Mohammad Ali SHAH[1]): *A stimulant in* Berberis vulgaris *inducing oviposition in coccinellids*

KEY WORDS: Coccinellidae — *Adalia bipunctata* — Oviposition — Stimulant —*Berberis*.

The spatial distribution of coccinellid larvae is largely determined by the oviposition behaviour of the adults. Field observations have shown that hedges of *Berberis vulgaris* L. most often harbour large numbers of larvae and pupae of *Adalia bipunctata* (L.) even when nearby shrubs or trees of other species are more heavily infested by aphids (B. Ohnesorge, pers. comm.). The following experiments were done to determine whether *B. vulgaris* is a preferred oviposition substrate.

Material and methods. Twigs from ornamental shrubs at the university campus in Hohenheim and from fruit trees (12—15 years old) in an experimental orchard were collected during April and May between 8—10 a.m., thoroughly rinsed with water to remove dust or honey dew and immediately used for experiments. Only twigs uninfested by aphids were used. The fruit trees had flowered but the shrubs had not.

A laboratory culture of *A. bipunctata* and *Coccinella septempunctata* L. was established with specimens collected from various crops in the field, maintained on *Vicia faba* and fed with *Acyrthosiphon pisum* (Harris). Adults emerging from the pupae were kept separately for 5—9 days until they started mating and then used for the experiments.

Preparation of water extracts: 8 g *B. vulgaris* leaves or 4 g *B. vulgaris* twigs or 8 g *Prunus cerasus* leaves were collected as indicated above and homogenized in 40 ml ice water.

Test method: Multiple choice test.

Exp. 1: Twigs (length = 20 cm) of *B. vulgaris* L., *Malus domesticus* Borkh., *Prunus avium* L., *P. cerasus* L. were exposed to 20 ♂♂ and 20 ♀♀ of *A. bipunctata*. The number of leaves per plant species was different but the total leaf area per species amounted to 140—150 cm². The arrangement of the twigs within the cage was changed several times during the experiment to avoid spatial effects. 4—500 *A. pisum* were released for food into the cage. They did not settle, no host plant being available, but distributed themselves more or less evenly over the leaves. The cages were kept in an insectary at 22° under artificial illumination (photoperiod = 18 hr). The number of eggs deposited by the coccinellids within 25 hr on each plant species was recorded. — Six replications.

Exp. 2: Same as exp. 1, but with *C. septempunctata*.

Exp. 3: Twigs of *B. vulgaris* L., *Lonicera periclymenum* L., *Cotoneaster tomentosa* Lindl., *C. integerrima* Med., *Symphoricarpus rivularis* Suksd. were exposed to 40 ♀♀ of *A. bipunctata* in the same manner as in exp. 1. The number of deposited eggs was recorded and also, 6 times during the experiment, the number of ♀♀ on each plant species. Females on the sides or the ceiling of the cage were not recorded. Six replications.

Exp. 4: Same as exp. 3, but with *C. septempunctata*.

Exp. 5: Each water extract was sprayed on a *P. cerasus* twig. Each twig had 6 leaves with a total leaf surface of 150 cm². The extract was sprayed on the upper and lower surface. The twigs were exposed to 20 ♂♂ and 20 ♀♀ of *A. bipunctata*. Six replications.

Exp. 6: Same as exp. 5, but with *C. septempunctata*.

Results. Females of *A. bipunctata* as well as of *C. septempunctata* deposited more eggs on leaves of *B. vulgaris* than on the leaves of any other plant species included in this experiment (Table I). The differences are highly significant. On the other hand the ♀♀ did not visit the twigs of *B. vulgaris* more often than the twigs of other shrubs; in experiment 3 and 4 the numbers of ♀♀ present on the twigs of the different plant species were not significantly different (Table I).

Leaf extract and wood extract from *B. vulgaris* enhanced oviposition in both coccinellid species when sprayed on the leaves of *P. cerasus* (Table II).

Discussion. It is obvious that *B. vulgaris*, when compared with the other plant species tested in these experiments, is a strongly preferred oviposition plant for *A. bipunctata* and *C. septempunctata*. Since there is no indication that the adult coccinellid ♀♀ stay preferentially on this shrub (see exp. 3 & 4), it can be concluded that there is a specific stimulus which elicits oviposi-

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TABLE I

Average number of eggs deposited by 20 (exp. 1 & 2) or 40 (exp. 3 & 4) ♀♀ of A. bipunctata *and* C. septempunctata

		A. bipunctata			*C. septempunctata*		
Exp.	Av. No. leaves	eggs	egg clusters	♀♀ on twigs	eggs	egg clusters	♀♀ on twigs
1 & 2							
B. vulgaris	160	188			293		
M. domesticus	7	0			0		
Pr. avium	5	7			0		
Pr. cerasus	6	0			5		
3 & 4							
B. vulgaris	130	345	45	2.0	571	23	2.5
L. periclymenum	130	46	10	2.8	53	3	1.5
C. tomentosa	130	38	6	2.5	0	0	3.8
C. integerrima	130	7	1	2.0	41	2	3.5
S. rivularis	130	29	2	3.7	22	1	3.2

TABLE II

Average number of eggs deposited on leaves of P. cerasus *sprayed with extracts of leaves or twigs of* B. vulgaris *and leaves of* P. cerasus. *N* = 6

	A. bipunctata		*C. septempunctata*	
	eggs	egg clusters	eggs	egg clusters
B. vulgaris leaves	68	10	169	11
B. vulgaris twigs	51	6	155	13
Pr. cerasus leaves	7	3	32	2

tion on it. This stimulus might arise from the size, shape or texture of *Berberis*-leaves. *B. vulgaris* was therefore tested together with shrub species whose leaves are of similar quality in these respects. Even though an influence of the above-mentioned features cannot be excluded, it is obvious from the results of these experiments, that they cannot account fully for the strong preference of *A. bipunctata* and *C. septempunctata* for *B. vulgaris*. On the other hand, there might be a chemical stimulus which arises from plant substances specific to *B. vulgaris*. This hypothesis is supported by the results of exp. 5 & 6. Extracts from *B. vulgaris*, when sprayed on leaves of a plant species which is otherwise not a preferred oviposition substrate enhanced oviposition.

It is not the first time that plant substances are found to induce oviposition responses in coccinellids. Boldyrev *et al.* (1969) provoked oviposition in *A. bipunctata* and other coccinellid species on spruce timber boards by treating them with alcohol extracts from *Juniperus virginiana*. The ecological significance of this response is not fully understood. *B. vulgaris* is colonized very often by *Liosomaphis berberidis*, and its leaves constitute a very good substratum for searching coccinellid larvae (Shah 1980). But it may be questioned whether these factors exert a selection pressure strong enough to account for the evolution of a specific oviposition response to chemicals of *B. vulgaris*.

ZUSAMMENFASSUNG

Ein Eiablage-Stimulans für Coccinelliden in Berberis vulgaris

In Auswahlversuchen, die mehrere Obstbaum- und Ziersträucharten umfaßten, legten ♀♀ von *Adalia bipunctata* und *Coccinella septempunctata* ihre Eier bevorzugt auf die Blätter der Berberitze *Berberis vulgaris* ab. Sauerkirschenblätter, die mit einem wässrigen Extrakt aus Berberitzenblättern bzw. -zweigen besprüht worden waren, wurden stärker mit Eiern belegt als solche, die mit Sauerkirschenblattextrakt behandelt worden waren.

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S. N. THOMPSON[1], L. BEDNAR[1]) and H. NADEL[1]): *Artificial culture of the insect parasite*, Pachycrepoideus vindemiae.

KEY WORDS: *In vitro* culture — Parasite — Parasitic — Hymenoptera — Pteromalidae — Artificial media — *Pachycrepoideus vindemiae*.

Preliminary investigations with the pupal ectoparasite, *Pachycrepoideus vindemiae* Rondani (Pteromalidae) demonstrated the potential for *in vitro* culture of this hymenopterous insect parasite (Thompson, 1981a). The parasite completed its larval development in the absence of host extracts on chemically defined media containing free-amino acids, fatty acids, cholesterol, inorganic salts, glucose and vitamins. Further development, however, was not obtained. Later studies with *P. vindemiae* and a pupal endoparasite, the chalcid, *Brachymeria lasus* Walker, suggested that the high osmotic pressures of diets containing high levels of small diffusible molecules are detrimental to development. Subsequently, *B. lasus* was reared successfully from the egg to fecund adult on media containing primarily albumin with a supplement of free-amino acids, glucose, and Intralipid (a phospholipid emulsion

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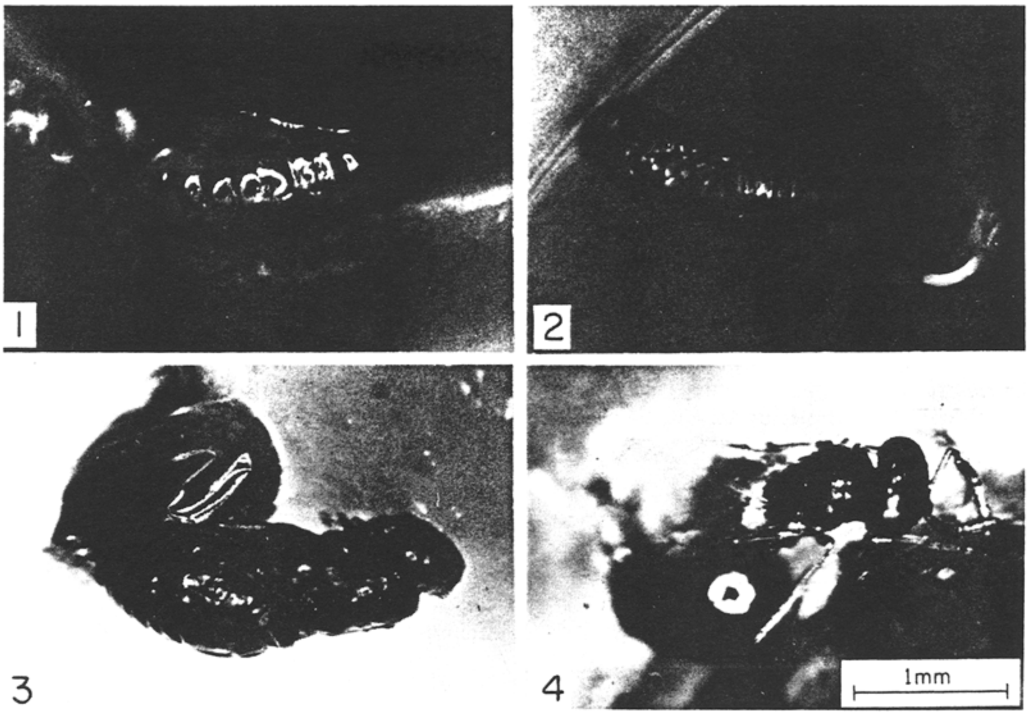

Fig. 1. *In vitro* development of the insect parasite, *Pachycrepoideus vindemiae*. 1) Mature larvae, 2) Newly-formed pupa, 3) pupa, 4) adult.