



THE FOOD INSECTS NEWSLETTER

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Hypothesizing About Palm Weevil and Palm Rhinoceros Beetle Larvae as Traditional Cuisine, Tropical Waste Recycling, and Pest and Disease Control on Coconut and Other Palms - - - Can They Be Integrated?

In their book on Cameroon cuisine, Grimaldi and Bikia (1985) describe their recipe for "coconut larvae" as a "favorite dish offered only to good friends" (see recipe, page 3). The flavor of "palmworms" (fat, legless larvae of the weevil genus *Rhynchophorus*) has been appreciated throughout the tropical world for centuries. There are a number of species, but the major ones from the standpoint of wide distribution and use as food are *Rhynchophorus palmarum* in the Western Hemisphere, *R. phoenicis* in Africa, and *R. ferrugineus* in Asia.

Newcomers to the Caribbean region were particularly effusive about palmworms. Bancroft (1769:239), in his "Natural History of Guiana," wrote that the larvae are "esteemed a delicate morsel, not only by the aboriginal Natives, but by many of the White Inhabitants, particularly the French, who roast them before the fire, and mix them with crumbs of bread, salt, and pepper." Smeathman (1781:167-69), who was working in West Africa at the time and had taken a particular fancy to the taste of the termite, *Macrotermes bellicosus*, said of the termites, "they are something sweeter, but not so fat and cloying as the [palmworm] which is served up at all the luxurious tables of West Indian epicures, particularly of the French, as the greatest dainty of the Western world." And Stedman (1796:22-23) in Suriname, remarked that, "However disgusting to appearance, these worms are a delicious treat to many people, and they are regularly sold at Paramaribo." Stedman later related (p. 115) that: "We here found concealed near the trunk of an old tree a case-bottle filled with excellent butter, which the rangers told me they made by melting and clarifying the fat of the palm-tree worms: this fully answers all the purposes of European butter, and I found it in fact even more delicious to my taste."

Indigenous populations throughout the tropics have prized palmworms no less than have Europeans, and in the case of *R. palmarum*, Chagnon (1968:30-32) in Venezuela/Brazil, Clastres (1972:160-61) in Paraguay, and Beckerman (1977) and Dufour (1987) in Colombia have reported primitive cultivation systems for the larvae. Chagnon reports: "The Yanomamo come very close to practicing 'animal domestication' in their techniques of exploiting this food. They deliberately cut the palm tree down in order to provide fodder for the insect. When they cut the tree, they also eat the heart of the palm, a very delicious, crunchy vegetable that slightly resembles the taste of celery hearts. One palm we cut yielded an edible heart of about 50 pounds. After the pith has been allowed to decay for several

months, it contains numerous large, fat, white grubs. The pith is dug out of the tree with sticks, broken open by hand, and the grubs extracted A fair-sized palm tree will yield three or four pounds of grubs, some of them as large as a mouse. The grubs are wrapped in small packages of leaves and placed in the hot coals to roast." Chagnon was told by a missionary that the grubs taste very much like bacon.

The Guayaki of Paraguay, according to Clastres, consider the palm larvae as "more than a food gathered by chance in the forest; rather, it is the product of a sort of cultivation. The Indians knock down the palm tree, leaving a stump about 3 feet high. They then generally cut the fallen trunk into sections 10 or 12 feet long, preparing the wood for the insects Each man is the owner of his larvaebed This private property is almost always respected and no one touches the larvae of another. Later, the harvest is divided and eaten collectively. Thus the Guayaki distribute a relatively abundant supply of food It is of great interest to see that the Guayaki, despite their being nomads, establish a fixed source of food to be gathered much later. In doing so, they are obliged to return to the cultivation area after many months of travelling This cultivation of *guchu* therefore exerts a profound influence upon the wandering habits of the Guayaki in that it gives an order to their travels."

In Colombia, Beckerman (1977) reported that the Bari Indians use only *Jessenia* palm as a "grub farm." The trees are cut down and the logs left lying in the forest. "In two or three months the whole trunk is infested with the edible larvae Several hundred grams of larvae can be extracted from a single trunk" Dufour (1987) reported that "The Tatuyo felled palms to harvest the fruits, and often returned at a later date to harvest the larvae which subsequently developed in the pith. Palms were also cut specifically with the expectation that they would be invaded by weevils and the larvae ready to harvest in two or three months. Thus, the larvae were both a by-product of the harvesting of palm fruits and 'cultivated.'" Dufour reported a live weight of 3-16 grams for the grubs and a maximum acquisition rate of 2,000 g/hour.

With this gustatory background, let's look at another dimension of palm weevils, restricting temporarily to the Western

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Putting Insects on the Australian Menu

(Extracted from an article by Graham Irvine published in *Food Australia*, formerly *Food Technology in Australia* 41:565-566, Jan. 1989.)

Vic Cherikoff is Australia's foremost authority on insects as foods. He is one of the prime movers in changing our aversion to eating insects. His company, Bush Tucker Supplies in Sydney may be the first in the Australian food industry to introduce insect foods to the Australian market early this year. He won't say what the product is, but says there is at least one other company vying to beat him onto the market.

His new insect food will be launched initially to the speciality catering industry but he also intends retailing it through speciality restaurants in several different states.

Cherikoff is far from being merely a laboratory-based boffin. He has eaten tens of thousands of insects over a twenty year period and claims never to have suffered any ill effects. He conducts insect food tastings and dinners, tours and courses.

He has developed a network of suppliers all over the country who send him their local delicacies, like the farmer near Lismore in the far northeast of NSW who digs longicorn beetles, tasting like scrambled eggs, from rotting trees. Cherikoff claims an 80% acceptance rate for the bush foods proffered in his courses, rising to 90% for such delicacies as Bogong moths.

While understandably coy about his forthcoming insect marketing ventures, he is effusive about the potential of the domestic and export markets. Already the demand is huge. He

US food processors and scientists are now investigating the commercial feasibility of Australian honey ants, and Asian interests are believed to be exploring the commercialization of Australian insect foods. Cherikoff considers that the insects with the best commercial potential could be witchetty grubs (<i>Xyleutes leucomochla</i>), bardi (<i>Bardistus cibarius</i>) and similar grubs, honey ants (<i>Melophorus bagoti</i>) and sugarbag (<i>Trigona</i> bees). However, Cherikoff feels much more research is needed before insects foods can be commercialised on a large scale. He cites the case of many of the native grubs which are liable to metamorphose into the next form in their life cycle if they are stressed when bred in captivity. What is already known is that insect foods are comparatively high in kilojoules, fat and protein. One study by Cherikoff and two university nutritionists concluded that they "have proximate compositions similar to those of equivalent domesticated foods". For example, the Bogong moths (<i>Agrotis infusa</i>) that plagued Sydney in the spring of '88 contain over 20% protein; fat averages 50% of dry body weight; have an energy content of nearly 2000 kilojoules; and are particularly high in zinc. Bardi grubs are a very complete protein source. When fed to fish, 1.8 kilograms of bardi convert to 1 kilogram of fish. Bill Mollison, another bush tucker man, is also a passionate supporter of insect foods. He believes that we are thoughtlessly foregoing a valuable natural resource because of our European aversion to insects. The locust plagues which periodically devastate wide areas of Australia contain some ten thousand tonnes of protein. The traditionally conservative NSW Department of Agriculture has suggested earthworms as a cheap and nutritious substitute for minced beef, pointing out that they have about the same protein content but that earthworms are much lower in fat.	quotes cases where he has had to decline orders of thousands of kilograms from Japan solely due to lack of supplies. Quarantine regulations, he says, pose no problem because the insects can easily be sterilised, vacuum-packed and freeze-dried. Market penetration has been slow but is steadily increasing as Asian influence in Australia grows. In the restaurant trade the adventurous gourmet may already sample insect foods on the menus of a growing list of restaurants. The doyen and progenitor of them all is Rowntrees, The Australian Restaurant, at Hornsby on Sydney's North Shore. Also in Sydney are Cafe Troppo in inner-city Glebe; the Garrison at The Rocks and the Sheraton Wentworth in the city. In other states there are the Tally Ho Lodge at Inglewood, out of Adelaide; the Metropolitan Brasserie at Bendigo, Victoria; Cloves at Kyneton, also in Victoria and a restaurant in Bundaberg, Queensland. But the list is not confined to Australian shores. Homesick Aussies with an irresistible craving for our native insects can also find satisfaction at the Excelsior Hotel in Hong Kong or the Caz Gallery in Los Angeles. Could it be that the nation which once rode on the sheep's back will one day ride on the backs of Bogong moths and witchetty grubs? While you're chewing that one over, why not chuck another bardi on the barbie? (Note: Thanks to Dr. Richard Gorham, Food and Drug Administration, Washington, D.C., for sending a copy of this article). Correction The statement on page 3 of the March 1990 Newsletter that read, "Hundreds of thousands of pounds of very high quality food for a few days of labor would have been a wise investment, especially since the resulting food was storable, should have read, "Hundreds or thousands of pounds. . . .
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PALM WEEVILS from page one Hemisphere. <i>Rhynchophorus palmarum</i> is one of the most dangerous pests of coconut and oil palms in Latin America and the Caribbean, mining the trunks of the trees and transmitting the nematode, <i>Rhadinaphelenchus cocophilus</i>, which is the causal agent of red-ring disease (RRD) (Morin et al 1986, and others). The weevil infests many other species of palms, both wild and cultivated, as well as sugarcane and several root and fruit crops (Hagley 1965, and others). Hill (1983) describes the damage from the weevils as follows: "The larvae burrow in the crown of the palm, feeding on the young tissues, and sometimes destroy the growing point when the palm will die. The leaves turn chlorotic and die, and the trunk becomes tunneled and weakened, and may break in a storm." Schuling and van Dinther(1981) provide a good entry to the extensive literature on RRD. The coconut palm may die within 3-4 months after the appearance of external symptoms which include yellowing	fermentation emanating from wounds in healthy palms or from the decay of dead or diseased palms, all injured or decaying trees are removed and traps are constructed along the edge of a plantation from cut pieces of thinning, wild palms or uninfested parts of damaged or diseased trees. Whole trunks of oil-palms, which are very thick, can be cut into cubes and left in small heaps; but only the tender apical 1-2 meters of the thinner but tougher trunks of wild and coconut palms are used. They are split into longitudinal sections and intercrossed into piles with the bud on top. Trap heaps should be renewed weekly, either by replacement with other palm pieces and burning of the old infested ones, or by spraying with palm sap to maintain attractiveness and also with 0.15% methomyl to prevent the piles from becoming a source of infestation. At the Paricatuba oilpalm estate in Para, Brazil, according to Schuling and van Dinther (1981), palm losses from RRD were held to 1. 14% of palms in the susceptible age group through the program
Cameroon cuisine - larves de palmier (From: <i>La Cuisine Camerounaise</i>, by Jean Grimaldi and Alexandrine Bikia, p. 136. Thanks to Dr. Jane Homan, UW International Agricultural Program, for providing a copy, and to Diane Landry for a translation from the French). The larvae of certain coleoptera harvested from the oil palm and from the palm of genus <i>Raphia</i> are eaten in Cameroon. These larvae,	called "Fos" in Ewondo, are white (oil palm) or yellow (raphia palm). They are sometimes reared. Before any preparation, the larvae are washed in a lot of water and pierced in the abdomen with a sharp piece of bamboo between each washing to let a white, fatty liquid escape. In all regions they are prepared either by stewing, frying in oil with salt and pepper, adding to squash seed paste, or putting on brochettes grilled over coals.
Coconut larvae recipe	The nuts are stood straight up by some banana leaves in a pot containing water. The amount of water should be such

Larvae coming from oil palms or raphia palms, salt, pepper, onion, coconut. Preparation: Larvae washed and cut in half are mixed with all the condiments cited. The coconuts are chosen at half-hard stage, so that the inside, completely globular, can be taken out of the husk without being broken. The most pointed end of the nut is cut in a way that forms a cap. The nuts are emptied of their milk, then refilled with the larvae and condiments and closed by attaching the caps firmly.	that, during the course of cooling, it cannot penetrate the nuts. The cooking is rather long. After cooking, the nuts are cut into slices. This favorite dish is only offered to good friends and is served with manioc sticks. Bamoun preparation Among the Bamoun, the larvae are strung up and left to dry hanging under the trellis that is found above the foyer. After they are well-smoked, they can be incorporated, after being washed, into the squash seed paste.
of leaves and premature nutfall. Internally the stem tissue is discolored and necrotic. There is evidence that only the adult weevils are involved in the transmission of the RRD nematode. Hill (1983) lists recommended insecticides and several cultural control methods that are applied against <i>R. palmarum</i>, including elimination of breeding sites by restricting physical injury to palms, control of <i>Oryctes</i> beetles, destruction of infested palms, and trapping of adult weevils. Morin et al (1986) describe procedures that have been successfully used in Para and Bahia, Brazil, since 1975. As adults are attracted for feeding and reproduction to the odor of	of phytosanitation, i.e., preventing wounds and early elimination of palms showing distinct growth disorders by felling and transporting the trunks to the oil factory where they were sawed into blocks and steam sterilized at 130C for 1 hour, which kills the nematodes. This program was considered much more effective than insecticides, the efficacy of which, according to the authors, is open to question. In Africa and Asia, <i>Rhynchophorus phoenicis</i> and <i>R. ferrugineus</i>, respectively, damage palms similarly to <i>R. palmarum</i> in Latin America and the Caribbean. RRD, however, is apparently not found outside the Western Hemisphere. SEE PALM WEEVILS, p. 4.

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from page 3

The hypothetical scenario that can be created from the foregoing has long intrigued this writer. Palmworms would certainly seem worthy of wider publicizing as traditional cuisine of gourmet quality, the kind of delicacy that could be promoted as tourist and urban fare by the best restaurants throughout the tropics and subtropics, and eventually, maybe, even as an item for export. Could such wider promotion and use create more opportunities for employment and entrepreneurship in the rural countryside? Could, in fact, expanded markets provide a basis for attempting to combine increased palmworm production with more efficient recycling of dead and diseased palms, and as part of reduced-pesticide integrated pest management (IPM) programs and disease control on coconut and other palm species?

Taking a cue from how indigenous populations have done it for centuries, could the trap logs recommended for pest and disease control, through a simple modification in procedure, be used simultaneously for palmworm productions? The desired harvest stage is the late-instar larva. Studies in Trinidad (Hagley 1965), Brazil (Morin et al 1986) and Mexico (Gonzalez and Camino (1974) have shown that the egg and larval stages of *R. palmarum* last 2-4 days and 40-61 days, respectively, at essentially ambient temperatures. Instead of burning trap logs at the end of a week or spraying them with methomyl to kill the larvae, as suggested by Morin et al, if left in place for approximately 45-50 days, the larvae would be ready for harvest. All would be large-sized, few would have pupated and no adults would have yet emerged. Possibly, logs could be reused if desired by spraying with palm sap to renew attractiveness. If not, they could at that point be burned or otherwise disposed of.

Greater efficiency might be achieved by additionally seeding new trap logs with eggs from adult weevils caught in traps baited with coconut tissue. This should exert additional control pressure within the plantation, while producing a higher density of developing larvae in the logs, thus producing more larvae per unit of substrate, more efficient recycling of the logs and a reduced mass of material left for burning. Maharaj (1973), in Trinidad, described a simple aluminum trap that catches more than twice as many weevils as the conventional split-log trap and uses only about one-fifth as much coconut tissue as bait. To incorporate food production as part of weevil IPM as hypothesized, trap logs would have to remain in place about 7 weeks instead of one, and thus would

A fourth species, *Rhynchophorus bilineatus*, the famous sago grub which is the subject of feast and ritual among certain Melaneseans in Papua New Guinea, is also "semi-cultivated" (Townsend 1970). In the opinion of at least one European, however, "the taste of the grub is fatty and oily and is no delicacy for the palate of a European" (Meyer-Rochow 1973).

Rhynchophorus larvae rank with winged termites as among the richest sources of animal fat, a frequently scarce and needed commodity among tropical rural populations. And insect fatty acids, in general, are highly unsaturated. The high fat content of *R. phoenicis* is reflected in its high energy value of 561 kcal/100 g of insect (Oliveira et al 1976). It is also high in thiamine, riboflavin, and zinc and fairly high in iron.

For U.S. gourmets, it should be known that one species of *Rhynchophorus*, *R. cruentatus*, extends into the southeastern states where its larval-feeding damage to the terminal bud is a lethal problem in transplanting mature cabbage palmettos (*Sabal palmetto*) and Canary Island date palms (*Phoenix canariensis*) (Giblin-Davis and Howard 1989). At a length of 24-33 mm, it is the largest known weevil in the United States.

In even a brief discussion of major pests of palms, the giant palm rhinoceros beetles, primarily of the genus *Oryctes* (Scarabaeidae: Dynastinae), must be mentioned. The larvae of these beetles have also been widely used as food in Africa and Asia. In this case, it is the adult beetles that do the serious damage, while the larvae are found in all sorts of refuse (Bedford 1980). Of the three species reported as food in Africa, *Oryctes monoceros* breeds in dead standing coconut and oil palms in western Africa and in decaying coconut logs in eastern Africa, *O. boas* breeds in rotting vegetation and manure heaps (but not in rotting wood), and *O. owariensis* in dead standing oil palm, coconut and *Raphia* trunks. *Oryctes rhinoceros*, in Asia and the western Pacific, breeds in a wide variety of dead but not yet decomposed plant material, including the tops of dead standing coconut palms, coconut stumps and logs on the ground, and other types of decaying wood, as well as compost, dung heaps, rotting straw, rotting coconut husks, coffee and cacao pulp waste, and refuse from sugar cane factories, ricemills, sawmills, and various other types of agricultural products processing. Larvae attain a length of 6-8 cm (Hill 1983) and Kalshoven and van der Laan (1981: 463-68), citing Leefmans in 1920, note that up to 50 grubs/ M³ may be found in refuse dumps adjacent to towns and larger villages. Although insecticides and a promising baculovirus *Rhabdionvirus oryctes*, are available, control of rhinoceros beetles is based on sanitation and cultural practices

occupy 7 times as much ground surface, but that should not be a huge problem in palm plantations. The writer has not seen reports of "cultivation" for either <i>R. phoenicis</i> or <i>R. ferrugineus</i>, but the latter is attracted to dying or damaged parts of palms, cut or split palm trunks, and even decaying sugarcane (Kalshoven and van der Laan 1981). The larval period, normally 2 months or longer, has been reported as only 24 days when feeding on the nutritious palm "cabbage." So, enriching the larval diet might have a place in increasing production as food.	similar to those recommended for <i>Rhynchophorus</i> weevils. Thus, it seems hypothetically possible that <i>Oryctes</i> could also be incorporated into palm IPM programs, recycling an endless variety of tropical wastes into animal protein and fat. SEE PALM WEEVILS, p.6
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Recent Technical Papers Larde, G. 1989. Investigation on some factors affecting larval growth in a coffee-pulp bed. Biol. Wastes 30:11-19. Instituto Salvadoreno de Investigaciones del Cafe, Nueva San Salvador, El Salvador, C.A. The author studied factors affecting the practical mass-production and harvest of fly larvae (as a protein source for domestic animals) developing in an open coffee-pulp (CP) bed, contained in a rectangular concrete tank 2.67 m long, 1.0 m wide and 0.51 m deep. The depth of the CP bed varied from 20 to 50 cm during the larval observation period of approximately 120 days. One-day-old CP was added periodically in amounts ranging from 4-13 kg wet matter per loading, the total weight loaded being 44.8 kg. Inoculation of eggs was by wild flies of the species <i>Ornidia obesa</i> (green hover fly), <i>Hermetia illucens</i> (soldier fly) and <i>Musca domestica</i> (house fly). Larvae migrating out of the tank dropped into a water-filled pit from which they were collecting for weighing. An undesirable feature was the formation of an anaerobic zone that constituted 49% of the total volume of the CP bed. Larvae developed only in the aerobic zones extending about 12 cm deep from the top of the bed and 8 cm inward from the tank walls. Young fly larvae of all three species were found in the bed within the first week after initial loading. Larvae of <i>M. domestica</i>, which has the shortest life cycle, were pupating within a few days after the initial loading, and 815 larvae of this species migrated out of the bed on day 9. Heavy migrations from the bed occurred on days 36 and 50 after initial loading as the result of a heavy addition of coffee-pulp the preceding day in each case. These migrations presumably were caused by increased temperatures resulting from the heat generated by the rapid aerobic fermentation of the large volumes of substrate added. Such migrations did not occur when smaller lots of CP were added. The only rain, on day 82, also initiated a major migration. Turning of the CP, beginning on day 90, was expected to increase migrations, but that did not happen, probably because of the smaller numbers of larvae in the bed at that time. Larvae of <i>O. obesa</i> and <i>H. illucens</i> were found to tolerate temperatures from 22.50C to 35°C in the medium and the latter was found in zones up to 40°C. <i>O. obesa</i> larvae were more migratory than <i>H. illucens</i> larvae, and this clearly contributed to the greater weight of the former that migrated out of the bed (11.8 kg wet matter or 0.3 kg wet matter kg⁻¹ wet matter total CP loaded, compared to 2.2 kg and 0.05kg, respectively, for <i>H. illucens</i>). The author recommends emphasis on harvest of these two species because the larvae are about 20 times heavier than <i>M. domestica</i> larvae. Some larvae of at least two of the species, <i>H. illucens</i> and <i>M. domestica</i>, were lost because of pupation within the medium, but there was apparently no attempt to determine the proportions lost in this manner. The author states that under the management conditions of the experiment, it would not be possible to achieve a constant daily level of larval production. A mass recovery can probably be accomplished, however, within 3-5 weeks after the initial loading by flooding the bed or by heat. Also a better ventilation of the substrate	is needed to prevent formation of anaerobic zones. Data on minerals analyses of one-day-old CP and at 104 days and 145 days after initial loading are presented in tabular form. Finke, M.D.; DeFoliart, G.R.; Benevenga, NJ. 1989. Use of a four-parameter logistic model to evaluate the quality of the protein from three insect species when fed to rats. J. Nutr. 119:864-871. Departments of Nutritional Sciences, Entomology, and Meat and Animal Science, University of Wisconsin, Madison, WI. 53706, Author's Abstract. The quality of three insect protein sources (Mormon cricket meal (MCM, house cricket meal (HCM and Eastern tent caterpillar meal (TCM was evaluated relative to that of lactalbumin (LA) and soy protein (SP) by using both amino acid analysis and a rat bioassay. The amino acid pattern of the three insect meals indicated that methionine should be the first limiting amino acid for growing rats. In the rat bioassay, weanling Sprague-Dawley rats were fed graded levels of the five proteins in purified diets and the response (weight or nitrogen gain) evaluated as a function of nitrogen intake. The individual nitrogen intake - animal response results could be described by a series of curves using a four parameter logistic model. The use of parameter sharing permitted the full range of responses to be described so that statistical differences between the dose-response curves could be identified. When used for either weight maintenance, nitrogen equilibrium, minimum weight gain or maximum nitrogen retention, the five protein sources could be ranked in the following order: LA>HCM>MCM = SP>TCM Relative to lactalbumin, the value of all four protein sources decreased with increasing nitrogen intake. The low values obtained for TCM may have been related to factors other than protein quality. The results of this study indicate that some insect proteins are equivalent or superior to soy protein as a source of amino acids for growing rats. Living It Up On Canadian Television Professor Yves Prevost of Lakehead University was interviewed last summer by Dianne Buckner, co-host of CTV's Live It Up. The event was a dinner of meal worms and crickets prepared by Dr. Prevost and scheduled for showing on national TV last September. The dinner began with an insect broth, followed by a cricket salad with dressing. The main course consisted of meal worms sauteed in garlic and butter served on a bed of green beans. Dessert was candied meal worms that looked almost like peanut brittle. "It was a dinner I'll never forget," said Buckner. The meal worms were kind of crunchy and reminded Buckner of Chinese noodles. The soup was ok. The salad was another matter. The cricket eyes kept staring back. Concluded Buckner, "To me crickets in a salad is most unappealing." (To the editor, it is significant that the event was reported in the <u>Modern Living</u> section of the <i>Thunder Bay Chronicle-Journal</i> [June 20, 1989]).

The Research Institute of Insect Resources in Yunnan Province, China

Information on the Institute was supplied recently by Chen Xiaoming, assistant professor and deputy department head. Originally called The Lac Research Institute, it was established in 1955 for the study of certain insects that produce industrial materials, i.e., the lac insect (<i>Kerria lacca</i>), Chinese gallnut (<i>Melaphis chinensis</i>) and the white wax insect (<i>Ericenus pela chavanes</i>). The Institute has published a particularly great amount of research on the biology and production of lac (marketed as shellac and formerly used also as a red dye). In 1985 the Institute initiated studies on insects as food and medicine.	<i>saratoma papillosa</i> a (Pentatomidae); and the weevil larva, <i>Cyrtotrachelus longimanus</i> (Curculionidae).
The Institute is located at Kunming City in Yunnan Province and is part of the Chinese Academy of Forestry. Xiaoming noted that there are many edible insects in Yunnan Province and that many minority nationalities are accustomed to using these insects as food and for medicinal purposes. Among the insects that are often eaten are a species of ant; locusts of the genera <i>Oxya</i> and <i>Locusta</i> ; pupae of the silkworm, <i>Bombyx mori</i> ; the termite, <i>Coptotermes formosanus</i> (Rhinotermitidae); larvae and pupae of five species of bees and wasps among the Apidae, Vespidae and Scoliidae; the moth larva, <i>Hepialus armoricanus</i> (Hepialidae); the bug, <i>Tes-</i>	In addition to studies on the folk edible insects of Yunnan, there is a study of <i>Macrotermes barnyi</i> as a health food. The queen termites are steeped in alcohol as a beverage rich in vitamins A and C among other micronutrients of benefit to health. A study that will not sound too appealing to many Westerners is on the presumed health benefits of Chongcha, a special tea made from the feces of <i>Hydrillodes morosa</i> (a noctuid moth larva) and <i>Aglossa dimidiata</i> (a pyralid moth larva). The former eats mainly the leaves of <i>Platycarya stobilacea</i> , the latter the leaves of <i>Malus seiboldii</i> . Chongcha is black in color, freshly fragrant, and has been used for a long time in the mountain areas of Guangxi, Funan and Guixhou by the Zhuang, Tong and Miao nationalities. It is taken to prevent heatstroke, counteract various poisons, and to aid digestion, as well as being considered helpful in alleviating cases of diarrhea, nosebleed and bleeding hemorrhoids. Whatever the extent of its preventive or curative benefits, Chongcha apparently serves as a good "cooling beverage" having a higher nutritive value than regular tea.

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Having a recipe from Cameroon was a rather flimsy excuse for writing this article, and I have done so with some trepidation. The main problem is that I haven't been in a palm plantation since becoming interested in insects as food, and have never seen a palm grub or rhinoceros beetle larva <i>in situ</i> . Many of our readers, however, are surrounded by palms, and some are no doubt knowledgeable about palm culture. Maybe we can hear from some of you as to the current situation and future possibilities with palm weevils and rhinoceros beetles.	Gonzalez, N.A.; Camino. L.M. 1974. Biología y hábitos del mayate prieto de la palma de coco, <i>Rhynchophorus palmarum</i> (L.) en la Chontalpa, Tab. <i>Folio Entomol. Mex.</i> 1974 (No. 28):13-19.
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Invertebrate Animal Care and Conservation During the 1980s the number of institutions displaying invertebrates in the UK trebled with the advent of the popular "butterfly houses." Largely as a result of the so-called "Collins Report" on butterfly houses, the National Federation of Zoological Gardens of Great Britain and Ireland established "The Invertebrate Working Group." The Group is to promote the keeping and breeding of invertebrates in captivity, and to improve understanding of invertebrate welfare and management under captive conditions. Reasons for keeping invertebrates in captivity include not only for display, but for research, for production of live animal food and for conservation. One of the major activities of the Group to date was organizing a conference entitled, "The Management and Welfare of Inverte-	brates in Captivity," held in December 1988 at the Royal Entomological Society of London (the proceedings of the conference were about to be published as of January of this year). Although the program was primarily aimed at UK-based institutions, the more than 90 registrants included delegates from as far away as Berlin and Ontario. The Working Group is interested in establishing contact with other national and international bodies concerned with invertebrate welfare and conservation. Further information can be obtained from: The Secretary, National Federation of Zoological Gardens of Great Britain and Ireland, Zoological Gardens, Regent's Park, London NW1 4RY. Collins, N.M. 1987. Butterfly Houses in Britain: the Conservation Implications. IUCN, Cambridge, 60 pp. + annexes.
The Food Insects Newsletter Letters Food insect consumption in India For the past three years, Dr. P.C. Bhattacharjee of the Animal Ecology Laboratory, Gauhati University, has been associated with the research project, "Ethno-biological Studies of the Bodo Tribe of Assam," which is sponsored by the Government of India. He writes, in part: "I have surveyed a number of areas covering three tribes-Bodo, Demasa and Sonowal Kachari in different parts of Assam and I was surprised at the number of insects which they eat on a mass scale and which they use for medicinal purposes. I have already recorded a large number of them." American tourists try Aztec cuisine. Bob Keeney and Marilyn King of Atlanta, Georgia, write in part: ". . . Upon arriving at the restaurant [in Mexico City] where few tourists ever go, and where our limited knowledge of Spanish didn't help too much, some Mexican VIP business persons helped us out.	Page 8 "Well, we finally lost our virginity in regard to this cuisine on 1) Jumiles tostadas con guacamole, 2) Chapulines tostadas con guacamole from the menu, but had to order off the menu 3) Escamoles. The first two dishes tasted like roasted nuts and the third was almost like a semi-sweet dessert. All three were served with corn tortillas. We also had armadillo filet. And washed it all down with good Mexican beer. The evening cost us about \$30.00 U.S., but we saved a lot by riding the subway (Metro) - 100 pesos per person, or under 4 cents US per person. "Our palate is becoming ever-increasingly international, and we would not hesitate to enjoy these treats again, as well as trying any others available. "Until North Americans get away from their conditioned prejudices, I doubt there is any possibility of insects ever becoming edible in the USA. Well, and good, as I would hate to see a diminished supply increase the prices ... [The Newsletter] has opened up a whole new dining horizon to us." (Note: jumiles are a kind of squash bug, chapulines are grasshoppers, escamoles are ant larvae/pupae).