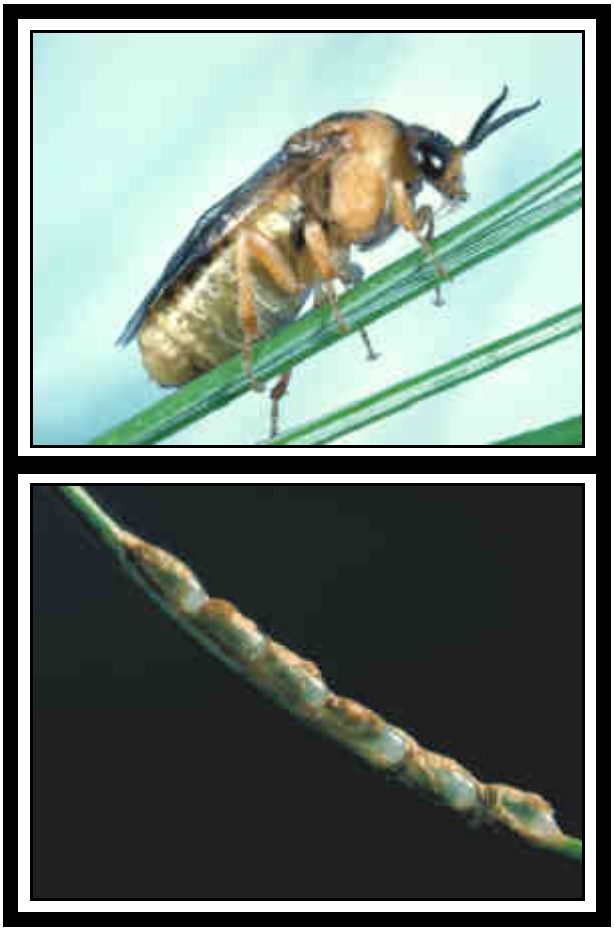

Figure 5 (top). Female introduced pine sawfly on pine needle. Photograph by John H. Ghent, USDA Forest Service. Image no. 0488040.

Figure 6 (bottom). An egg mass along a slit pine needle deposited by an introduced pine sawfly. Note the deposited oviduct secretion along the row of eggs. Photograph by John H. Ghent, USDA Forest Service. Image no. 0488043.

of random evolutionary development.

Some of the methods herbivores use are quite "advanced." The elm leaf beetle's scratching a shallow groove with its mouthparts on the underside of an elm leaf is quite clever. The beetle does not scratch completely through the leaf, which likely would cause the release of defensive volatiles. Hiding eggs on the underside of a leaf may also prevent possible damage from predators and exposure to certain adverse weather conditions. The roughening of the groove insures better adhesion of the egg mass, similar to the human activity of roughening or sanding the surfaces of two items to be glued together. In their entirety, these delicate interactions support the concept of design in origins rather than the slow, ineffective interactions of mutations and natural selection.

The southern green stink bug's sucking mouthparts operate in the same fashion as some mining machinery which pumps fluid down a shaft, dissolving certain minerals, and then pumping the mixture or solution aboveground. Sawfly females use their "saws" to cut a needle along its length, the same technique as a saw cutting wood. Evolutionists probably will claim that such techniques were acquired by chance, whereas creationists would identify them as having been imparted to the organism by the Creator, who had foreknowledge of the needs involved. The ability of a wasp parasitoid to detect small quantitative changes in one compound of an emitted mixture of plant volatiles is remarkable, and fits well with a creation model.

Salerno et al. (2002; p. 251) consider that the southern green stink bug and its egg parasitoid, *T. basalis*, coevolved — meaning that the two organisms followed a sequence of reciprocal steps wherein they interacted with one another by evolution over a long period of time. The two species were involved in one-upmanship adaptation.

But can natural selection, a brute random process, even "know" what is occurring in order to direct coevolution? Evolutionists are willing to impart to nature or some natural force an understanding that it cannot possibly possess. True blind processes occur in a random fashion, in which one fluctuation may reverse the direction of a previous fluctuation, and certainly never produce an ordered sequence such as coevolution. Evolutionists attribute to nature intelligence and planning ability, and in the same breath deny the existence of a Creator who imparted all created beings with the information and abilities they need.

Glossary

(E)-β-farnesene or β-farnesene: one of the simplest sesquiterpene olefins. The E denotes the position of a particular double bond.

gravid: heavy with young or eggs.

monoterpene: any class of terpenes, $C_{10}H_6$, containing twin isoprene units per molecule.

oviduct: in oviparous animals, the passage from the ovaries to the outside of the body; eggs travel along the oviduct.

oviposition: the process of laying eggs by oviparous animals.

sesquiterpene: any class of terpenes, $C_{15}H_{24}$, with a lower volatility than monoterpenes.

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Editor's note: All photos used by permission, www.forestryimages.com.

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Dr. Williams, who is retired from the CRS Board of Directors, has a Ph.D. in engineering. Dr. Howe, with a Ph.D. in botany, is on the Board and serves as the biology editor for the CRS Quarterly.

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Creation Calendar

Note: Items in "Creation Calendar" are for information only; the listing of an event does not necessarily imply endorsement by the Creation Research Society.

June 7 - 9
Exploring the History of Life
Cedarville University, Cedarville, OH
[abstracts due Feb. 24, 2006]
Sponsored by the Baraminology Study Group
Contact: Dr. Tim Brophy, (434)582-2733, tbrophy@liberty.edu
http://www.bryancore.org/bsg/exploring06/

June 8 - 10
Annual Meeting of Board of Directors
Creation Research Society
Lancaster, SC

July 2 - 7
Twin Peaks Family Science Adventure
Fun-filled vacation for families, on Colorado's Grand Mesa
Sponsored by Alpha Omega Institute, Grand Junction, CO
Contact: (970)523-9943, www.discovercreation.org

July 14 - 16
Mt. Elim Weekend Retreat
Enjoy a weekend family retreat near Yampa, CO
Sponsored by Alpha Omega Institute, Grand Junction, CO
Contact: (970)523-9943, www.discovercreation.org

July 30 - August 4 and August 6 - 11
Redcloud Family Mountain Adventure
Dynamic programs for adults & children, near Lake City, CO
Sponsored by Alpha Omega Institute, Grand Junction, CO
Contact: (970)523-9943, www.discovercreation.org

August 25-27
Grand Canyon 3-Day Rafting Trip
Canyon Ministries (Tom Vail) and Creation Safaris (David Coppedge)
Registration: $710 per person (call or email for details)
Contact: David Coppedge, (661)298-3685 bwana@creationsafaris.com

Speaking of Science
...continued from page 5

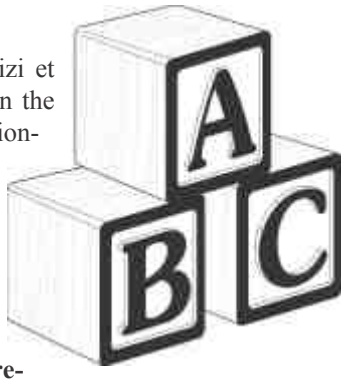
Minimum Genome Doubles

How many genes does a bacterium need to live? Evolutionists interested in the origin of life have been trying to determine the minimal genome for life. Those estimates may have been way too low, say researchers from the University of Bath (Pál et al, 2006). Though they did not supply a number, they estimated that the required number of genes should be twice as high as those in earlier estimates.

This means Mt. Improbable just got higher, and the evolutionists cannot use their natural selection ice axes to climb. All they have is bare feet to go straight up on ice, now twice as high, with avalanches every few minutes. We should actually use analogies that are more realistic. This is way too generous to the evolutionists.

Pál, C., B. Papp, M.J. Lercher, P. Csermely, S.G. Oliver, and L.D. Hurst. 2006. Chance and necessity in the evolution of minimal metabolic networks. Nature 440:667-670.

Evolution of "A-B-C"



Four Caltech scientists (Changizi et al., 2006) have tried to explain the shapes of alphabet letters in evolutionary terms, reported EurekAlert (Anonymous, 2006):

> In a new study … Mark A. Changizi and his coauthors … explore the hypothesis that **human visual signs have been cross-culturally selected to reflect common contours in natural scenes that humans have evolved to be good at seeing.** (emphasis added)

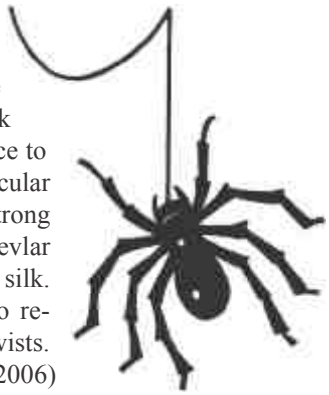
These authors believe that the contours of letters of the alphabet tend to correlate with contours in nature. Wait — there's more. "The researchers also examined **motor and visual skills** and the shapes that are easiest to see and form," the article continues. "They make a **strong case** that the shape signature for human visual signs is **primarily selected for reading, at the expense of writing.**" (emphasis added)

No hint, now, that these skills might have been designed that way? As usual, evolution is both the premise and the conclusion, the question and the answer, the approach and the justification, the jot and the tittle, the alpha and omega.

Anonymous. 2006. Why are letters and other human visual signs shaped the way that they are? *EurekAlert* (published online 30 March). www.eurekalert.org/pub_releases/2006-03/uocp-wal033006.php

Changizi, M.A., Q. Zhang, H. Ye, and S. Shimojo. 2006. The structures of letters and symbols throughout human history are selected to match those found in objects in natural scenes. *The American Naturalist* 167:5.

Spiders Rappel Without Getting Dizzy



How can spiders drop straight down their dragline silk without going into dizzying spins on the way down? It's because spider silk has "shape memory" and a resistance to twisting, due to its unique molecular structure. Scientists tested three strong threads for shape memory: Kevlar thread, copper thread, and spider silk. The winner was spider silk; it also retained its flexibility after multiple twists. The report in *Nature* (Emile et al., 2006) was summarized on *LiveScience* (Carey, 2006).

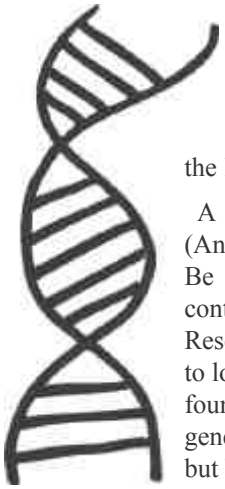
Too bad the Darwinists are in power; they bring science to a halt, claiming, "evolution did it." (This can be called the Darwin-of-the-gaps fallacy.) Think of how rock climbers and rescue workers could benefit from studying a little intelligent design from these lowly organisms.

Carey, B. 2006. Why spiders don't do the twist. *LiveScience* (published online

... continued on p. 10

29 March). www.livescience.com/animalworld/060329_spider_twist.html
Emile, O., A. Le Floch, and F. Vollrath. 2006. Biopolymers: Shape memory in spider draglines," Nature 440:621.

Non-Coding DNA: Whatcha Calling Junk?



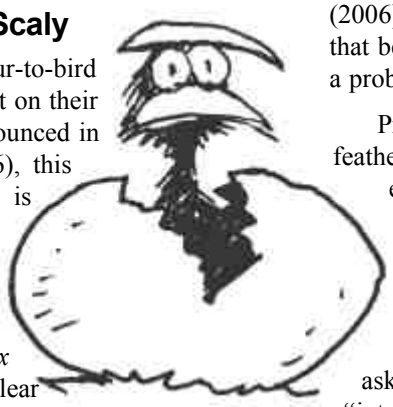
The focus on genes continues to blur, as more geneticists look outside the box. Some 98% of DNA in the nucleus of human cells does not code for genes. Long dismissed as genetic junk, much of it may turn out to be the hands on the controls.

A press release from Johns Hopkins Medicine (Anonymous, 2006) reports "Junk DNA May Not Be So Junky After All." It may contain vital control regions that switch the genes on and off. Researchers found that control regions don't have to look the same between different species. They found a case where a control region for a human gene looked very different from one in a zebrafish, but both performed the same function. This hints that the non-coding regions are filled with enhancers and suppressors that we are only beginning to understand.

Evolutionists baffled, not a simple story of descent, natural phenomena more complex than realized, design scientists vindicated; watch this space.

Anonymous. 2006. Junk DNA may not be so junky after all. *Johns Hopkins Medicine News & Information Services* (published online 23 March). www.hopkinsmedicine.org/Press_releases/2006/03_23_06.html

"This Is a Problem": Dino-Feather Story Gets Scaly



Just when proponents of dinosaur-to-bird evolution were getting agreement on their story, along came Juravenator. Announced in *Nature* (Göhlich and Chiappe, 2006), this new dinosaur fossil from Germany is dated later than the earliest alleged "feathered dinosaur," but had no feathers. The finely-preserved specimen, in the same Solnhofen limestone that preserved *Archaeopteryx* (dated 2-3 million years later), had clear impressions of scales. Commenting on this find, Xing Xu (2006), in the same issue of *Nature*, explained why this fossil disturbs the simple line from scales to feathers:

> The **evolution of biological structures must be studied within an evolutionary framework**. In the case of **feathers**, a **robust theropod phylogeny** is **the basis** for reconstructing the sequence in which **feathers evolved**. The distribution of various feather morphologies on **the currently accepted phylogeny suggests** that **simple, filamentous feathers first evolved** no later than the earliest stage of coelurosaurian evolution. More **complex feathers** with a thick central shaft and rigid symmetrical vanes on either side appeared early in the evolution of the coelurosaurian group Maniraptora; and feathers with **aerodynamic features**, such as a curved shaft and asymmetrical vanes, appeared within the maniraptors but before the origin of birds. This **inferred sequence of events** is supported independently by developmental data. Göhlich and Chiappe place Juravenator within the Compsognathidae, a group that is 'basal' in the coelurosaurian tree ... **So Juravenator should bear filamentous feathers.** But it **seems to be a scaled animal**, at least on the tail and hind legs.
>
> **Why**, then, does a **member of a feathered dinosaur family** bear **scales**? The authors' answer is straightforward: **feather evolution, they say, is more complex than we thought.** (emphasis added)

It's so complex, in fact, that in order to maintain the phylogeny, scientists may have to believe that feathers and scales may have evolved and re-evolved more than once. Xu continues, "It would **not be surprising** if feathers were lost and scaly skin re-evolved in some basal coelurosaurian species, or **if feathers evolved several times independently** early in coelurosaurian evolution."

Xu opts for the possibility that the discoverers misclassified Juravenator; perhaps it belongs deeper in the evolutionary tree, before the first feathers appeared. Keeping a positive outlook, he says that the story of "early feather evolution" has been "enriched" by this find, whatever the explanation. Since the fossil record is poor to begin with, "*Juravenator* may complicate the picture, but it makes it more complete and realistic."

Bjorn Carey invoked "convergent evolution" in his *LiveScience* article, and quoted Chiappe saying that he didn't have a precise explanation: "We see it as a **red flag** that says 'maybe you guys have been **interpreting the evolution of feathers** in **too simple a way**. Maybe things are more complex." In the Reuters (2006) story, Göhlich told reporters, "Now we have a little dinosaur that belongs to coelurosaurs that does not show feathers. This is a problem."

Problem? What problem? Scales are scales, and feathers are feathers. Dinosaurs are dinosaurs, and birds are birds. Before, evolutionists wanted us to believe that scales, a skin feature, evolved into feathers that are totally different and embedded beneath the skin. They expected us to believe there was a straight line of descent from gray wrinkles on a dinosaur into the colorful, aerodynamic, exquisitely-designed feathers of acrobatic swifts and high-diving cormorants. They asked us to believe that birds co-opted what appeared to be "integumentary structures" of doubtful utility on the legs and tails of some dinosaurs and turned them into flying wonders, complete with interlocking hooks and barbules that are lightweight, water-resistant and extremely adaptable (compare doves and penguins).

Furthermore, they expected us to believe that at the same time feathers evolved, dinosaurs transformed all their internal organs and completely redesigned their lungs and most other bodily systems. One only has a "problem" when one has to keep telling new just-so stories to back up old ones. Maybe some day museums will be realizing that evolutionists are dinosaurs, too.

Carey, B. 2006. Dinosaur find raises questions about the origin of feathers. *LiveScience* (published online 15 March). www.livescience.com/animalworld/060315_dino_feathers.html

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Göhlich, U.B. and L.M. Chiappe. 2006. A new carnivorous dinosaur from the Late Jurassic Solnhofen archipelago. *Nature* 440: 329.

Xu, X. 2006. Palaeontology: Scales, feathers and dinosaurs. *Nature* 440:287.

Scientists, Learn Darwinism on TV

In *Current Biology*, Kenneth E. Sawin of Wellcome Trust Center for Cell Biology at Edinburgh University was interviewed about his career. One of the questions was, "What are the big ideas for you now?" Here is part of his answer:

> Another thing that I think about, which may be more **ethereal**, is that cell biologists interested in molecular mechanisms **should always be reminding themselves that evolution proceeds without any predestined direction**, and this is as **true for cellular regulatory mechanisms** as it is for organismal evolution. Even if we **don't think too much** about evolution in our day-to-day work, it is **the backdrop against which everything takes place**, and one needs to keep a very **open mind**, and **not be too dogmatic**, about **how biological systems may be "designed," because there is no designer**. The **best stimulus** for this is to **watch a few nature programs on TV.** (emphasis added.)

If anyone can figure out how being dogmatic about evolution is an example of open-mindedness, or how directionlessness produced cellular regulatory mechanisms, or how maintaining faith in purposelessness as a backdrop aids thinking, or how telling oneself there is no designer demonstrates things are not designed, let us know.

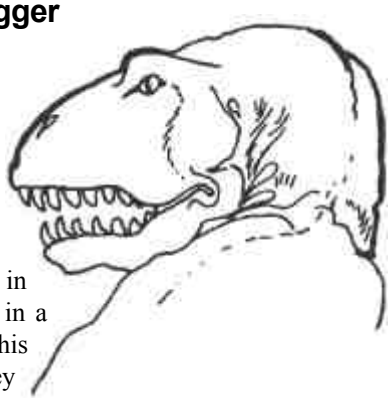
Notice two other things he said: (1) scientists don't think too much about evolution in their day-to-day work, indicating that evolutionary theory is useless; and (2) TV is this evolutionist's source of inspiration. So producers get their stimulus from the dogmatic claims of the evolutionary biologists, and biologists in turn get their inspiration from watching the resulting TV shows: a vicious cycle, with emphasis on vicious.

For example, last night The Science Channel replayed *The Rise of Man*, one of the dumbest examples of evolutionary storytelling ever made for the tube. In this ridiculous portrayal of made-up history, presented in all seriousness, naked ape-faced actors invent religion when lightning strikes, invent language when stealing ostrich eggs, invent the family when the she-ape needs help in childbirth, and invent art when one ape-man sticks a shiny stone on his female's mud-plastered forehead. The group all giggles in the mud together at this new sign of beauty.

If this is Sawin's inspiration, God help him. *Cave Man* was much better. At least Ringo Starr, Barbara Bach and John Matuszak all knew it was only a spoof. Let's offer Sawin and his ilk free unending reruns of all the evolution shows they want; maybe this will keep them in a permanent state of euphoria – and out of the classroom.

Anonymous. 2006. Q&A: Kenneth E. Sawin. *Current Biology* 16:R268.

Step Aside, *T. Rex*: Bigger Dino Found



A cache of dinosaur bones, meat-eaters bigger than *Tyrannosaurus rex,* has been uncovered in South America. Owen (2006) says the new species, *Mapusaurus,* exceeded the former heavyweight carnivore in size and agility. All the bones in a river deposit were 100% from this one species, so "the chances they had been deposited randomly are extremely low, said Rudolfo Coria, the discoverer. "The skeletons showed no signs of disease, Coria says, so the animals were apparently victims of some sudden catastrophic event."

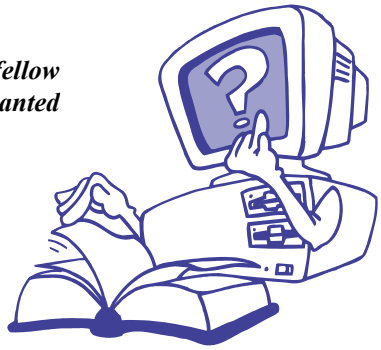
The article says that even larger creatures may remain to be discovered. See also the Associated Press (2006) story, which has comparative diagrams. What would bury a group of heavy, agile, strong, mobile, intelligent monsters suddenly? Think about it.

Owen, J. 2006. Meat-eating dinosaur was bigger than T. rex. *National Geographic News* (published online 17 April). http://news.nationalgeographic.com/news/2006/04/0417_060417_large_dino.html

Associated Press. 2006. Huge dinosaurs roamed Argentina in groups. MSNBC (published online 18 April). www.msnbc.msn.com/id/12356665/

Editor's note: All S.O.S. (Speaking of Science) items in this issue are kindly provided by David Coppedge. Opinions expressed herein are his own. Additional commentaries and reviews of news items by David, complete with hyperlinks, can be seen at: www.creationsafaris.com/crevnews.htm. Unless otherwise noted, emphasis is added in all quotes.

What Are Creationists Thinking about ...?



As new scientific discoveries make the headlines, have you ever wondered how your fellow creationists are reacting? Have you ever thought of a "crazy" new idea about origins and wanted to bounce it off another creationist?

Now you can keep in contact daily with creationists from all around the world. The Creation Research Society sponsors **CRSnet**, an online community of CRS members who have e-mail access to the Internet. Not only do participants discuss the latest scientific findings related to origins, but they also receive news about the CRS — its research, publications, and activities — and other creation-related news.

For more information, send an e-mail message to Glen Wolfrom at contact@creationresearch.org.
Participation is limited to CRS members in good standing.

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All by Design

EXPLOSIVE DEFENSE

by Jonathan C. O'Quinn, D.P.M., M.S.

To those who believe we evolved in stages from more primitive forms of life, listen to the lesson of the bombardier beetle.

Bombardier beetles are members of a group of small beetles that employ a most unique defense mechanism when threatened. They produce a caustic mixture of *para*-benzoquinones that they can aim and deliver with the precision of a marksman. This can buy a beetle enough time to open its wing covers, spread its wings, and fly away from danger.

This defensive spray is produced by two special glands in the beetle's abdomen. Each gland contains a large, thin-walled storage chamber containing hydroquinones and hydrogen peroxide, paired to a smaller, thick-walled reaction chamber containing special enzymes, catalases, and peroxidases.

When a beetle wants to spray, it squeezes fluid from the storage chamber into the reaction chamber. This sets off an explosive chemical reaction that liberates oxygen from the hydrogen peroxide.

The oxygen then oxidizes the hyrdoquinones to quinones, and acts as a propellant,

forcing the chemicals out of the beetle's abdomen through special openings that can direct the spray in any direction. In addition, the chemical reaction heats the expelled spray to 100°C.

This specialized defense mechanism, with enzyme-catalyzed chemical reactions and unique anatomy to properly store and mix the agents, would have to had worked perfectly from day one to be effective; it could not have evolved in stages. According to natural selection, an evolving defense spray would only confer an evolutionary advantage if it worked, and this system is all-or-nothing.

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