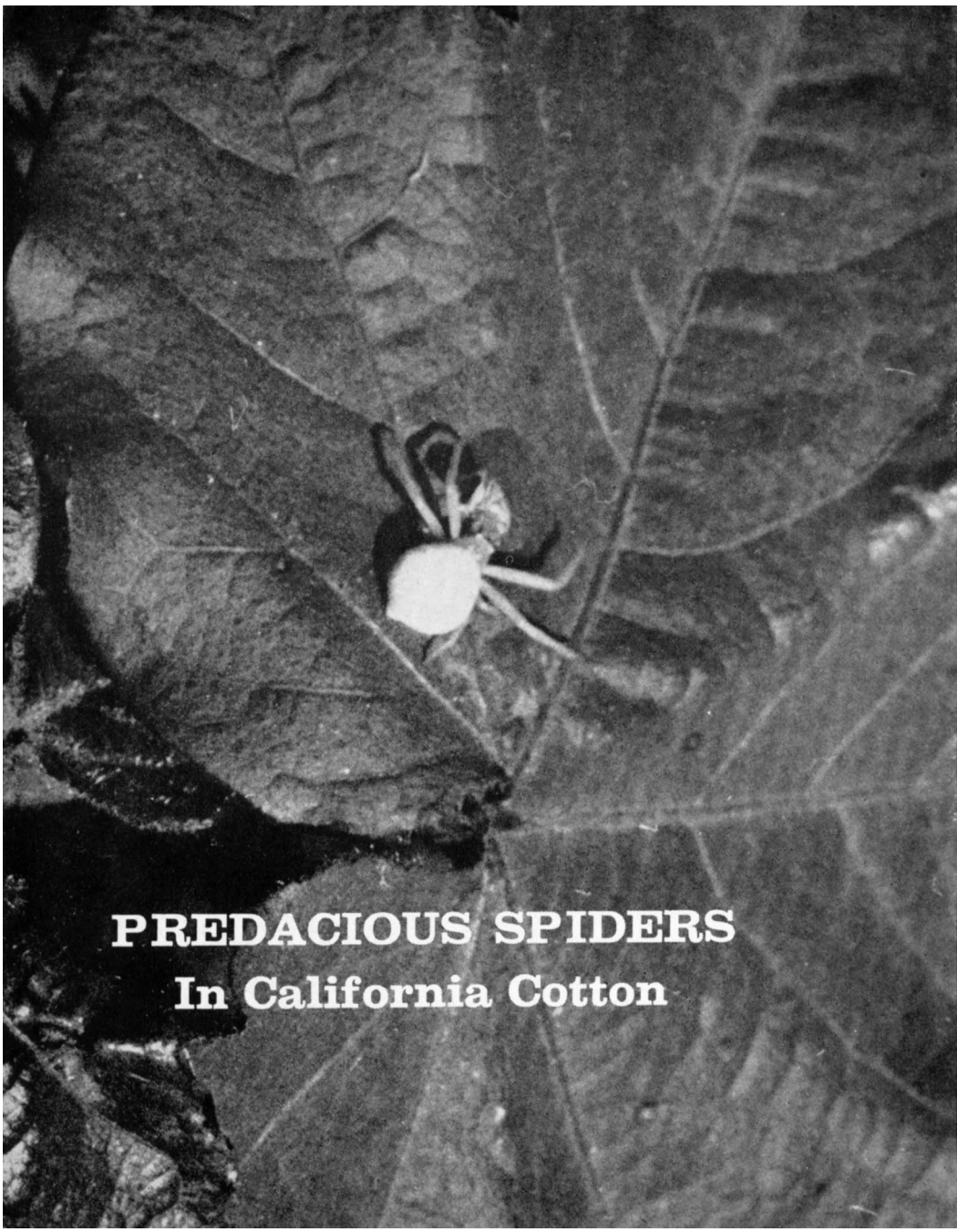

PREDACIOUS SPIDERS In California Cotton

Results of this study indicate that a wide variety of spiders are present in California cotton fields. Several of these are abundant during the cotton growing season and appear to feed extensively on such cotton pests as the lygus bug (seen being attacked by a crab spider in photo to left). Differences were apparent in the portions of the plant that different species inhabit and the area of the valley they occupy.

T. F. LEIGH · R. E. HUNTER

SPIDERS ARE KNOWN to kill a wide array of insects and mites. However, little detailed information has been available concerning the species of spiders present in California crops. The research reported here was conducted to learn what spiders are in the cotton fields, how abundant they are, what portions of the plant or field they inhabit, and to learn about their feeding habits and life histories.

This survey was conducted at three locations in the San Joaquin Valley: Rosedale, Kern County; Hanford, Kings County; and Five Points, Fresno County. At these locations, fields or portions of fields were selected in which no insecticides were used.

Spiders were collected by methods including the placing of "pitfall" traps in the ground, sweeping with insect nets, vacuuming, beating plants, and visual search and capture. The pitfall traps were used to capture species that move across

TABLE 1. LOCATION, HABITAT, ABUNDANCE AND ACTIVITY OF COMMON SPIDERS IN SAN JOAQUIN VALLEY COTTON FIELDS

Species	Locations* commonly taken	Main collection† method	Time of activity	Type of predation	Predominant site of activity**	Seasonal abundance
Dictynia reticulata **Gertsch & Ivie**	I, II, III	d, e	All times	Web	A, H	June–Oct.
Psilochorus **spp.**	I, II	c	Night	Web	D, I	June–Oct.
Misumenops deserti **Schick**	I, II, III	a, b	Day	Hunt	A, C	May–Oct.
Xysticus californicus **Keyserling**	I, II, III	d, e	Day	Hunt	A, B, D	Mar.–Sept.
Metaphidippus imperialis **Peckham**	I, II	d, f	Day	Hunt	A, E	June–Sept.
Pardosa ramulosa **(McCook)**	I, II	c, h, a	Night	Hunt	D, E	Year-round
Schizocosa **new spp.**	III	c, h	Night	Hunt	D	May–Oct.
Arctosa **spp.**	I, II	c	Night	Hunt	D	Mar.–June
Oxyopes salticus **Hentz** lynx spider	I, II	a, b, e	Day	Hunt	E	May–Sept.
Latrodectus mactans **(Fabricius)** black widow spider	I, II, III	c, f	Night	Web	F	Mar.–Nov.
Theridiidae spp. #1	I, II, III	d, e	All times	Web	H	Apr.–Oct.
Neoscona **spp.**	I, II	f	Morning	Web	G	July–Oct.
Tetragnatha spp.	I, II	a, f	Morning	Web	G	July–Sept.
Erigone dentosa **Cambridge**	I, II, III	a, b, c, d, g	All times	Hunt & Web	D, E, I	Year-round
Eperigone eschatologica **(Crosby)**	I, III	c, g	All times	Hunt & Web	D, I	Feb.–Nov.
Spirembolus phylax **Chamberlin & Ivie**	III	c, g	Unknown	Hunt	D,	Mar.–Oct.

* I = Rosedale, Kern County; II = Hanford, Kings County; III = Five Points, Fresno County

† a = Sweep net; b = Suction machine (tips of shoots); c = Pitfall traps; d = Beating; e = Suction machine (on side of plant); f = Individually captured specimens; g = Trash samples run through Berlese funnels; h = Headlamp collection at night.

** A = Inside bracts of squares and bolls; B = Hunt in lower ⅔ of the plant; C = Hunt in terminal portion of the plant; D = Hunt on the ground; E = Hunt throughout the plant foliage; F = Web built on the ground and in the lower part of the plant; G = Orb web built between the plants; H = Web built in the lower ⅔ of the plant; I = Web built on the ground

TABLE 2. SUMMARY OF LIFE HISTORIES OF SIX SPECIES OF SPIDERS REARED IN A LABORATORY

Species	Sex	No. post emergence molts (range)	Avg. immature life in days (range)	Avg. total life in days (range)	Avg. number egg cases (range)	Avg. number eggs per case (range)
Dictynia reticulata	F	7 (7–8)	143 (79–206)	261 (198–318)	11 (5–24)	15 (6–27)
Gertsch and Ivie	M	7 (7–8)	61 (23–98)	177 (144–210)		
Misumenops deserti	F	8 (8–13)	300 (188–531)	523 (276–720)	4 (2–6)	143 (7–208)
Schick	M	7 (6–9)	242 (145–395)	406 (272–642)		
Xysticus californicus	F	10 (9–12)	470 (346–561)	658 (428–732)	3 (1–4)	169 (15–228)
Keyserling	M	9 (8–10)	382 (304–493)	571 (392–688)		
Pardosa ramulosa	F	9 (9–10)	115 (100–147)	258 (152–310)	5 (1–7)	29 (3–46)
(McCook)	M	8 (8–9)	92 (55–104)	204 (177–244)		
Schizocosa new spp.	F	11 (10–13)	337 (228–416)	683 (378–745)	3 (2–5)	73 (0–189)
	M	10 (10–11)	250 (203–367)	354 (300–466)		
Erigone dentosa	F	6 (5–6)	42 (18–75)	99 (77–158)	14 (5–27)	14 (0–27)
Cambridge	M	6 (5–6)	48 (15–108)	99 (57–173)		

the ground hunting for prey. The sweeping technique and use of a suction machine were both used to sample for insects and spiders in the terminal portion of plants. Sweeping with the net dislodged more of the clinging specimens, because more of the large spiders were apparently able to resist the suction machine. The suction machine was also used to take samples deep within the canopy of plants. The beating technique provided samples of spiders inhabiting the entire plant zone. The visual search technique revealed the kinds of spiders not taken by the other methods and enabled the observers to study their biology and habits. The visual method was also used at night with the help of a headlamp to observe nocturnal activity of spiders.

Life history studies were carried out in a laboratory with temperatures maintained at 80°F. Spider data obtained included measurements of the width of the carapace (dorsal thoracic plate) recorded at several growth stages. These measurements were used to establish an index for estimating the growth stage of immature specimens. A number of field-collected immature spiders were reared to the adult stage for comparison with specimens in the laboratory. This information was used to determine the "age" of field-collected specimens.

Species obtained

Thirty-four species of spiders have been identified at the three locations. Sixteen of these species occurred in considerable abundance. The common species are indicated in table 1 along with locations, habits, habitats and seasonal occurrence. The abundance of some species was highly variable from one year to the next.

Spiders reared in the laboratory were fed on other arthropods reared for this purpose, including: *Lygus hesperus* Knight, *Spangonicus albofasciata* (Reuter), *Heliothis zea* (Boddie), *Trichoplusia ni* (Hubner), *Drosophila melanogaster* Meigen, *Drosophila hydei* Sturtevant, and *Tetranychus urticae* Koch.

The prey species used was always slightly smaller than the individual spider being fed. The larger wolf spiders were also fed nymphs of field crickets, *Gryllus* spp., from a laboratory culture.

The feeding habits of different spiders varied with such factors as location and habits of the spider and of the prey, size of the spider, size of the prey, speed of the spider and of the potential prey, and hardness of the prey. In a few instances insects had a repellent effect on the spiders. This was especially apparent in the case of Reduviids, *Zelus renardii* Kilenati (assassin bug) and *Sinea* spp. (soldier bug), but is also apparent to a lesser degree in the consperse stink bug *Euschistus conspersus* Uhler.

Feeding tests

Feeding tests conducted in the laboratory and field observations indicate that most species of the spiders found in cotton fields are general feeders. Most of the arthropods—harmful, beneficial and neutral—were accepted by the spiders. Exceptions included aphids, fed upon only by *Dictynia;* stink bugs, fed upon only by *Latrodectus* (the black widow spider) and *Schizocosa; Hippodamia* spp. (lady beetles), fed upon by *Schizocosa; Collops* spp. (collops beetles), fed upon by *Schizocosa, Pardosa,* and the black widow spider. None of the spiders tested would feed on assassin bugs, soldier bugs or honey bees. The black widow spider was not tested with these species, but it would readily accept the consperse stink bug.

The life histories of six species have been completed. Cycles were widely different, as indicated in table 2. Both sexes of *Erigone dentosa* Cambridge required an average of 45 days to develop from egg to adult and lived an average of 99 days. *Xysticus californicus* Keyserling required an average of 382 and 470 days from hatch to adulthood for males and females respectively. Average adult male life was 189 days while females averaged 188 days. The other species that were reared had cycles that were generally between these two extremes.

Carapace measurements for the several stages of the common species were distinctive in the earlier instars, but overlapped in later instars. The stage of the first few instars may be estimated to within one instar with a high degree of accuracy. Field collected material was found in all stages of development.

T. F. Leigh is Entomologist; and R. E. Hunter was Laboratory Technician, Department of Entomology, University of California, Davis. *This investigation was supported in part by Agricultural Research Service Grant Number USDA-12-14-100-8006 (33). Cotton growers Jay Dow and Everett H. Feaver, and farm advisors Hodge Black and O. D. McCutcheon assisted with this study. Joseph Hein assisted in sorting field collected material and in the studies of life cycles.*

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