Index for A Place to Browse - The Food Insects Newsletter Home

THE FOOD INSECTS NEWSLETTER

NOVEMBER 1994 VOLUME VII, NO. 3

Some Insect Foods of the American Indians: And How the Early Whites Reacted to Them

There is a small fly *(Hydropyrus hians)*, belonging to the group known as "shore flies" (Diptera: Ephydridae), that formerly bred in vast numbers in the alkaline waters of Mono Lake and other alkaline lakes in the California-Nevada border region. It was called *kutsavi* (or variations thereof) by the Paiute and other tribes. The fly pupae washed ashore in long windrows. J. Ross Browne', who visited Mono Lake in about 1865, told of encountering a deposit of pupae about two feet deep and three or four feet wide that extended "like a vast rim" around the lake:

"I saw no end to it during a walk of several miles along the beach. ... It would appear that the worms [read fly pupae], as soon as they attain locomotion, creep up from the water, or are deposited on the beach by the waves during some of those violent gales which prevail in this region. The Mono Indians derive from them a fruitful source of subsistence. By drying them in the sun and mixing them with acorns, berries, grass-seeds, and other articles offood gathered up in the mountains, they make a conglomerate called *cuchaba, which* they use as a kind of bread. I am told it is very nutritious and not at all unpalatable. The worms are also eaten in their natural condition. It is considered a delicacy to fry them in their own grease. When properly prepared by a skillful cook they resemble pork 'cracklings.' I was not hungry enough to require one of these dishes during my sojourn, but would recommend any friend who may visit the lake to eat a pound or two and let me know the result at his earliest convenience .... There must be hundreds, perhaps thousands of tons of these oleaginous insects cast up on the beach every year. There is no danger of starvation on the shores of Mono. The inhabitants may be snowed in, flooded out, or cut off by aboriginal hordes, but they can always rely upon the beach for fat meat."

William Brewer[2], a professor of agriculture, had sampled *kutsavi* during a visit to Mono Lake in 1863. Noting that hundreds of bushels could be collected, he wrote:

"The Indians come far and near to gather them. The worms are dried in the sun, the shell rubbed off, when a yellowish kernal remains, like a small yellow grain of rice. This is oily, very nutritious, and not unpleasant to the taste, and under the name of *koo-chah-bee fon-ns* a very important article of food. The Indians gave me some; it does not taste bad, and if one were ignorant of its origin, it would make fine soup. Gulls, ducks, snipe, frogs, and Indians fatten on it."

Somewhat earlier, in 1845, Captain John C. Fremont was impressed with a windrow of *kutsavi* which he described as 10-20 feet in breadth and 7-12 inches deep. Fremont related an experience told to him by an old hunter, Mr. Joseph Walker. Walker and his men had surprised a party of several Indian families encamped near a small lake who had abandoned their lodges at his approach, leaving everything behind them:

"Being in a starving condition, they were delighted to find in the abandoned lodges a number of skin bags, containing a quantity of what appeared to be fish, dried and pounded. On this they made a hearty supper; and were gathering around an abundant breakfast the next morning, when Mr. Walker discovered that it was with these, or a similar worrn, that the bags had been filled. The stomachs of the stout trappers were, not proof against their prejudices, and the repulsive food was suddenly rejected."

The Mormon *cricket*, *Anabrus siniplex* (Orthoptera: Tettigoniidae), was another important insect food of the Indians, all over the West. It is not really a cricket, being more closely related to katydids. It is a large insect, about two inches in length, wingless, and it travels in large, dense bands. Bands may be more than a mile wide and several miles long, and with 20-30 or more crickets per square yard. It is sometimes damaging to crops or range vegetation and has been a pest target of the U.S. Department of Agriculture since before the turn of the century. Major Howard Egan' described, in his delightful first-person style, a Mormon cricket drive that took place in about 1850. The procedure was basically to dig a series of trenches, each about 30 to 40 feet long and in the shape of a new moon, cover the trenches with a thin layer of stiff wheat grass straw, drive the crickets into the grass covering the trenches, and then set fire to the grass. As the drive began, Egan thought the Indians were going to a great deal of trouble for a few crickets: "We followed them on horseback and I noticed that there were but very few crickets left behind. As t hey went down, the line of crickets grew thicker and thicker till the ground ahead of the drivers [men, women and children] was black as coal with the excited, tumbling mass of crickets." After the grass had been fired, Egan observed that in some places the trenches were more than half full of dead crickets: "I went down below the trenches and I venture to say there were not one out of a thousand crickets that passed those trenches."

Once the drive was over, the men and children had done their part and were sitting around while the women gathered the catch into large baskets which could be carried on their backs. We should remember that this was long before the days of the womens' movement, as Egan says, in obvious admiration:

SEE AMERICAN INDIAN INSECT FOOD, P. 2

American Indian Insect Food (from page one)

"Now here is what I saw a squaw doing that had a small baby strapped to a board or a willow frame, which she carried on her back with a strap over her forehead: When at work she would stand or lay the frame and kid where she could see it at any time. She soon had a large basket as full as she could crowd with crickets. Laying it down near the kid, she took a smaller basket and filled it. I should judge she had over four bushels of the catch. But wait, the Indians were leaving for their camp about three or four miles away. This squaw sat down beside the larger basket, put the band over her shoulders, got on her feet with it, then took the strapped kid and placed him on top, face up, picked up the other basket and followed her lord and master, who tramped ahead with nothing to carry except his own lazy carcass. There were bushels of crickets left in the trenches, which I suppose they would gather later in the day."

Egan learned that the crickets were used to make a bread that was very dark in color. They were dried, then ground on the same mill used to grind pine nuts or grass seed, "making a fine flour that will keep a long time, if kept

A certain species of aphid even provided the Indians with sugar--in the form of the sweet honeydew it secreted. In the early Mission records of California, Pere Picola wrote in 1702: "In the months of April, May and June there falls with the dew a kind of manna, which solidifies and hardens on the leaves of reeds from which it is collected. I have tasted some. It is a little less white than sugar, but has all the sweetness of it." Some of the Fathers considered this "manna" a dispensation from Heaven.

John Bidwell[9], a pioneer in the Humboldt Sink area in 1841, looked at the "manna' with a more discerning eye: "We saw many Indians on the Humboldt, especially towards the sink. There were many Tule marshes. The tule is a rush, large, but here not very tall. It was generally completely covered with honeydew, and this in turn was wholly covered with a pediculous-looking [louse-like] insect which fed upon it. The Indians gathered quantities of the honey and pressed it into balls about the size of one's fist, having the appearance of wet bran. At first we greatly relished this Indian food, but when we saw what it was made of--that the insects pressed into the mass were the main ingredient--we lost our appetites and bought no more of it."

dry" (this was often refer-red to as "desert fruitcake" by early settlers). Egan's Indian companion told him "the crickets make the bread good, the same as sugar used by the white woman in her cakes."

There were other efficient methods of harvesting Mormon crickets. One of them was to drive the crickets into a stream, circa *1864, as* described in the journal of Perter Gottfredson[5]: "The squaws [placed) baskets in the ditch for the crickets to float into. The male Indians with long willows strung along about twenty feet apart whipping the ground behind the crickets driving them towards the ditch.... [The crickets] tumbled into the ditch and floated down into the baskets. ... They got more than 50 bushels." In this instance, service berries and wild currants were mixed with the crickets to form the loaves of bread. In a similar account of floating the crickets into baskets, John Young states that they were caught by the tons.

Another method was to simply scoop up the crickets by the bushel when they were clustered under vegetation and too cold to be active. Beatrice Whiting' wrote of the Paiute: "The women went out early in the morning and caught them, were back by sunrise, and spent the rest of the day roasting, drying, and pounding them and putting them in bags to be cached for the winter."

There are few first-hand assessments of the flavor of Mormon crickets by early whites, for reasons that are apparent from the following excerpt from the reminiscenses of Captain Joseph Aram[7] who was in the Humboldt Sink in 1846: "We came to an Indian village, they came out in strong force but finding us friendly, they treated us kindly. They were digging roots on a creek bottom. They looked like a small red carrot. They gave us some that were cooked, they tasted like a sweet potato. They also offered us some dried crickets but those were declined, thinking they would not relish well with us." According to a modem account of the Honey Lake Paiute (Lassen County, California) by F.A. Riddell[8], when Mormon crickets were made into a soup, the flavor was somewhat like that of dried deer meat.

It wasn't until 1945 that the scientific identity of the aphid was determined. Volney Jones[10] established its identity as *Hyaloplerus pruni,* which is called the mealy plum aphid because it spends its winter phase on plum trees and other species of *Prunus.* In the spring and early summer it migrates to summer hosts, primarily the reed *grass, Phragmites communis,* where it produces the honeydew. The gathering of the honeydew seems to have been one of the annual seasonal rounds of activity of the Indians of the Great Basin. A family or band might camp for a short time near a strewn or lake when the honeydew was ready. By piecing together various accounts of the manner of collection, Jones gives the following picture: "The collection seems to have been primarily the work of women and children. The reeds were cut and carried away from the water .... Cutting was done just after sunrise, and the reeds were spread out to dry during the warmer part of the day to dry the honeydew and make it brittle. During the afternoon the reeds were held over a hide and beaten with a stick to dislodge the deposits of honeydew which fell on the hide and could be collected .... The honeydew was rolled into balls, wrapped in leaves, and stored in baskets until needed."

Many other insects contributed on a regular basis to the Indian diet, among them grasshoppers, cicadas, ants and ant pupae, wasp pupae and prepupae, certain beetle larvae and several kinds of caterpillars. Edible insect harvest was a part of the annual rounds of food procurement. The Indians knew exactly where to go, and when, to find the desired insects, and large numbers of people and considerable planning, travel and effort were often involved in harvesting them (Sutton"). Some insects such as the Mormon cricket, grasshoppers and pandora moth caterpillars yielded a very high energy return for the energy expended in their harvest, often much higher than return rates from seeds or other plant food resources. And, when dried, the insects were storable for use as winter food.

SEE AMERICAN INDIAN INSECT FOOD, P. 10

Insects as Remedies for Illnesses in Zaire

Tango Muyay Flavien Antonio
Research Associate at CEEBA
B.P. 456
Bandundu, Zaire

(Ed.: Tango Muyay is the author of the 177-page book, *Les Insectes Comme Aliments de LHomme,* published in 1981 (reviewed in the July 1991 *Newsletter).* Mr. Muyay informed me that his studies are in "a terrible financial crisis.' Any organization (or individual) who would like to provide some financial support for his work should contact him. Thanks to Cynthia Zick for translating this paper from French to English.)

For the 18 remedies discussed below, the local name of the insect is given first, followed by the French and English names, then the condition(s) or illness(es) treated, and lastly, the method(s) of preparation and use.

L.NKAAM
fourmi rouge tremblant
trembling red ant

Muyeem (bronchitis)

Because of the sticky saliva of the ants, the solution helps the patient recover his normal respiration.

The entire ant or ants are used, one uses the whole nest. The healer places the ants in a bowl made of forest leaves; he mixes it with sweet and clear water and gives it to the patient to drink. Duration of treatment: up to one week.

Second use: aid in child-birth. These insects have a common name meaning "child-birth aid" because of the sting they leave on the body of the woman who is in the height of childbirth. Thanks to these ants the woman will give a breath to make the baby come out

2. MPAY LAAR
sauterelle
grasshopper

Violent headaches.

The healer crushes the dry grasshoppers and ashes; he mixes the ashes of the grasshopper with a little organic salt. He makes incisions on the nape and front of the patient. He then applies the solution on the incisions. This stings a lot and the

3. NGANKOY
guepe maconniere
worker wasp

Strengthens a weak infant.

The healer takes the nest of the wasp, crushes it in a glass of water, and has the infant drink it. Also, she rubs it into the skin 0 over the body of the infant. The nest of the worker wasp has a substance which gives life strength to the weak.

4. KEMBAAR
cafard or blatte
cockroach

Cures scabies/mange caused by the animal cockroach.

The entire animal is used. The mother, or the patient if it's an adult, takes several cockroaches and bums them. He mixes the ashes with palm oil. After each bath one rubs it on the body until the scabies is cured.

5.KAYAKUA
nwnte religieuse
praying mantis

Epilepsy.

The entire animal is used. The healer places the whole mantis in a pot with boiled aromatic leaves. He washes the entire body of the patient

6. KENBUL MPIAK
chenille construiseur,
builder/worker caterpillar

Hemorraging during childbirth, or before, i.e., during pregnancy

The nest and entire caterpillar is used. The healer crushes the nest and the caterpillar, and equally crushes the red earth called 'largile nkol". He makes a mix and makes the woman drink it, and die hemorrhaging stops.

7. N'ZO MUSIEN
tennite
termite

Internal hemorrhaging

The nest of the termite is used. The specialist removes the bark of the "Muton" (a tree which gives red bark). He puts these in a broken pot and mixes them with the nest of termites. He has the patient drink a little of this solution and places it on the "composition".

Second use: heals hemorrhage from a wound. The healer mixes the nest of termites with wild leaves.

8. NKWAZEB
luciole or ver luisant,
glowworm

Chasing the spirits/boogey-men from an infant when

patient must sleep a lot. Duration of treatment at least 3 days.

with this and has him drink it. Duration of treatment: one week.

he's having nightmares

Insect Remedies in Man (from page 3)

The healer takes several glowworms, mixes them with ashes from the cooking fire where the infant resides. He has the victim drink a small quantity, which he has put in a glass of water. The mother rubs this same mixture on the forehead, head, ears and nape of the infant. Symbolism of the glowworm; vanquishee of sorcerers, and of evil spirits. The ashes signify the invisibility of the infant.

9. **NGOBO**
abeille
bee
Cures stuttering

The healer places several bees in a calabasse (gourd-bowl) of palm wine. He pours a glass of wine which contains several bees and has the stutterer drink it. The moment he drinks, the healer touches the nape and emits sounds like a bee.

10. **MPAYENZO**
criquet domestique
domestic cricket
Cures stuttering

The healer takes the domestic cricket and has the stutterer eat it After eating it, he puts his tongue on the opening of a casserole dish. The healer and several assistants insult and mock the patient so that he can definitely abandon stuttering.

11. **KENGUAPOB**
papillon,
butterfly

Heals illnesses of the ears

The nymph-larvae-worm stage in his cocoon is used. The healer puts the nymph and his cocoon in a cone made with wild leaves. She puts in the. aromatic plant "Losaal Nzian" *(aile de Dieu;* wings of God), adds the cocoon, a hot coal with fire, and blows the smoldering smoke on the ears of the patient. When the heat has touched the ears, the illness will be cured.

12. **NKUKAB**

chenille qui niche dans lesfeuilles, la plus grosse chenille
caterpillar who hides in the leaves,
the fattest caterpillar

Elephantiasis of the arms.

The whole caterpillar and his excrements are used The healer receives the patient at his home. He makes incisions on the swollen arms, makes ashes of the caterpillar and mixes this with vegetable salt. He then applies the solution on the incisions.

By certain traditions, this caterpillar is often living in the trees which grow in the ancient place of the village. If the genie/spirit resides there, and the caterpillar NKUKAB also resides there, the caterpillars become the infants of the genie. Since they are edible insects, if a person or (?) takes one, he will be pursued by the genie and in consequence, he will be struck with elephantiasis.

13. **KEBTY**
mouche tse tse
tse-tse fly

To avoid the sleeping sickness after having been bitten by the tse-tse fly.

The person stung by the tse-tse fly, after having captured this fly, he I crushes it. He rubs it on his skin, and making an incision, applies it there. After this he will not be affected by the sleeping sickness (trypanosemiase).

14. **NGUNDUMUGUN** (Mbala language) and **KENDER MAZA** (Fansi language)
abeille tlquatique,
aquatic bee

To end exaggerated menstruation. The healer, after fishing for this insect, places it in a pot with a piece of clothing from the woman who's menstruating. He bums these to make ashes. She gives the cinders to the patient who applies them in her vulva each time after bathing.

According to certain traditions, when you see a girl or woman having exaggerated Menstruation, it is said that she is struck by a genie/spirit of the pond where the insect lives.

15. **MBWIIDI**
soldats de termites
soldier termites

To revive someone who's fallen into a syncope/blackout/fainting fit.

The whole animal is used. The specialist takes the soldier termites and puts them in a container, into which he's already put the sap of tobacco leaves/tobacco juice. The live insects are absorbed into this substance. He places them on the body of the patient, when the termites bite the patient, he will wake up and quickly regain consciousness. The tobacco juice used here signifies the remedy, the substance which will bring the patient to full consciousness. The soldier termites are used like an injection/shot in the arm.

16. **BENTIEY**
insectes salivaires, comestibles
salivating insects, edible

stops exaggerated salivating

The specialist takes the BENTIEY insects. He prepares them by cooking them with the meat of the gourd called "Nta mbien." Very hot, the patient eats the solution. After one -week of this meal, the person will no longer salivate excessively.

17. **KENZI&NZIIE**
insect aquatique non-comestible, autrement dit insectelion
water-bug, non-edible, also called the lion bug

Insanity, craziness

The specialist captures the water bugs, and has the patient eat the insects mixed with mud from the same river. These insects calm insanity.

18. **MUNKUUK**
fourm-lion
lion-ant

To relieve and cure a high fever

The person accompanying the Patient takes he lion ant and makes it bite the patient.

Some Follow-Up Discussion Professor Berenbaum's Article on the Sequestering of Plant Toxins by Insects

The article, "Sequestered Plant Toxins and Insect Palatability" appeared in the November 1993 issue of *The Food Insects Newsletter.* We were (and are) grateful to May Berenbaum, professor and head of the Entomology Department at the University of Illinois, for responding to our request for such an article, setting forth some of the principles pertaining to this subject. Similarly, Professor Murray Blum of the University of Georgia prepared an article for the *Newsletter* on toxic compounds synthesized within the body of the insect; this appeared in the March 1994 issue. Then, in April we received a note from a reader in Illinois which said, "Please remove my name from your mailing list. I enjoy reading the *Newsletter*--but it encourages me to be a fulltime vegetarian! Thanks much!"

Some readers, particularly some with little background in entomology, Berenbaum cautioned about aposematic, or brightly colored species, which frequently are black, red, yellow, orange, or combinations of these colors. Dutifully, *Zonocerus* adults (based on Z. *elegans)* are dark greenish with bold patterns of black, yellow and orange. Berenbaum also cautioned about conspicuous behavior (such as leisurely flight) being indicative of chemical protection. *Again, Zonocerus (Z. elegans)* complies. Both nymphs and adults are sluggish and gregarious, many specimens are short-winged and cannot fly. *Zonocerus* goes one step further in trying to warn would be predators not to eat them. The adults have a characteristic odor which is unpleasant and they are sometimes called "stink grasshoppers" (Hill 1983).

So, why should they be chosen as food by anybody? Good question, although not directed at anybody in particular. What is the physiological basis for the unpleasant odor? Just guessing, it would seem likely the result of a synthesized chemical rather than one sequestered from a plant. Quin (1959), who reported Z. *elegans* as food in S. Africa, mentions it as a serious pest of garden plants and says nothing about an odor. Also, neither

probably overlooked the import of the Editor's introduction to each of the above papers, noting that they dealt with "potential hazards that could be posed by indiscriminate consumption of insects." Actually, it was our intention to include with each article a follow-up interview with the authors in order to immediately clarify the specific relevance of toxins in those insect groups that have been widely used as food by humans. Unfortunately, it didn't happen because of time and space limitations. But, we're finally getting to it with some additional discussion of sequestered compounds below and of insect-synthesized compounds in the next issue of the *Newsletter.*

The articles by Berenbaum and Blum show clearly why it is not a good idea to collect insects willy-nilly for eating. In cultures that have routinely used insects as food for centuries, however, one would expect that those species presenting a substantial toxic threat would have been screened out long ago simply on the basis of user experience. Berenbaum presented a "fairly comprehensive" list of species known to sequester hostplant toxins, 62 species belonging to 49 genera in 18 families. When one checks this list against a list of the nearly 400 genera containing species that are used as food, it is not surprising to find that there is only one solid overlap, the genus *Zonocerus* in the grasshopper family Pyrgomorphidae.

Professor Berenbaum noted that only a "tiny fraction" of herbivorous insects have been studied for their sequestering characteristics. But even when data become available on a greater number and variety of species, it seems logical to expect that long user experience will be found to have effectively screened out most of the toxic species.

There are only two described species of *Zonocerus.* Berenbaum's table shows Z. *variegatus* as sequestering pyrrolizidine alkaloids from Leguminosae and Z. *elegans* sequestering cannabinoids from Cannabinaceae. Z. *variegatus* is eaten roasted in southern Nigeria, where large dry season populations may develop (A.E. Akingbohungbe, pers. comm. 1988; Fasoranti and Ajiboye 1993), and Z. *elegans*, which has a wide distribution in Africa, was reported by Quin (1959) as a food of the Pedi in South Africa.

Akingbohungbe nor Fasoranti and Ajiboye who discuss *Z. variegatus* as food in Nigeria mention anything about an unpleasant odor. I don't recall either that Scholtz and Holm (1985) mention odor in relation to *Z. elegans* in southern Africa although I don't have their book in hand at the moment. According to Hill (1983), plants attacked by *Z. elegans* include cassava, finger millet, cocoa, castor, coffee, cotton, sweet potato and a variety of weeds, and it is an especially severe pest on crops in the seedling stage. Can it be that insect populations having a wide hostplant range vary in toxicity (and odor?) from one geographic area to another, depending on which host plants are mainly utilized? Or depending on different toxin concentrations in the same plant species in different regions? Professor Berenbaum pointed out, citing as an example *Asclepias syriaca* and the monarch butterfly in North America, that specific plant species vary widely in the chemical composition of their tissues and thus the insects that eat those plants may "show tremendous variability in their toxin content." Or, in the case of odor, is itjust that ies not a deterrent as it isn't in the case of several species of "stink bugs" of the hemipteran family Pentatomidae used in parts of Asia and elsewhere?

There is one other overlap of food insects with Berenbaum's list, but it's rather a technicality. Berenbaum lists *Arctia caja* (family Arctiidae) as sequestering cardenolides from Asclepiadaceae and Scrophumaceae, and pyrrolizidine alkaloids from Compositae. Powers (1877) reported that larvae of two species of *Arctia,* known as "shek" were eaten by the Nishinam of Pacer County, California. According to Amett (1985), however, *A. caja americans* is the only North American representative of the genus, so the observation may well represent a misidentification by Powers. The larva of A. *caja* is a general feeder, according to Arnett.

Professor Berenbaum noted that "there are insect families in which sequestration is certainly more widespread than in most" and mentioned specifically the Lygaeidae (seed bugs, Hemiptera), Aphididae (aphids) and Coccoidea (scales, Homoptera), Chrysomelidae

SEE BERENBAUM, P. 6

Berenbaum (from page five)

(leaf beetles, Coleoptera), and "a host of caterpillars" in the Papilionidae, Nymphalidae, Arctiidae and Pieridae (Lepidoptera). Again, it is interesting that reported food insects are almost absent from these families. So far as known to the editor, among the hundreds and hundreds of species reported as food, none are in the Lygaeidae or Papilionidae, only one each in the Aphididae (honeydew in western N. America), Chrysomelidae (in Mexico), Nymphalidae (in Zaire) and Arctiidae (the questionable record discussed above), one or two in the Coccoidea (Australia) and two in the Pieridae (Mexico). Larvae of one of the Mexican pierids, *Eucheira socialis,* feeds on madrone *(Arbutus* spp.) leaves which contain glycosides. The pupae are roasted and sometimes mixed with corn gruel by the Tarahumara Indians, and Tarahumara who eat large numbers of the pupae sometimes vomit or develop headaches (see Kevan and Bye 1991; these studies were summarized in the July 1992 and July 1993 issues of the *Newsletter).*

Another point made by Berenbaum was that, for entomophages it is nice to know where your potential insect meal last dined. A case report of a poisoning in S. Africa puts an exclamation point at the end of that advice. Steyn (I 962) described the case history of a 4-year-old Swazi child who died after eating a single grasshopper of the *species, Phymateus leprosus.* This species is not eaten by adult Swazis because they know it to be poisonous. Rabbits dosed by stomach-tube with freshly minced grasshoppers exhibited toxic symptoms of the heart and respiratory system. It was not determined whether the toxicity was caused by the insect itself or by toxic plant material that it had ingested. *P. leprosus* often feeds on the leaves of wild cotton or milk-bush *(Asclepias fruticosa)* and on Ceylon rose *(Nerium oleander),* and both plants are active heart poisons.

And, by the way, May, you mentioned that insects that sequester certain hostplant toxins might be used as flavoring agents, stimulants, or even as narcotics. There is evidence that certain Indian tribes ingested ants (accompanied with fasting) to produce hallucinogenic or mind-altering effects and a number of potentially mind-altering substances have been isolated from ant toxins. I have no idea whether the toxins are sequestered or synthesized, but by way of contributing to the preventive drug control effort, I shall refrain from revealing the identity of the ants.

And, finally, a specific question. Humans are the only predators that cook most of the food they eat. Although some insects are eaten raw, most are fried, roasted or cooked in some other manner. What happens to these aceous toxins, by accelerating oxidative decomposition at high temperatures, and by dissolving or diluting toxins. Cyanogens were specifically cited as compounds that are oxidized by cooking; inasmuch as these compounds are sequestered from hostplants by some insects (e.g., *Seirarctia echo),* cooking would likely drive down the toxic glycoside content of the sequesterers much as it does plant tissue. How ancient the practice of cooking insects is has not been established, as least as far as I can tell; I haven't found any anthropological references to charred insect remains in archaeological sites. How well these remains would be preserved, however, is anyone's guess; humans have been cooking for at least 300,000 years. It is important to note, though, that not all plant chemicals are rendered nontoxic by cooking; furanocoumarins, photocarcinogenic and phototoxic components of edible parsnip *(Pastinaca saliva)* are completed unaffected by boiling or microwaving, a fact that does little to bolster the already rather minimal appeal of parsnip as a vegetable (Ivie *et al* 198 1).

It should be mentioned as well that other forms of food preparation that reduce toxicity of plant materials have their parallels in the processing of insect food items. For example, plant foods are rendered more palatable and less toxic by selective removal of certain parts that are particularly high in toxin content; peeling potatoes, for example, removes a substantial portion of the total glycoalkaloid content of the tubers. Although insects are rarely peeled before eating (no doubt a laborious and time-consuming task only for the agile-fingered), they are often chopped and sectioned in such a way that noxious glands and their contents can be removed.

Finally, with respect to the comment that "humans are the only predators that cook most of the food they eat"--not to quibble, but there is at least one other entomophagous species that engages in a process similar in several ways to cooking. Loggerhead shrikes *(Lanius ludovicianus)* impale insect and other prey on large thorns or barbed wire prior to consuming it. Yosef and Whitman (1992) observed these birds in central Florida impaling *Romelea guttata, a* large and highly poisonous lubber grasshopper, and returning after one or two days to eat them. These grasshoppers, which sequester a staggering array of plant chemicals from their many hosts as well as manufacture endogenous defensive compounds, are repellent and even outright toxic to most vertebrate predators in the area. Indeed, these insects are distasteful to the birds while they are alive; only after ageing one to two days do these insects become palatable. Considering daytime temperatures in central Florida between June and September, when these tests were done, it is entirely possible that these rubbers lost their toxicity due to the fact they

sequestered plant toxins when they are subjected to the heat of cooking?

Professor Berenbaum:

In response to your specific question, as far as I know, nobody has specifically investigated the fate of sequestered plant toxins in fried, roasted, or otherwise processed food insects; I Would venture to guess, however, that cooking has the same effect on plant chemicals whether they are housed in plant resin ducts or insect storage glands. Leopold and Ardrey (I 972) described three ways that cooking acts to remove toxic substances from plant foods: by denaturing protein-

were spit-roasted in the sun.

References

Arnett, R-H. 1985. *American Insects: A Handbook of the Insects of America North of Mexico.* Florence, Kentucky: Van Nostrand Reinhold.

Fasoranti, J.O.; Ajiboye, D.O. 1993. Some edible insects of Kwara State, Nigeria. *Amer. Entomologist* 39(2):113-116.

SEE BERENBAUM, P. 8

A Baltimore Sun article (minus two photos) reprinted by permission, *The Baltimore Sun,* Copyright, 1994.

One man's pest is another's delicacy

People swarm to sample bugs

by Shirley Leung, *Sun* Staff Writer

Something spicy and greasy filled the air at the Oregon Ridge Nature Center yesterday afternoon.

"Smell's good," said 9-year-old Caitlin O'Connor as she reached over to grab a handful of "caterpillar crunch," a pan-fried mix of pecans, cumin, cayenne pepper--and mealworms. "The bad thing is that I don't like nuts. So I'll just eat the bug," she said, popping the inch-long rust-colored worm into her mouth. "Tastes like Japanese food-Japanese chicken," she exclaimed. Twenty-five other culinary daredevils tasted "caterpillar crunch," "wax-worm corn fritters" and "chocolate-covered crickets" at a demonstration at the Cockeysville nature center yesterday. Another session on eating bugs will be conducted today. "If you think about it, a mealworm is not really different from a small shrimp," explained Adrienne van den Beemt, 19, an Oregon Ridge counselor and amateur bug chef. "Like anything, they take a bit getting used to. Some say mealworms taste like creamy shrimp."

The idea of a two-hour seminar on how to catch and eat bugs was Ms. van den Beemt's concoction. For the past six months, she has researched the subject and become an avid reader of *The Food Insects Newsletter* published by the University of Wisconsin at Madison.

To prepare worm dishes, Ms. van den Beemt advised freezing them first. "This is the most humane way to kill them," she said. She advised taking the legs and the wings off crickets and grasshoppers because they're "scratchy." "What about the fuzz on caterpillar? someone asked. "They should be singed off," said Ms. van den Beemt. The insects are then added to regular recipes--like adding nuts to cookie batter. For example, the "wax-worm corn fritters" are just like plain fritters with soft white caterpillars poking out of them. Waxworms "were kind of juicy--like a fruit candy with juice in the middle," said Brentt Holmes, 14, of Columbia. "When you bite into them, all the juice comes out."

Yesterday's session had families swiping butterfly nets in a stalky field to catch grasshoppers and crickets. But the variety of insects tasted--the mealworms, wax-worms and crickets--all can be bought from animal food stores, says Ms. van den Beemt.

Entomophagy, the practice of eating insects, is common around the world except in the United States and Europe, say entomologists, Since humans have roamed the earth, they have been eating insects, ranging from termites in Africa to honeybees in Nepal to grasshoppers in Japan.

An issue of *The Food Insect Newsletter* reports that 80 percent of the worlds population eats insects intentionally--and 100 percent eat then unintentionally. Most insects are eaten as a way to supplement diets and are even considered delicious. By weight, termites, grasshoppers, caterpillars, weevils, houseflies and spiders are better sources of protein than beef, chicken, pork or lamb, according to the Entomological Society of America. Insects are also sanitary, low in cholesterol and low in fat.

"Americans have negative impressions of insects and chances are you aren't going to eat them," says Justin Schmidt, an entomologist at the Carl Hayden Bee Research Center in Arizona. "Now you look at crabs and lobsters. Do you know what they eat? Everything that dies," notes Mr. Schmidt. "But you won't eat a mealworm that eats grass and nice things we eat."

But not all bugs are edible: nor are they tasty. "Insects that taste bad, they usually advertise it," warned Ms. van den Beemt. "If you see an insect with colors, chances are you don't want to pop it in your mouth." So, for example, avoid monarch butterflies, she advised.

Yesterday's bug bites gained followers. Many asked for recipes and places to buy bugs. "I like the idea of getting food from another source," said Phyllis Bomeman of Timonium, who brought her two grandchildren along. "All three [recipes] were very good. The corn fritters reminded me a lot of soft crabs. It's good eating."

It was an all-around great day for edible insects at Oregon Ridge Nature Center

We received some interesting follow-up on the Oregon Ridge event. To show that edible bug news generated in Maryland is also edible bug news in Utah, Tim Bowers-Irons of Salt Lake City sent an abbreviated version of the Sun article which he clipped from the *Deseret News* of August 8-9. That it was a truly quality day at Oregon Ridge was further indicated in a letter from someone who attended the event:

Dear Dr. DeFoliart:

My wife and I enjoyed a splendid lecture and field trip and demonstration on Food Insects at the Oregon Ridge Nature Center leading me to ask for whatever number of past, present and future copies of your newsletter that can be provided and mailed.... This 2 hour exercise was conducted by a 19 yr-old counselor at the park named Adrienne van den Beemt with a degree of knowledge, charm, enthusiasm and audience captivation, free of self consciousness, that was barely believable to me, who has been on the giving and receiving end of scientific teaching since 1935. Keep an eye on this gal.

Sincerely, (signed)
William E. Grose
Assoc. Prof. Surgery, Emeritus
Johns Hopkins Med School

And finally, a letter dated August 16 from the organizer herself:

SEE OREGON RIDGE, P. 8

Oregon Ridge (from page seven)

Dear Dr. DeFoliart,

Hello! May name is Adrienne van den Beemt, and I am a second year student at the University of Michigan as well as a Naturalist at the Oregon Ridge Nature Center in Cockeysville, Maryland.

Commercial sources of edible insects

In the November 1992 *Newsletter* we published the addresses and telephone numbers of seven commercial sources from which crickets, mealworms or waxworms can be ordered. For new readers who have come aboard since then or

The weekend of August 6 and 7, 1994, I held a program called "Eatin' Bugs at Oregon Ridge". I had been a little nervous about conducting this program because I had never heard nor seen such a program run before. It went splendidly--with the invaluable help of your *Food Insects Newsletter.* I credit your publication with 90 percent of the information and recipes that I shared. Our nature center had issues back to 1988, and I must have gone through at least twenty newsletters during my research. I really do think that there are no better references around! They were absolutely wonderful--fascinating--and I have recommended *The Food Insects Newsletter* to everyone who lets me!

Around 30 people each day sampled Caterpillar Crunch, Worm Fritters, and Chocolate-Covered Crickets. People loved the cuisine--plates were licked clean, and I had several requests for recipes. The *Baltimore Sun* ran a story on August 7, 1994, which I have enclosed. The next day I found out that the story had been picked up by the Associated Press. Since then, I have been bombarded with calls from radio stations from Virginia, California, Pennsylvania, Michigan, Montana, and even from Austria and South Africa!

The program was an absolute success! I'd like to thank you wholeheartedly for your help and commend you on such a unique and resourceful newsletter…

Sincerely, (signed)
Adrienne van den Beemt

will come aboard in the future, it seems a good idea to re-list one or two of these in each or nearly each issue when and as space permits. Starting alphabetically:

Armstrong's Cricket Farm
PO Box 125
West Monroe LA 71294-0125
For orders: 1-800-345-8778.
For inquiries: 318-387-6000.
Available: crickets.

Bassetts Cricket Ranch
535 North Lover's Lane
Visalia CA 93292
1-800-634-2445.
Available: crickets, mealworms.

Berenbaum (from page six)

Hill, D.S. 1983. *Agricultural Insect Pests of the Tropics and Their Control*. London: Cambridge Univ. Press.

Ivie, G.W., HoIt, D.L., Ivey, M.D. 1981.Natural toxic ants in human foods: psoralens in raw and cooked parsnip root. Science 213:909-910.

Kevan, PJ.; Bye, R.A. 199 1. The natural history, sociobiology, and ethnobiology of *Eucheira socialis* Westwood (Lepidoptera:Pieridae), a unique and little-known butterfly from Mexico. *The Entomologist* 110(4):1146-1165.

Leopold,A.C.,Ardrey,R. 1972.Toxic substances in plants and the food habits of early man. *Science 176:512-514.*

Powers, S. 1877. Tribes of California. *Contributions to North American Ethnology.* Vol. HI. U.S. Geograph. & Geol. Surv. of Rocky Mtn Region, Dept' Interior, pp. 430-431.

Quin, P.J. 1959. *Foods and Feeding Habits of the Pedi*. Johannesburg: Witwatersrand Univ. Press.

Scholtz, C.H.; Holm, E. 1985. *Insects of Southern Aftica.* Durban: Butterworths.

Steyn, D.G. 1962. Grasshopper *(Phymateus leprosusfabr.) poison*ing in a Bantu child. *S. Aft. Med. J.* 36:822-823.

Yosef, R. and D.W. Whitman, 1992. Predator exaptations and defensive adaptives in evolutionary balance: no defence is perfect. *Evolutionary Ecol.* 6:527-536.

Berenbaum: One more note, your plan for preventing drug abuse by not revealing the identity of ants that produce mind-altering substances may come to naught. Recently the Associated Press wire service ran a story about ant abuse in Dubai, listing not only the commercial product name--Sarnaseem--but also the going price.

Ed.: Dr. Berenbaum enclosed a news clipping of the AP story which was sent to her by a friend in California. The story must have had wide circulation. We also received copies from Dr. John Medler who saw it in *The Honolulu Advertiser* of September 11, and from Ed Abbot who saw it in the *San Francisco Chronicle*, same date. So it may be hard to keep this cat from getting out of the bag. As printed in the *Advertiser:*

Teens in Dubai get high on ants

Manama, Bahrain (AP) - Even the lowly ant isn't safe from Persian Gulf teenagers in search of exotic new "highs."

Adolescents in the free-wheeling port of Dubai are smoking the tiny insects or sniffing the fumes they emit when crushed, The English language, *Gulf News* reported.

Hameed el-Khafeef of the Dubai police forensic lab was quoted Friday as saying a number of youths were arrested for intoxication after getting high on ants. The practice has become so popular that a small packet of "Samaseem"--Gulf Arabic for ants--sells for up to $135 in the emirate of Abu Dhabi, the newspaper said.

The Persian Gulf has been a lucrative market for illicit drugs since the oil boom of the 1970s. But the daily quoted Dubai police as saying youngsters are trying alternative substances either because they can't afford the usual narcotics, heroin and hashish, or they believe they won't be prosecuted for getting high on ants.

Letters ....

Ants a $100 million business in China

From **Dr. Sachi Sri Kantha,** Osaka Bioscience Institute, Osaka, Japan, in part:

Also enclosed is a news item which I located early this month in the *Asahi Evening News*, entitled "Ant foods make big bucks in China." I'm not sure whether you have seen this. If not, you may be interested in the sales figures quoted. According to my calculation (please check it again, if you wish to quote this news item in a future newsletter), annual sales for ant foods in China amount to approximately $100 million.

Morton Bay Bugs aren't bugs

From **Dr. Yves Prevost,** Lakehead University, Thunder Bay, From **Dr. John Medler,** Bishop Museum, Honolulu, Hawaii, in part:

You may know about this NTV 1992 production, "Harvesters of Honey," which tells the story of the Himalayan honey bee and the villagers who risk death to harvest their honey and beeswax. It was seen on Public Television in Honolulu on August 6, 1994. It was a good presentation, and for a few seconds near the end of the program, there were good shots of natives eating wild honeybee larvae in the combs.

Some people just say nice things about the *Newsletter* or tell us how it's useful

From **Dr. John** G. **Stoffolano, Jr.,** Department of Entomology at the University of Massachusetts, Amherst, in part:

Keep up this excellent work. It is a great boost for entomology.

Ontario:

Just read the July 1994 issue of the *Newsletter.* It is great reading. Keep up the great job. Just to answer your question about Morton or Moreton Bay Bugs. No, they are not insects. They are shrimps (species??). Enclosed is an Australian (Rio's in Cairns) menu where they are featured.

(Ed.: About a dozen readers informed us that Morton Bay Bugs are not bugs, but Yves was the first one we heard from. It seems that everyone knew, except the editor.)

Edible insects gaining educationally

From **Dr. David** Rivers, Assistant Professor of Biology at Loyola College in Maryland, in Baltimore, in part:

I was hoping that I might be able to obtain a few of the newsletters you produced concerning insects as food, particularly any that contain recipes (even photocopies would be a great help). I am developing a laboratory for my General Entomology course that will focus on insects as a food source for humans and I wanted to incorporate an insect eating experience for the students. Several graduate students in Entomology at Ohio State University have added an insect-eating day to their labs and the students seem to really enjoy this topic ....

(Ed.: Professors at quite a few colleges and universities are now including a lecture/lab on edible insects in their entomology/biology courses, and the number is steadily increasing.)

From **Karl Winneker,** Pollock Pines, California, in part:

Find enclosed... for *The Food Insects Newsletter.* My students find it to be a high interest publication.

From **Dr. Barrett P. Brenton,** Department of Anthropology, Grinnell College, Iowa, in part:

I would like to continue receiving *The Food Insects Newsletter* ... . As a nutritional anthropologist I find it to be extremely useful as a reference and network for discussing cross-culture perspectives on food habits and issues dealing with international nutrition.

From **Dr. Samuel Kyamanywa,** Department of Crop Science, Makerere University, in Kampala, Uganda, in part:

I wish to express my sincere thanks to you for having kept me posted with *The Food Insects Newsletter. Since* I started receiving this *Newsletter* my courage to influence decision makers to research on edible insects of Uganda has increased. I will be sending you in due course a paper I presented in a conference on alternative sources of food....

(Ed.: We've heard similarly from a number of scholars in developing countries. The wider the network of information and knowledgeable people becomes, the easier it is for everybody in making the case.)

Roger D. Akre

We sadly report the death, on August 16, 1994, of Dr. Roger D. Akre, Professor of Entomology at Washington State University, Pullman. Dr. Akre, only 57 years old, was one of our most productive ant and wasp researchers, and a frequent contributor to the *Newsletter.* We thank Dr. Gregg Henderson for notifying us.

American Indian Insect Food (from page two)

In several localities, pandora moth caterpillars *(Coloradia pandora)* are still harvested by elderly Paiute. Called *piuga by* the Indians, the caterpillars feed primarily on the needles of the Jeffery pine and when fully grown descend the tree trunk to pupate in the soil. They sometimes occurred in great numbers and were collected in trenches dug around the bases of the trees. They were then roasted by mixing them with hot sand. *Piuga* is regarded by the Paiute as "a tasty, nutritious food that is especially good for sick people, much like our chicken soup," according to Elizabeth Blake and Michael Wagner[12] , two researchers at the University of Northern Arizona. In former times, according to the late E.O. Essig[13] (formerly an entomologist at the University of California-Berkeley), hungry whites who tasted piuga claimed that boarding with the early Californians on the American plan was not so good."

Finally, among the insect foods of the western Indian tribes, none were more widely harvested than grasshoppers. They were most often collected by using what hunters call a "surround." H.M. Chittenden and A.D. Richardson", in their account of the life and travels of the French missionary, Father Pierre-Jean De Smet, described the "surround" used in a Shoshoco grasshopper hunt *(circa* 1850): "They begin by digging a hole, ten or twelve feet in diameter by four or five deep; then, armed with long branches of artemisia, they surround a field of four or five acres, more or less, according to the number of persons who are engaged in it. They stand about twenty feet apart, and their whole work is to beat the ground, so as to frighten up the grasshoppers and make them bound forward. They chase them toward the centre by degrees--that is, into the hole prepared for their reception., Their number is so considerable that frequently three or four acres furnish grasshoppers sufficient to fill the reservoir or hole."

A variation of the Shoshoco procedure was to build a fire covering 20 to 30 feet square. The people then formed a large circle around it and drove the grasshoppers onto the hot coals. Sometimes a field was simply set afire, and the scorched grasshoppers were picked up afterward. Or as in the case of Mormon crickets, grasshoppers could be collected by hand in the early morning while they were too cold to be active.

Edwin Bryant[15] *(circa* 1848) provided one of the few assessments of grasshopper palatability by a white, following an encounter with Utah Indians, an occasion when three women appeared, "bringing baskets containing a substance, which, upon examination, we ascertained to be service-berries, crushed to a *jam* and mixed with pulverized grasshoppers. This composition being dried in the sun until it becomes hard, is what may

Prejudice aside, I have tasted what are called delicacies, less agreeable to the palate."

Nutritionally, insects are high in protein, fat (and thus energy) and many of the important vitamins and minerals. They have served as traditional foods in most cultures of non-European origin and have played an important role in the history of human nutrition not only in western North America, but in Africa, Asia and Latin America. As might be expected from our European cultural heritage, some early American whites looked with open disgust at the insect foods of the American Indians. It is interesting, though, that so often, as shown by the above. examples, these cross-cultural encounters relative to food seemed dominated by feelings of mutual tolerance, curiosity and respect and were described with a sense of humor.

Gene R. DeFoliart, Editor

(Ed.: This article was originally written two or three years ago at the invitation of a travel and outdoor magazine published in California. When the magazine went on a reduced publication schedule, we got our manuscript back. Nobody likes to throw away a manuscript that's already written, so we decided *that Newsletter* readers might enjoy it.)

Addendum: This wasn't included in the original manuscript, but I think the second of the two paragraph, below quoting Father Kino (as found in Bolton 191916) is one of the more humorous passages (because of Kino's religious candor) that I have encountered in the older North American literature. Kino labored in California, Arizona and Sonora. In the first paragraph, he is talking about aphid honeydew. The second paragraph is more on spiritual matters, and from Father Kino's account it seems questionable as to who was converting who:

"In order that sugar, which with so great artifice and toil is made over here, may not be lacking to the Californians, heaven provides them with it in abundance in the months of April, May, and June, in the dew which at that time falls upon the broad leaves, where it hardens and coagulates. They gather large quantities of it, and I have seen and eaten it. It is as sweet as sugar to the taste, and differs only in the refraction, which makes it dark." (II:56).

"All this fertility and wealth God placed in California only to be unappreciated by the natives, because they are of a race who live satisfied with merely eating .... By nature they are very lively and alert, qualities which they show, among other ways, by ridiculing any barbarism in their language, as they did with us when we were preaching to them. When they have been domesticated they come after preaching to correct any slip in the

be called the 'fruitcake' of these poor children of the desert. No doubt these women regarded it as one of the most acceptable offerings they could make to us. We purchased all they brought with them, paying them in darning needles and other small articles, with which they were much pleased. The prejudice against the grasshopper 'fruitcake' was strong at first, but it soon wore off, and none of the delicacy was thrown away or lost .... After being killed, they [the grasshoppers] are baked before the fire or dried in the sun, and then pulverized between smooth stones.

use of their language. If one preaches to them any mysteries contrary to their ancient errors, the sermon ended, they come to the father, call him to account for what he has said to them, and argue and discuss with him in favor of their error with considerable plausibility; but through reason they submit with 0 docility." (II:58-60)

SEE REFERENCES, P. 11.

Need a Christmas present for the person who loves beauty but has everything?

Conversations with Bugs, A Journal with Words and Drawings by Gwynn Popovac, was described in the *March 1994Newsletter.* We noted that both drawings and words are exquisite. Twelve of the drawings and their accompanying words have been incorporated in a 1995 calendar (pages 12xl3 inches, or 12x26 inches when open and hanging on a wall). The title of the drawing for January is "Flight path of a lacewing." The title of the calendar is "Conversations with Bugs 1995 Calendar." It can be ordered through Pomegranate Artbooks, Box 6099, Rohnert Park, CA 94927, Tel (800) 227-1428, Fax (800) 848-4376. Ordering number is 95098, price $10.95 (plus normal shipping charge of $3.95).

Another good Christmas idea

For those who are hard to shop for, it's a good bet that one thing they don't have is an insect recipe book. Or maybe not even a single insect recipe. *Entertaining with Insects,* by Ronald Taylor and Barbara Carter, has about 85 of them, and might open a whole new life of adventure for that hard-to-shop-for person on your list. Available from: Salutek Publishing Co., 5375 Crescent Drive, Yorba Linda CA 92687.

Price per copy: $14.95. California residents add sales tax (state and, if any, local and transit).

Shipping and handling per book: U.S. $4.05; Foreign $9.05. Add $1.00 for each additional book.

Method of payment: U.S.: Money order (delivery within 7 days. Check (allow 6 weeks for delivery). Credit card purchases are not accepted. Foreign orders: International Money Order in U.S. dollars.

Notice:
International Bee Conservation Symposium

A two-day symposium, "Conserving Europe's Bees" will be held in London, UK, on April 6 and 7, 1995. Organized by the International Bee Research Association and the Linnean Society of London, the meeting will concentrate on bee conservation in Europe and the Mediterranean basin, but will also consider the Americas and other areas. Conservation of bee diversity is a topic being increasingly discussed by biologists. For further information contact: Conserving Europe's Bees, The Linnean Society of London, Burlington House, Piccadilly, London WIV OLQ, United Kingdom. Tel (+44) 71-4344479; Fax (+44) 71-287-9364; e-mail: john@linnean.demon.co.uk.

China's women swimmers swim as fast as their runners run

At the World Swimming Championships in Rome this past September, the Chinese women won 7 gold medals and broke 3 world records, if we counted correctly. And the margins of victory in some cases were about as impressive as those by Chinese runners last year at the National Gaines in Beijing. For example, the former 100-meter freestyle world record was broken by 0.47 seconds, and the forTner4OO-meter medley relay by 0.87 seconds. As happened with their track team (see November 1993 *Newsletter),* such sterling performances were accompanied by complaints from rival swimmers and coaches that the results must have been drug-aided. The Chinese coach, angered by suggestions that his female swimmers are boosted by drugs, accused critics of ignorance about his country's training methods and jealousy of their success.

Drinking a potion made of a hepialid caterpillar-associated fungus combined with various herbs was among the training methods to which the track coach attributed his runners' success. None of the three short accounts of the swimmers, in our local newspaper, the *Wisconsin State Journal,* mentioned any training details, but everything else parallels. The identity of the caterpillar-fungus association is *hepialus armoricanus/Cordyceps sinensis* (see letter from Professor Karl Espelie in the March 1994 *Newsletter).*

American Indian Insect Food (from page ten)

References

[1]Browne, J.R. 1865? *Washoe Revisited. Notes on the Silver Regions of Nevada.* Oakland, Calif.: Biobooks, pp. 111-114. (Also in *Harpers Monthly* 31:274-284;411-419.)

[2]Brewer, W.H. 1930. *Up and Down California in 1860-1864.* New Haven: Yale Univ. Press, p. 417.

[3]Fremont, J.C. 1845 (1988 reprint). *The Exploring Expedition to the Rocky Mountains,* p. 154.

[4]Egan, W.M. (Ed.). 1917. Pioneering the West 1846-1878: Major Howard Egan's Diary. Richmond, Utah: Howard Egan Estate, pp. 228-233.

[5]Gottfredson, P. 1874. Journal of Perter Gottfredson, From the Gottfredson Family History. Ms. on file, Utah State Hist. Soc., Salt Lake City, pp. 15-16.

[6]Whiting, Beatrice B. 1950. Paiute sorcery. *Viking Fund Publs. Anthropol. No. 15,* New York, pp. 17-19.

[7]Aram, J. 1907. Reminiscences of Captain Joseph Aram. *Jour. Amer. Hist.* 1, pp. 623-632.

[8]Riddell, F.A. 1978. Honey Lake Paiute ethnography. *Occas. Papers, Nev. State Mus. 3(l):51-52.*

[9]Bidwell, J. 1890. The first emigrant train to California. *Century Mag.* 19:106-130.

[10]Jones, V.H. 1945. The use of honey-dew as food by Indians. *The Masterkey 19:145-149.*

[11]Sutton, M.Q. 1988. Insects as Food: Aboriginal Entomophagy in the Great Basin. *Ballena Press Anthropol. Papers.* No. 33, 115 pp.

[12]Blake, E.A.; Wagner, M.R. 1987. Collection and consumption of pandora moth, *Coloradia pandora lindseyi* (Lepidoptera: Saturniidae), larvae by Owens Valley and Mono Lake Paiutes. Bull. *Entomol. Soc. Amer.* 33:23-27.

[13]Essig, E.O. 1934. The value of insects to the California Indians. *Sci. Monthly* 38:181-186.

[14]Chittenden, H.M.; Richardson, A.D. 1905. *Life, Letters and Travels of Father Pierre-Jean De Smet, S.J., 1801-1873.* New York: Harper, pp. 1032-1033.

[15]Bryant, E. 1967. *What I Saw in California ... in the Years 1846, 1847.* Palo Alto, Calif.: Lewis Osborne, pp. 162-163, 168.

1[6] Bolton, H.E. 1919. *Kino's Historical Memoir of Pimeria Alta. 2* vols.

Cleveland: Arthur H. Clark Co.,Vol.II, pp.56, 58-60.