Chapter 44

INSECTS CAUSING VESICATION, URTICATION AND ENVENOMIZATION IN MAN

IN ADDITION to allergic and toxic manifestations produced by bites of blood-sucking flies, fleas, lice and bugs, certain species of beetles, moths, bees, wasps and ants cause a variety of local and systemic reactions in the human body, when they introduce their secretions or excretions onto or into the tissues.

BEETLES (Order COLEOPTERA)

Definition. Beetles (COLEOPTERA), literally insects with "sheathed wings," typically have 2 pairs of wings, of which the members of the first pair are thickened to form sheathed covers, or *elytra*, which characteristically come together in a median dorsal line over all or part of the abdomen. The mouth parts are adapted for chewing. Metamorphosis is complete.

Beetles as Hosts of Human Parasites. Several species of beetles have been incriminated as intermediate hosts of helminths which infect man (*i.e.*, *Gongylonema pulchrum*, page 351; *Macracanthorhynchus hirudinaceus*, page 560; *Moniliformis moniliformis*, page 561; *Hymenolepis diminuta*, page 527; *Echinococcus multilocularis*, page 550).

Beetle Infestation of Man. A number of cases of *cantharíasis* (*scarabiasis*), or temporary infestation of the digestive and urinary tracts of man with larval or adult beetles, have been reported from widely scattered localities, while Liggett (1931) described nasal cantharíasis due to oviposition of eggs within the human nares by a mother beetle, and larval beetles have been recovered from the human eye. Tabular summary of reported cases was published by Théodoridès (1948). Intestinal infestation with the dung beetle, *Onthophagus unifasciatus*, caused enteritis in a 3-year-old child in Calcutta (Bhattacharya, 1966). More often certain species of adult beetles produce blisters on the human skin or cause severe irritation of the intestinal tract in case beetles are accidentally swallowed. These vesications are due to body fluids which contain toxic principles.

Vesicating Beetles. Blister beetles (Family MELOIDAE) (Fig. 44.1,*A*) contain cantharidin, a volatile substance most concentrated in the beetle's genitalia, and at times amounting to about 2.5% of dry weight of the beetle. It has a pungent odor, a weakly acid taste, and is unjustifiably used as a powerful rubefacient, less commonly in small amounts as a diuretic or aphrodisiac. Commercially it is obtained from the "Spanish fly," *Lytta* (syn. *Cantharis*) *vesicatoria*. In times past as a powder it was frequently used as a "love philter." The lesions produced accidentally by crushing blister beetles on the skin, by discharge of their body fluids on the skin, or by external therapeutic use of cantharidin, consist of slowly forming blisters, which involve only the outer layers of the skin and do not damage the underlying dermis (Lehmann *et al.*, 1955). Toxic doses

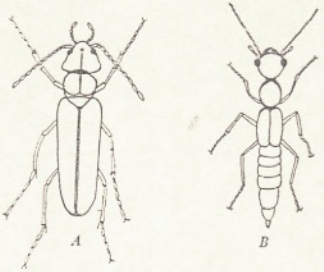

Fig. 44-1. Vesicating beetles. *A*, *Lytta vesicatoria* ("Spanish fly"); *B*, *Paederus sabaeus* (rove beetle). (Original adaptations, Faust, from Smart.)

of cantharidin taken internally give rise to severe gastrointestinal irritation, with nausea, vomiting, diarrhea, severe cramps and occasionally collapse. In Natal, southeast Africa, species of paussid beetles enter human habitations, attracted by night light, and on contact with the skin secrete a highly acid liquid that produces a painful blister. Additional reports on the annoying blisters produced by these beetles have come from Europe, the U.S.S.R., Gambia, Nairobi and the Democratic Republic of the Congo, Malaysia, Java, Guatemala, Ecuador and particularly Brazil.

Members of the genus *Paederus* (Fig. 44–1,*B*), of the family of rove beetles (STAPHYLINIDAE), which are distributed throughout the world, have an irritating principle (*pederin*) in their body fluids, which, on contact with the human body, causes a necrotizing lesion of the victim's skin, with chronic desquamation, which heals very slowly. This substance is present in all parts of the beetle's body. Rove beetles are most abundant during spring and early summer and cause most annoyance when the air is humid, as after heavy rains. Their lesion develops primarily on the most exposed parts of the skin, as the face, neck and hands. If the fluid gets into the eyes, there is commonly intense pain and swelling. Discharge of the fluid by the beetle is entirely involuntary and occurs when the insect is crushed. A major outbreak of vesicular dermatitis caused by contact with the beetle *Paederus fuscipes* or with a closely related species occurred on Okinawa during the summer of 1966 (Armstrong and Winfield, 1969).

The toxic principle of the larva of the chrysomelid beetle, *Diamphidia simplex*, consists of a powerful hemolytic toxalbumin. South African Bushmen use this substance to poison the tip of their arrowheads.

Calamine lotion, applied locally to the cutaneous lesions, is palliative. Persons with sensitive skins should be warned not to handle or crush beetles; if they get on the skin they may be safely blown off. Well-screened quarters will prevent the beetles from getting on the body at night and prevent accidental crushing.

Asthma. Dermestid beetle larvae may at times produce asthma in persons closely associated with them. Allergic rhinitis and asthma have also resulted from contact with the Mexican bean weevil, *Zabrotes subfasciatus* (Wittich, 1940).

Beetles as Vectors of Pathogens. Many species of beetles which frequent human fecal deposits on the soil rapidly break up these deposits, scattering the eggs of *Ascaris*, whipworms and hookworms over a considerable radius.

MOTHS AND BUTTERFLIES
(Order LEPIDOPTERA)

Definition. Moths and butterflies (LEPIDOPTERA), literally insects with "scaly wings," typically have 2 pairs of membranous wings covered with overlapping scales, and mouth parts adapted for sucking. They have complete metamorphosis. Some species of moths in Africa and Asia have been reported feeding on secretions from the eyes of sleeping humans (Büttiker, 1966).

Etiology and Epidemiology of Urticating Dermatitis. There are records of adult moths causing an urticating dermatitis, but most probably in these cases nettling was due to poison larval hairs clinging to the adults as they emerged from the cocoons. One family of butterflies (NYMPHALIDAE) and several families of moths have caterpillars (*i.e.*, larvae) equipped with specialized poison hairs or spines, used in protecting the larvae from their enemies. (*Vide* Table 44–1, p. 752.) When these hairs enter the skin of man, or the spines penetrate the human epidermis, they produce urtication or vesication, depending on the species of caterpillar, the susceptibility of the victim and the area of skin affected.

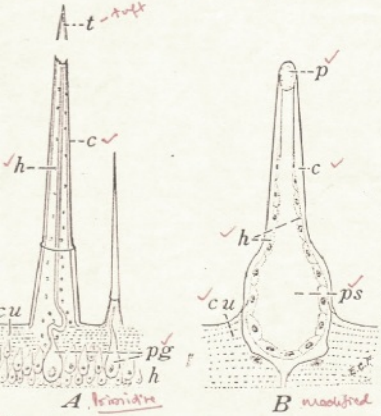

Fig. 44-2. Diagrams of the poison hairs of caterpillars. *A*, primitive type; *B*, modified type; *c*, chitinous covering of spine; *cu*, cuticula; *h*, hypodermis; *p*, canal plug; *pg*, poison gland cell; *ps*, poison sac. (Adapted by Faust, *A*, after Beyer and *B*, after Foot.)

The poison hairs of caterpillars consist of two types, a *primitive* and a distinctly *modified type* (Gilmer, 1925). In the former (Fig. 44–2,*A*), a hair (or a group of several to many distinct hairs) is supplied with venom produced by a single glandular hypodermal cell at the base. In the second type (Fig. 44–2,*B*), there is a true spine, frequently heavily chitinized, either lined with, or filled with several hypodermal cells which elaborate the toxic substance. These true spines are tipped with a blunt or pointed process and may at times be provided with branched poison spines. In some caterpillars the poison hairs or spines may be isolated into tufts or be borne on tubercles or plates. According to Morisita *et al.* (1955), the caterpillar of the Oriental yellow moth (*Euproctis flava*) begins to develop a pair of tubercles bearing nettling hairs in the second instar. The nettling hairs, in bunches of 36 to 37 are concealed by dark violet silky hairs. In other cases they may be scattered among harmless hairs, which may completely conceal the poisonous ones. The chemical composition of the poison elaborated in the specialized hypodermal cells is not known, except that it is thermostable and resists one per cent KOH and NaOH (Morisita *et al.*, 1955). In some groups it appears to be adsorbed to the proteins in the cytoplasm of the hypodermal cells.

Poison hairs used in building cocoons for the pupal stage, those scattered in nests of the cocoons, and those blown by the air and reaching the skin or mucous membranes of man, may possess vesicating properties for several months. Hairs which have apparently been blown from nests in trees into drinking water have caused serious inflammation of the buccal mucosa. In other instances poison hairs have been inhaled into the upper respiratory tract.

Pathogenesis, Pathology and Symptomatology of Urtication. In addition to the burning

Table 44–1. A List of Some of the More Important Urticating Caterpillars, the Types of Poison Hairs Which They Possess, and the Geographical Distribution of These Species of Lepidoptera

Family of Lepidoptera and Type of Poison "Hairs"	*Common Name*	*Scientific Name*	*Geographical Distribution*
	(Modified according to Herms and James, 1961)		
NYMPHALIDAE (4-footed butterflies) Long, heavily chitinized spines, having short, stubby, terminal, and branch spines, with tips set off by a chitinous ring.	Mourning cloak Peacock's mirror	*Nymphalis antiopa* *Nymphalis io* Probably all other species with stiff spines.	*N. America, Europe.* *Europe.*
MEGALOPYGIDAE (flannel moths) Spine type, having spine short, lined with hypodermal cells; spines arranged radially on elevated ridges	White flannel moth Flannel moth Puss caterpillar Tata-rana ("fire-body")	*Lagoa crispata* *Lagoa pyxidifera* *Megalopyge opercularis* *M.* spp. *M. krugii* *M. urens* *M. lanata* *Norape crenata*	E. and S. United States. S. United States. S. United States. Upper Amazon (Brazil). Puerto Rico. Uruguay, Argentina. Tropical America. United States.
LIMACODIDAE (Syn. *EUCLEIDAE*) (slug-caterpillar moths) Spine type, having shaft of spines lined with hypodermal cells.	Saddle-back caterpillar Hag moth	*Sibine stimulea* *Parasa chloris* *P. indetermina* *P. hilarata* *P. latistriga* *Phobetron pithecium* *Adoneta spinuloides* *Sisyrosea textula*	United States. E. United States E. United States. China, Korea, etc. Transvaal. E. United States. E. United States
THAUMETOPOEIDAE (Syn. *NOTODONTIDAE*) (processionary caterpillars) modified barbed hairs	Oak processionary Pine processionary	*Anaphe infracta* *Thaumetopoea processionea* *T. pinivora* *T. pityocampa*	Europe. Europe. Europe, Africa.

Table 44–1. A List of Some of the More Important Urticating Caterpillars the Types of Poison Hairs Which They Possess, and the Geographical Distribution of These Species of Lepidoptera—*Continued*

Family of Lepidoptera and Type of Poison "Hairs"	*Common Name*	*Scientific Name*	*Geographical Distribution*
(Modified according to Herms and James, 1961)			
LYMANTRIIDAE (Syn. *LIPARIDAE*) (tussock moths)			
Modified single hair type in *Euproctis*, with setose hairs in groups, arising from cuticular cups; primitive hair type in *Hemerocampa* and *Psilura*, with hairs borne in dense groups on tussocks or tubercles.	Gypsy moth	*Porthetria dispar*	Europe.
	Brown-tail moth	*Nygmia phaeorrhoea*	Europe.
		Dasychira pudibunda	Europe.
	Golden-tail moth	*Euproctis chrysorrhoea*	United States.
		E. similis	Canada, Europe.
	Chinese tussock moth	*E. flava*	China, Japan.
	White-marked tussock moth	*Hemerocampa leucostigma*	N. America.
	Satin moth	*Stilpnotia salicis*	N. America, Europe.
	Nun moth	*Lymantria monacha*	Europe.
ARCTIIDAE (tiger moths)			
Primitive hair type, with hairs borne on dorsal tufts	Hickory tiger moth	*Halysidota caryae*	N. America.
	Harlequin milkweed caterpillar	*Euchaetia egle*	N. America.
		Arctia caja	Europe.
		Lithosia caniola	Europe.
		Lithosia griseola	Europe.
NOCTUIDAE (owlet moths)			
Primitive hair type in *Apatela*, hairs scattered among dorsal hair tufts; slender sharp spine in *Catocala*, breaking off in skin.	American dagger	*Acronicta lepusculina*	United States.
		Acronicta oblinita	United States.
		Catocala sp	
SATURNIIDAE (Syn. *HEMILEUCIDAE*) (giant silkworms)			
Seta-bearing and pointed spines lined with hypodermal cells; spines distributed on dorsal and lateral tubercles; pointed spines function as a hypodermic syringe.		*Hylesia irritans*	Fr. Guiana.
		H. nigricans	Argentina, Patagonia.
		H. volex	Peru.
	Io moth	*Automeris io*	United States.
	Maia moth	*Hemileuca maia*	E. and Central United States.
	Range caterpillar	*H. oliviae*	SW. United States.
		H. nevadensis	W. and SW. United States.
		H. lucina	SW. United States.
		Pseudohazis hera	W. United States.
		Pseudohazis eglanterina	W. United States.
		Coloradia pandora	W. United States.
MORPHOIDAE		*Morpho hercules*	S. America.

In addition, Herms and James (1961) list *Macrothlacia rubi*, *Dendrolimnus pini*, *Lasiocampa quercus* and *Gastropacha quercifolia* (Family Lasiocampidae) from Europe.

stinging sensation experienced by the victim immediately following the introduction of the poison substance into the skin, the affected site usually becomes erythematous, later may become elevated and whitish, with a reddened area up to 5 cm. in diameter and a peripheral zone of reddish macules 2 cm. beyond (*i.e., Parasa hilarata; Megalopyge opercularis, vide* Lucas, 1942). Occasionally the entire member of the body becomes swollen, urticarial wheals may appear at various sites on the body and serious systemic manifestations of toxemia may develop, including severe muscle cramps, intense headache, nervousness and tachycardia (Lucas, *l.c.*). In case the poison hairs come in contact with the conjunctiva, cornea or iris, excruciatingly painful local lesions may be produced, with the development of pseudotubercles around the hairs. Cheverton (1936) reported superficial gangrene of the upper and lower lids of the right eye, followed by superficial scars, corneal ulceration and chronic conjunctivitis in a boy who accidentally allowed poison hairs of the pine processionary caterpillar (*Thaumetopoea pinivora*) to get into his eye. Bishop and Morton (1968), in Australia, described 132 cases of kerato-conjunctivitis caused by hairs from caterpillars of the genus *Anthela;* the hairs became embedded in the tarsal conjunctiva, causing mechanical irritation of the cornea and a conjunctival reaction probably accentuated by toxic factors. Gusmão *et al.* (1961) reported an epidemic of dermatitis involving 70 per cent cases (40 per cent of local population) in Federal Territory of Amapi, Brazil, May, 1960, due to venenating hairs of a species of *Hylesia* (Hemileucidae). Mass invasion by *Hylesia canitia* of a tanker moored at Caripito, Venezuela, resulted in marked dermatosis, diagnosed as "butterfly itch," caused by the stinging hairs of the anal hair tufts of the female butterflies, in almost all crew members. The hairs were deposited *via* the ventilation system all over the vessel, causing repeated irritation for months (Goethe *et al.*, 1967). Randel and Doan (1956) reported a series of cases in the Panama Canal Zone among Airforce personnel resulting from contact with the poison hairs of *Megalopyge lanata*. Usually there are no distinct systemic reactions to caterpillar urtication but in particularly sensitive individuals the following symptoms have been observed: nervousness, anxiety, tremors, convulsion; anorexia, nausea, vomiting; dyspnea and bradycardia.

Asthma. In addition to the urticating properties of certain caterpillars, some persons in contact with eggs or larvae of the range caterpillar (*Hemileuca olivae*) develop asthmatic attacks with coryza, coughing and severe wheezing (Randolph, 1934).

Treatment. There is no approved specific therapeutic to counteract the effects of vesication produced by the poison hairs of caterpillars. Local applications of warm baking soda or ammonia water are at times believed to be palliative but do not always bring relief from the burning, nettling pain. Application of calamine lotion to the injured skin is a moderately satisfactory palliative. At times of systemic reaction supportive treatment is recommended to allay the pain, and epinephrine to counteract allergic complications The lesion heals slowly, like a chemical burn. Repeated contacts with poison hairs of caterpillars may be followed by increased susceptibility.

Prevention of Urtication. The only effective preventive measures consist in refraining from handling caterpillars, keeping away from vegetation on which they feed, and possibly destroying plants in certain areas where they breed and on which they depend for food.

Lepidoptera as Intermediate Hosts. Some of the Microlepidoptera are acceptable intermediate hosts of *Hymenolepis diminuta.* (*Vide* p. 528.)

BEES, WASPS, HORNETS AND ANTS (Order HYMENOPTERA)

Definition. Members of this order (HYMENOPTERA), literally insects with "membranous wings," typically possess 2 pairs of membranous wings, held together on each

side by a row of minute hooklets situated on the anterior border of the hind wings, which are considerably smaller than the fore wings. The mouth parts are adapted for chewing or for chewing and sucking or lapping food. In the female and worker the caudal extremity is usually provided with a sting apparatus, which is a modified ovipositor. Metamorphosis is complete.

The Sting Apparatus. The *venom apparatus* in the honey bee consists of: (1) A pair of tubular *acid glands*, which discharge their product through long coiled ducts that unite before entering the inner end of the *poison sac;* (2) an unpaired tubular *alkaline gland*, which empties into the outer tubular end of the poison sac; (3) a strong *muscular bulbus*, immediately distal to the neck of the poison sac; and (4) *the sting*, which is made up of (*a*) a dorsal *sheath*, barbed at its distal extremity, (*b*) a pair of ventro-lateral *lancets*, having sharp, recurved teeth and fitted by grooves to the lower side of the sheath on which they slide up and down and (*c*) a pair of lateral finger-like *sting palps*. The sheath and lancets make the puncture wound, and the mixed secretions from the two types of glands pass down the semi-closed poison canal, formed by the sheath and the lancets, into the wound. Bees, bumble bees, hornets, wasps and several species of ants have an efficient sting as well as potent venom glands. Ants of one group (Subfamily CAMPONOTINAE), which lack the sting, spray their venom into the wound made by their efficient mandibles.

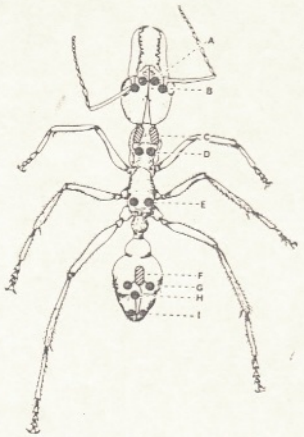

Fig. 44-3. Exocrine gland system of the bull ant, *Myrmecia gulosa* (Fabr.), subfamily Myrmeciinae. (*A*) Pharyngeal glands; (*B*) mandibular glands; (*C*) salivary reservoirs; (*D*) salivary glands; (*E*) metasternal glands; (*F*) venom reservoir; (*G*) venom glands; (*H*) accessory gland; (*I*) dorsal abdominal glands. (From "Ant Venoms, Attractants, and Repellents," G. W. K. Cavill and P. L. Robertson, Science, Vol. 149, pp. 1337–1345, Fig. 3, 17 September 1965. Copyright 1965 by the American Association for the Advancement of Science. Courtesy of authors and publishers.)

Envenomization. When provoked to sting the victim, the females of the honey bee and of some wasps leave the posterior tip of their abdomen, together with the entire sting apparatus, in the skin, where the muscles attached to the apparatus continue to contract for some time, thus forcing the sheath and lancets more deeply into the wound and discharging more venom. Unlike most bees, the bumble bee does not leave the sting in wound and may use it several times.

While the nature of bee poison has never been satisfactorily analyzed, it contains a principle secreted in the acid fraction, "*apitoxin*," which is "a dialyzable protein of low molecular weight with an isoelectric point of about pH 8.7" (Wigglesworth, 1939). The alkaline gland secretions are believed to be only lubricative in function.

Pathology and Symptomatology. Persons living in temperate climates are familiar with the pain usually accompanying the sting of the honey bee, bumble bee, hornets and wasps. The lesion produced by stings of these species may be only slight local inflammation which disappears within a few hours. At other times the injured member of the body becomes greatly inflamed and edematous, and the local reaction is accompanied by appreciable or profound systemic symp-

toms. The introduction of the venom into the conjunctiva is particularly liable to produce serious results. Some individuals are especially sensitive to bee sting and appear to develop no immunity to the venom. Jex-Blake (1942) stated that *post-mortem* examination of individuals who died of bee venenation showed the following: (1) voluminous emphysema of the lungs, possibly with a frothy fluid exudate; (2) over-distention of the right side of the heart, and (3) splanchnic dilation and hepatic engorgement. In a study of 88 deaths from wasp stings recorded in the United States during the years 1950–1954 and 1957–1959, O'Connor *et al.* (1964) found that nearly 80% of the victims were more than 40 years of age. Of the 36 cases in which sufficient data were available, almost half the victims had previous history of severe reactions following insect stings. Autopsy reports indicated high incidence of cardiac disease in fatal cases, suggesting predisposing circulatory mechanisms.

Studies have shown that bees, wasps and yellow jackets each possess two types of antigen; the body antigen of bees and wasps is not found in yellow jackets, that common to yellow jackets is not present in wasp extracts, while bees lack antigen of wasps and yellow jackets (Shulman, 1967).

In Temperate Zones, stinging ants usually inflict little damage, although the velvet ants (Family MUTILLIDAE) on the shores of Lake Erie may cause considerable inconvenience to barefooted bathers. Likewise the "fire ant" (*Solenopsis saevissima* var. *richteri*), imported in recent decades into the southeastern United States, causes a fiery sensation immediately after its sting, commonly followed by an extremely pruritic vesicle at the site of injury. Favorite (1958), Adrouny *et al.* (1959) and Wilson (1963) discussed the "fire ant" problem. *S. saevissima* var. *richteri* requires differentiation from the ordinary tropical form, *S. geminata* and from the indigenous species of the Southern United States, *S. xyloni*. Since importation in 1918, *S. saevissima* var. *richteri* has advanced into practically the entire southeastern area. Mounds of this ant in an unconfined area have a diameter of 24 inches and a height of 18 to 24 inches. Mature colonies may include up to 25,000 individuals. The cutaneous lesion, where the hemolytic toxin of the ant has been introduced, consists of a painful wheal which in 24 hours transforms into a vesicle or pustule, and in a period of 3 to 8 days breaks down, discharging a clear or purulent fluid, or may be absorbed with development of a covering scar. In cases with allergic manifestations, treatment consists in parenteral administration of 1:1000 epinephrine for children (0.1 to 1.0 ml. depending on age and weight), and Benadryl (diphenhydramine HCl) for adults (1.5 ml. parenterally). Control consists of introducing dieldrin or heptachlor (5% concentration) or chlordane, into the mounds where the colonies are concentrated. In the Tropics, certain species of stinging ants are very aggressive, inflict wounds which produce agonizing pain and may even endanger the life of persons attacked. The large ants of central and northern South America, particularly the tucandeira (*Paraponera clavata*), are especially feared because of the excruciatingly painful lesions resulting from the stings caused by these primitive giant-sized black ants, which have a matriarchal mode of life. The sting has a length of about 0.6 cm. The food consists of small beetles, caterpillars, spiders and similar animal life. Males are reddish-brown, about half as large as the females. The venom is composed of histamine, 5-hydroxytryptamine and acetylcholine; it produces an agonizing, throbbing painful swelling about 18 cm. in diameter, which, however, abates in a few hours unless the victim has an allergic tendency (Zahl, 1963). The lesions produced by tropical foraging ants (Genus *Monomorium*) in India, Africa and the islands of the South Pacific are of an entirely different nature, being produced by the bites of their mandibular jaws. In the bull ant, *Myrmecia gulosa* (Fig. 44-3), the venenating apparatus contains histamine,

hyaluronidase and a hemolytic factor (Cavill *et al.*, 1964.)

Treatment and Control. No really satisfactory treatment has been discovered for stings of the various species of HYMENOPTERA. Once the sting apparatus has been left in the wound, it should be removed with a sharp knife-blade or needle, to prevent discharge of additional venom from the poison reservoir. Local applications of warm packs and, when necessary, the application of a tourniquet at an appropriate site will at times prevent absorption of the toxin into the system. Epinephrine is employed at times to counteract the histamine-like substances in the venom. In cases of systemic shock, cardiac and respiratory stimulants may be needed. Whenever possible, appropriate clothing should be worn to keep these insects from contacting the skin.

Bee Allergy. Bees are not uncommonly associated with allergic reactions in persons sensitive to pollen and to other substances which the bees bring into close proximity to human beings. "Bee allergy" constitutes a specialized problem. Hypersensitized persons may die of shock from bee sting following previous sensitization.

While persons hypersensitized to bee venom may be temporarily saved by the administration of epinephrine, before opportunity for additional exposure to sting is anticipated they should be desensitized by injections of filtered whole bee extract made up in Coca's solution (*i.e.*, NaCl, 0.7%; $NaHCO_3$, 0.05%; phenol, 0.4%). (*Vide* Benson and Semenov, 1930; Ordman, 1951).

A satisfactory commercial product is "*Bee Extract* Lederle," available in 6-ml. vials, one containing 1.0 mg. N desensitizing fraction per ml. and one containing 0.001 mg. N per ml. Desensitization may usually be undertaken with 0.1 ml. of the weakest dilution (0.001 mg. N per ml.) and by increasing the dose at weekly intervals up to 1.0 ml. If well tolerated, the injection may then consist of the stronger extract, first diluting it 1:10 and again 1:10 with "*Diluting Fluid* Lederle" (4.5 ml. vial), to provide 1:100 dilution of the 1.0 mg. N extract per ml. Honeybee extract is group specific and desensitizes persons to the sting of honey bees, bumble bees, hornets, wasps and ants equally well (Prince and Secrest, 1939).

Hymenoptera as Vectors of Pathogens. In addition to the venenating capacities of many species of HYMENOPTERA, Pawlowsky and Sondak (1936) demonstrated that the wasp, *Polistes gallicus*, is an efficient disseminator of the eggs of *Ascaris*, the hookworm and the whipworm, as well as the rhabditoid larvae of the hookworm. The helminths are carried about on the wings, legs, body and mouth parts, but not in the digestive tract.

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