

Alfalfa leaf with mummified pea aphids containing the parasite pupa of the imported Indian wasp. Now established in coastal valleys. 9X

# Imported Indian Parasite of Pea Aphid

established in California

The pea aphid—*Macrosiphum pisi* (Kaltenbach)—frequently causes great damage to the spring alfalfa crop in southern California.

In central California, populations of the pea aphid infesting alfalfa usually do not reach outbreak proportions because, during the spring in particular, the aphid is suppressed by natural enemies—principally, ladybird beetles and a fungus disease. However, the pea aphid is found in California wherever leguminous crops

are grown and sporadic outbreaks do occur and severe damage can result.

Early in 1958, a small parasitic wasp—*Aphidius smithi* Sharma and Rao—was identified as being largely responsible for the natural control of the pea aphid in India. The Entomology Research Division of the United States Department of Agriculture imported the Indian wasp and supplied breeding stock to the University of California for propagation in the biological control insectaries at Albany and Riverside. Releases of the wasp were started in California alfalfa fields in May, 1958 and by May, 1960 more than 220,000 parasites of the pea aphid had been released.

The wasp from India readily became established in several coastal valley alfalfa fields in 1958, and by the following spring the colonies were spreading rapidly into surrounding fields. In the fall of 1959 the parasite was exerting considerable control of the aphid in most colonized coastal valleys.

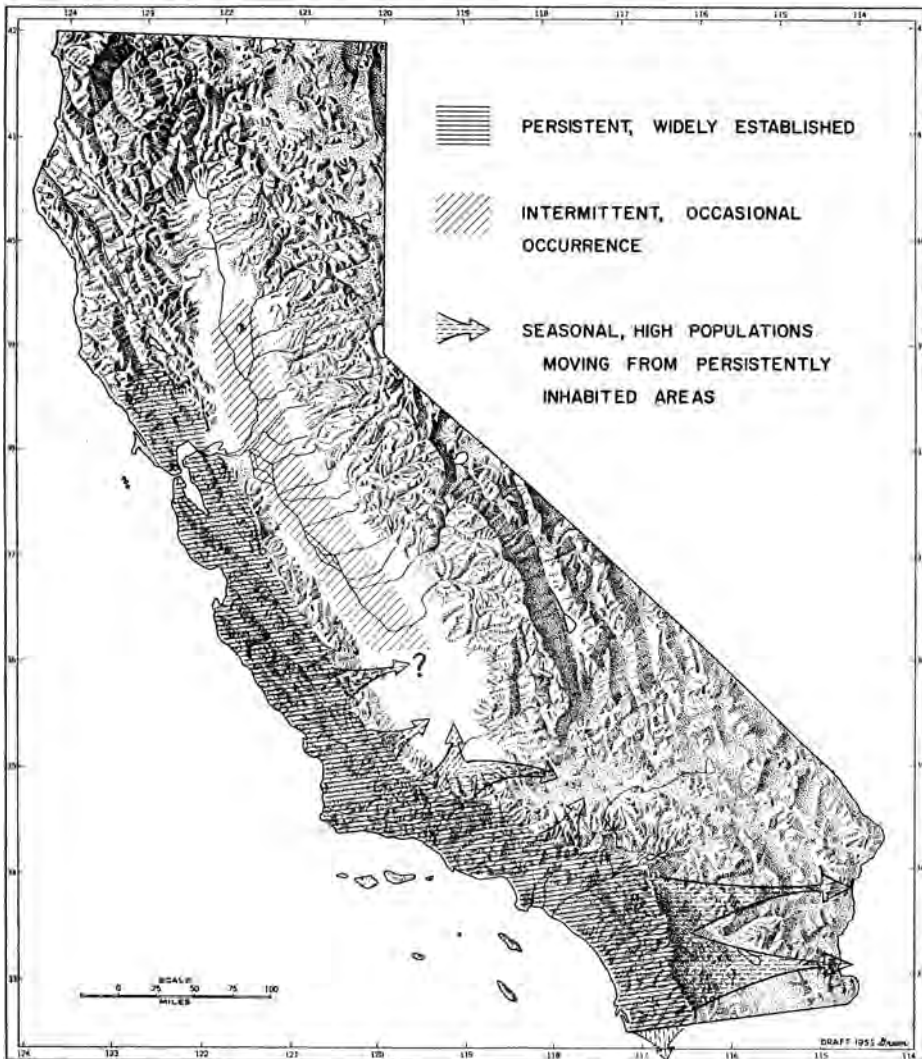
Surveys in the spring of 1960 revealed the Indian wasp to be widespread in the coastal valleys from north of the San Francisco Bay Area south to San Diego and in many interior valleys, including the desert regions of southern California.

In the coastal fields the imported wasp was exerting a dominant role among the natural enemies in the biological control of the pea aphid. The parasite became so abundant that great numbers moved inland where conditions permitted. In southern California, Indian wasps were found in all alfalfa fields in the Coachella Valley, Imperial Valley, Borrego Valley, across the desert to Blythe in the Palo Verde Valley, to Winterhaven, California and into Yuma, Arizona.

Presumably the coastal valley fields will serve as the breeding grounds from where the wasps will disperse to invade the interior valleys. The absence of the pea aphid in the inland valleys during the summer does not enable the parasites to survive in sufficient numbers to become permanently established. The In-

Concluded on next page

Distribution of the imported Indian wasp—*Aphidius smithi*—parasite of the pea aphid in California in the spring of 1960.



## IMPORTED WASP

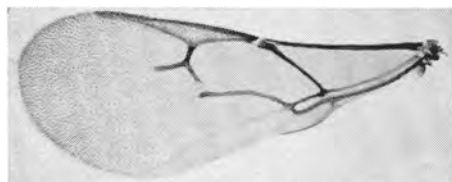
Continued from preceding page

dian wasp is not known to attack any alternate host aphid species, which limits its activity when pea aphids are absent.

Some recoveries of the Indian wasp have been made in the release areas of the Central Valley but the populations have been relatively low. The competition with ladybird beetles for pea aphids during the spring, and the extremely low pea aphid populations in alfalfa during the summer seem to limit the production of any great number of the parasite in the Central Valley. What the wasp will do in the northern Sacramento Valley and in Lassen County remains to be determined as parasite releases are continuing in those areas.

The coast ranges bordering the west side of the San Joaquin Valley apparently blocked any large-scale movement of the parasite from the coastal valleys into the Central Valley during the spring of 1960, or prevailing air movements were not conducive to such dispersal.

In the coastal valleys the parasite be-



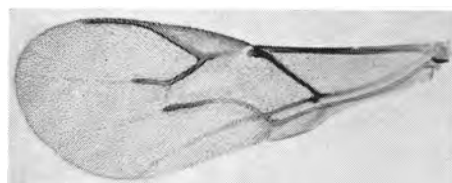
Forewing of *Monoctonus paulensis*. (Greatly enlarged.)

came established in several locations where as few as 100 individuals were released at the same time. The spread of the wasp was greatly facilitated by the parasitized winged aphid carrying the parasite larva while dispersing.

The wasp—approximately 1/4" long—attacks by inserting an egg inside the pea aphid with a needle-like ovipositor. The egg soon hatches and the young larva—a legless, pale grub—begins to devour the internal organs of the aphid. Before the aphid dies it usually moves to the upper surface of the alfalfa leaf where it becomes fastened to the leaf by silken strands of the parasite larva. The mature larva spins a silken cocoon tightly against the inside skin of the aphid. All that remains of the aphid is the husk-like skin with its external appendages. The skin is swollen and globular and houses the parasite pupa. The tannish, globular, husk-like, mummified aphids are quite conspicuous on the leaves in an alfalfa field and are the best indication of the parasites' presence. In a few days the fully developed wasp chews a circular

opening in the aphid mummy and emerges.

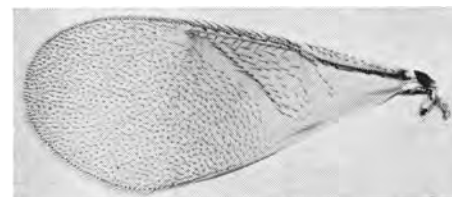
Two generations of the parasite can be produced between alfalfa cuttings and—during the cooler periods of the year—when ladybird beetle activity is greatly slowed, the Indian wasp is very active. Active adult parasites have been observed during the entire year in coastal valleys—except perhaps, January in northern California—and mummified aphids can be found in all seasons. Apparently the Indian wasp has no diapause—prolonged dormancy—and the parasite is active throughout the year if aphids are present. However, the lack of a diapause does not allow the parasite to survive the long periods of aphid absence that occur in the interior areas.



Forewing of the Indian wasp; *A. pisivorus* wing is quite similar. (Greatly enlarged.)



Adult male of the Indian wasp, *Aphidius smithi* (10X)



Forewing of *Aphelinus howardii*; wing of *A. semiflavus* is quite similar. (Greatly enlarged.)

The Indian wasp resembles some of the pea aphid parasites native to western North America, but it differs in color and other characteristics. Most of the thorax of the female Indian wasp is brownish while the native pea aphid parasites have an entirely black thorax, or only a small part pale in color. The arrangement of the wing veins separates the Indian wasp from four of the five native parasites. Also, the wasp can be separated from the spotted alfalfa aphid parasites by the larger size and its wing vein arrangement.

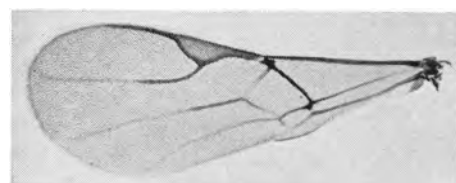
In northern California, the native parasites which are all small wasps that attack the pea aphid are *Monoctonus*

*paulensis* (Ashmead), *Praon simulans* Provancher, *Aphidius pisivorus* Smith, and *Aphelinus howardii* Dalla Torre. In southern California *Praon occidentalis* Baker, and *A. howardii* have been reared from the pea aphid.

Occasionally in northern coastal alfalfa fields *M. paulensis* and *P. simulans* become fairly common but are rarely considered important as controlling agents. The highest population of a native parasite encountered in conjunction with the Indian wasp was a ratio of one *P. simulans* to five of the imported species.

In the laboratory, *A. pisivorus* was unable to compete with the Indian wasp, and in the field *A. pisivorus* is usually scarce.

Because the imported wasp from India is widely established in California's coastal valley fields, there should be fewer outbreaks of the pea aphid there and in certain interior valleys the wasp will presumably invade annually. The wasp has been carried a distance of more than 100 miles—even across desert areas—by parasitized winged aphids.



Forewing of *Praon simulans*; wings of *P. occidentalis* and *P. pallans* are quite similar. (Greatly enlarged.)

The life cycle of Indian wasp seems to be well synchronized with that of the pea aphid in coastal California, but not in the Central Valley.

The Indian wasp is expected to have an important role in the biological control of the pea aphid in the coastal valleys and to be of less importance as a regulating agent in the Central Valley. What the parasite will do in the northern Sacramento Valley and in Lassen County is still to be determined.

*Kenneth S. Hagen is Associate Entomologist, Department of Biological Control, University of California, Berkeley.*

*Evert I. Schlinger is Assistant Entomologist, Department of Biological Control, University of California, Riverside.*

*Photographs by F. E. Skinner, Laboratory Technician, Department of Biological Control, University of California, Berkeley.*

*G. W. Angalet, United States Department of Agriculture, identified, in 1958, the Indian wasp as an important factor in the biological control of the pea aphid in India.*

*Base map of California was provided by the Department of Entomology and Parasitology, University of California, Berkeley.*

*The above progress report is based on Research Project Nos. 1650 and H-1748.*