At 270°C solid benzene exhibited the transition from phase I to phase II, in agreement with our previous observations (*4*), and, as the pressure on benzene II was increased still further, another transition was observed in the solid to benzene III. In an effort to determine whether the II-III equilibrium line intersects the melting curve in a triple point, the melting curve was followed as a function of pressure and temperature. The triple point L-I-II was observed as reported earlier (*4*), and then a second triple point L-II-III was observed at a temperature of 590° ± 15°C and an estimated pressure of about 40 kb. A single crystal of benzene II was grown from the liquid at 430°C and, as the pressure on this crystal was increased, benzene III appeared again at an estimated pressure of about 40 kb. Therefore, the transition line II-III appears to run nearly vertical. These results are presented in the approximate phase diagram for benzene (see Fig. 1).

In benzene an irreversible process also takes place at about 600°C at pressures above 40 kb. The benzene reacts to form initially a reddish-orange liquid whose color continues to deepen until a dark opaque material is formed. The rate of the process (estimated on the basis of the intensity of the color) depends on the heating rate and can be reduced by slow heating. The reaction occurs if either Inconel or molybdenum gaskets are used. In one experiment the reaction products, a mixture of solid and liquid, were removed from the gasket at ambient conditions and studied by x-ray diffraction. The results showed that the solid material was amorphous. The decomposition of aromatic compounds under pressure was first observed by Bridgman (*3*). He noted that after shear experiments on anthracene up to 50 kb the anthracene "altered to a substance of deep purplish black color."

In order to obtain a larger quantity of the reaction product, an experiment was carried out in a piston-cylinder device in which silver capsules were used as containers (*9*). The experimental conditions were 610°C and 40 kb, and the solid black reaction product showed an x-ray diffraction pattern consistent with that of amorphous carbon. Chemical analyses for carbon and hydrogen showed approximately 1 atom percent hydrogen (*10*). Therefore, the ultimate product is carbon. The intermediate reddish liquid is probably a mixture of large, condensed aromatic hydrocarbons. For example, both naphthacene and rubrene are orange or reddish in color.

Apparently all three aromatic compounds undergo similar reactions at elevated temperatures and pressures. The temperatures at which the reactions become noticeable, that is, 600°C for benzene, 550°C for naphthalene, and 500°C for anthracene, appear to be correlated with the expected stabilities of these materials (Table 2). The hydrogen evolved on decomposition may escape by diffusion at the elevated temperatures or may dissolve in the decomposition products and escape when the pressure is removed. Occasionally a bubble, presumed to contain hydrogen, has been observed to form as the pressure was reduced on partly degraded (liquid) material.

The three substances, therefore, show quite analogous phase equilibrium behavior. Only benzene shows the orthorhombic low-pressure phase, but all three materials have very similar monoclinic phases which transform at high pressures to another structure. Only in the case of benzene is the higher-pressure phase in equilibrium with the liquid; in both naphthalene and anthracene decomposition occurs at a temperature and pressure below that of the assumed triple point. Decomposition occurs in benzene at temperatures and pressures slightly above the triple point (L-II-III). Although it is possible to grow single crystals of benzene III from the melt in a special cell, the temperature required is too high to allow the x-ray diffraction cell to be used. Therefore, studies of the structures of the high-pressure forms do not yet appear feasible.

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Multiple Mimetic Forms in an Ant-Mimicking Clubionid Spider

Abstract. Castianeira rica *mimics about five classes of ant models. The multiple mimetic forms result from (i) sexual dimorphism, (ii) color variation in the adult female, and (iii) developmental changes in the preadult instars. A congeneric, sympatric, and nonmimetic species,* Castianeira alba, *acts as an evolutionary "control" for comparison.*

Two species of recently described *Castianeira* (a world-wide genus of ground-running clubionid spiders) are common and occur together in the cacao plantations near Turrialba, Costa Rica (*1*). *Castianeira rica* is a benign spider resembling stinging myrmicine and ponerine ants (a case of Batesian mimicry), whereas *Castianeira alba* is nonmimetic. The special adaptations for ant mimicry in *C. rica* can be better illustrated when *C. alba* is used as a natural evolutionary "control" (that is, a nonmimetic standard to which the mimic can be compared).

Castianeira rica has a general ant-like appearance in all its active stages. Both sexes walk over leaf litter with a jerky gait, raising the first pair of legs and keeping them actively moving, producing the visual equivalent of foraging ants with searching antennae. The continually raised first pair of legs and the forward placement of the second pair of legs produces a "hexapod" from an octopod (Fig. 1). The male has a thin, elongated body, with a full abdominal

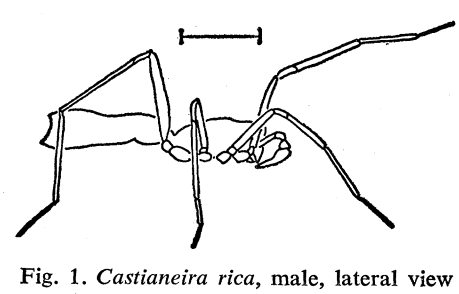

Fig. 1. *Castianeira rica*, male, lateral view (only right legs shown). The scale line represents 2 mm.

Table 1. Three indices used as mimicry indicators.

Index	*Castianeira rica* (mimetic)		*Castianeira alba* (nonmimetic)	
	Male	Female	Male	Female
Carapace	55–58	57–61	69–72	69–75
Leg thickness	15–19	22–23	29–31	30–32
Abdomen	33–38	46–64*	52–58	62–63

* High values are for gravid females.

dorsal scutum; the abdomen is distinctly constricted, the legs are thin, and the hind femora extend high above the abdomen. *Castianeira alba* is not antlike, either morphologically or behaviorally. It runs, never walks, from under one leaf to under another.

Ants have much thinner legs and longer, thinner bodies than do most clubionid spiders, so the degree of morphological resemblance to ants can be quantified by means of several indices that express the extent of elongation: the carapace index (carapace width/carapace length × 100), the leg thickness index (femur IV width/femur IV length × 100), and the abdomen index (abdomen width/abdomen length × 100). These indices are useful as mimicry indicators, low values indicating mimetic adaptation (Table 1).

Castianeira rica exhibits several mimetic forms which result from three different factors: (i) sexual dimorphism, (ii) a wide variation in color in adult females, and (iii) developmental changes. The two sexes differ markedly in color and form. The female is red-brown to maroon-black with a moderately narrow carapace and abdomen, whereas the male is bright red-orange with a very thin carapace and abdomen and with thinner legs than the female (Table 1). The male resembles species of *Atta* and *Odontomachus*, whereas the female is a more general mimic, resembling moderately large ponerine ants within the spiders' color range.

Castianeira rica achieves adult form in six molts after hatching. The developing spiders resemble ant models of equivalent size. Instars II and III (instar I is spent in the egg sac) are small, black, and shiny, and mimic small myrmicine ants; instars IV and V are yellow-orange and resemble medium-sized attine ants. A similar case involving the development of the salticid ant mimic, *Myrmarachne plataleoides*, was reported from India by Mathew (*2*), and he coined the term "transformational mimicry" for this phenomenon.

The mimetic complex in *C. rica* thus contains at least five forms—two from sexual dimorphism, an additional one from color variation in the female, and at least two more from transformational mimicry. *Castianeira alba* has developmental changes in size, but exhibits little sexual dimorphism (Table 1); it has one basic, disruptive, black and white pattern for all instars and both sexes.

The only relationship between mimetic *C. rica* and its model ants appears to be their occurrence in the same microhabitat—heavily shaded leaf litter. *Castianeira alba* is found nearby in sunny, drier, more open areas devoid of most ants (*3*).

The obvious protection from predators resulting from ant mimicry is enhanced by two specific advantages of the described mimetic complex: (i) the mimic maximizes its protection at every stage by resembling available models of a similar size and, (ii) the mimic uses various models, even in one general size class, increasing the repertoire of models, and thereby making the system potentially more stable.

This latter advantage is also the result of the generalized character of the individual mimics. *Castianeira rica* is a mimic of subfamilial and tribal taxa of ants and is not species-specific (*4*).

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3. In captivity *C. rica* can rarely live more than 24 hours without the presence of liquid water or water-saturated cotton. Under similar conditions *C. alba* can survive about a week.
4. A related species *Myrmecotypus rettenmeyeri*, found in Panama, is a species-specific mimic of a dominant neotropical ant *Camponotus sereceiventris* [J. Reiskind, *Psyche* **74**, 20 (1966)], whereas most mimetic *Castianeira* of North America are more generalized than *C. rica*.
5. Field work supported by a grant from the Evolutionary Biology Committee of the Department of Biology, Harvard University. I thank the Instituto Interamericano de Ciencias Agricolas in Turrialba, Costa Rica, and Mr. J. Erickson, the assistant director at that time, for aid in this investigation. This study is part of one presented in partial fulfillment of the requirements for the degree of Doctor of Philosophy, Harvard University, and was supported by graduate fellowships from NSF and Harvard University.

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LSD: No Teratogenic Action in Rats, Mice, and Hamsters

Abstract. *Lysergic acid diethylamide tartrate was given to 98 pregnant rats, 67 mice, and 22 hamsters as a single dose of 5 to 500 micrograms per kilogram of body weight per day either at the beginning of gestation or during the period of organogenesis. Examination of the 1003 rat fetuses, 521 mouse fetuses, and 189 hamster fetuses obtained failed to prove any abortifacient, teratogenic, or growth-depressing effects.*

Whether LSD is a teratogen is still an open question. A teratogenic action for LSD has been reported several times. In rats, the number of stillborn and stunted fetuses was increased after subcutaneous administration of 5 μg/kg to pregnant rats on the 4th day of gestation (*1*). However, this experiment was performed on only ten rats; five rats were treated later in gestation without effect. In certain strains of mice a high incidence (57 percent) of brain malformations was reported after administration of LSD on day 7 of pregnancy (*2*). Lens anomalies have been described in the mouse treated with LSD (*3*). When LSD was given to 37 pregnant hamsters at dosages varying from 0.084 μg/kg to 0.24 μg/kg, it provoked 5 to 8 percent malformation (anencephaly, exencephaly, spina bifida, hydrocephaly, localized or generalized edema) (*4*). Some fetuses had several malformations. However, the percentage of malformed fetuses was not specified. In the same article, a similar action of mescaline and of bromolysergic acid was reported. In the case of mothers taking LSD, two babies born with limb deformities are known (*5, 6*). Nevertheless, two observations can hardly be considered as evidence of the teratogenic action of LSD in man. On the other hand, no teratogenic effect from LSD was found in 55 litters of rats, the 508 fetuses examined all being normally developed (*7*). Similar negative results have been reported for the rabbit (*8*), mice and hamsters (*9*), and man (*10, 11*).

In respect to the possible causal relationship between chromosomal dam-