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STUDIES ON THE PHENOLOGY OF THREE SPECIES OF APION (COLEOPTERA CURCULIONIDAE) OCCURRING ON WINTER LEGUMINOUS CROPS IN ISRAEL

by

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S U M M A R Y

Details on the phenology of the common species of Apion on leguminous crops in Israel were obtained by a systematic survey carried out between 1957 and 1965 at nine observation sites.

Of the many individuals which were collected, 27 species were identified; of these, the most common were A. arrogans, A. aestivum and A. seniculus. A. arrogans was most abundant in the southern region and in the Yizreel Valley; A. aestivum in the Hula Valley; and A. seniculus along the Carmel Coast\*\*

Most of the A. arrogans population was found on vetch, broad bean and, to a much smaller extent, on alfalfa; only few individuals were found on clover. The main host of A. aestivum and A. seniculus was clover; neither species was found on broad bean.

A. arrogans and A. seniculus were the first to appear after the diapause period, in early December, and their populations increased in January. The first beetles of A. aestivum were collected at the end of January, and the population peak was reached in March.

The new generation of A. arrogans began to appear at the end of February, and their numbers increased in March and April; in May they entered into estivation. The new generations of A. aestivum and of A. seniculus appeared at the end of April and during May; in early June, individuals of these species were, still found in the field.

Snout beetles of the genus Apion occur on leguminous and other plants in Israel. However, there are no details about the main species that make up the Apion population, their host plants, the time of their occurrence, and other phenological data.

In his book "Animal Life in "Palestine", Bodenheimer (2) lists ten species, five of them hosted by wild clover, the others having hosts of different families. Later, in "Prodromes Fauna Palestine," Bodenheimer (3) lists 33 species, without mentioning their hosts.

In the course of the last three decades the fields of legumes in Israel have extended over larger areas, with Apion populations increasing as a result.

During the eight years from 1957 to 1965, a survey was made of occurrence of Apion species on the leguminous winter crops in Israel. The aim of this survey was to collect the species which occur in the winter leguminous crops and ascertain which of them are the most common. This survey made it possible to establish the time of appearance and the main period of activity of the various species and their major hosts.

#### METHODS

Nine observation sites were chosen in the north, center and south of the country, in which observations were carried out regularly. At six of these sites (Hula Valley, Carmel Coast, Bet Dagan, Masmmya, Beer Toviyya and Gilat) the survey was carried out for six years; at three sites (Western Galilee, the Jordan Valley and Yizreel Valley) for two only years.

Once every two weeks, 100 sweeps were made with a net at each of the sites. The sweeps were made while walking slowly across the field, in all directions. The net was of regular cloth of a dense mesh. The sweeps were generally between the hours of 10:00 a.m. and 12:00 noon. The insects caught were brought to the laboratory for identification, counting and recording.

Four kinds of legumes were chosen for the survey: Vetch (Vicia sativa L.), broad bean (Vicia faba L.), alfalfa (Medicago sativa L.) and clover (Trifolium alexandrinum L.). The four hosts were not always found at the same site, nor were they found at the same site in all years; however, when any of the hosts was available at any of the sites, the survey was made in each field separately. The number of years, the survey was carried out on each of the host plants, at each observation site, is given in Table 1.

Table 1 - Number of years the survey was carried out in each of the host plants at each site

Observation site	H o s t			
	Alfalfa	Clover	Vetch	Broad bean
Hula Valley (Upper Galilee)	6	6	3	-
Western Galilee	2	2	2	-
Jordan Valley	2	-	2	-
Yizreel Valley	1	1	2	-
Carmel Coast	6	6	1	-
Bet Dagan	4	6	6	2
Masmmya	5	5	4	2
Beer Toviyya	6	6	4	5
Gilat	5	1	2	2

In addition, a special survey was made in order to establish the host preference of A. arrogans. Larval populations of this species were counted in fields of purple vetch - Vicia arthropurpurea - and of common vetch - Vicia sativa. A site was chosen where both species of vetch were available. One hundred heads of plants were picked at random, and were examined closely in the laboratory for the occurrence of Apion arrogans larvae.

## RESULTS

### Composition of the Apion population in winter leguminous crops

Of the various species of Apion that were collected in the field during the survey, the following were determined by E. Györfy, Budapest and Dr. med. B. Büttner, Germany.

1. Apion (Pseudotrichapion) arrogans Wenck.
2. A. (Protapion) aestivum Wagn.
3. A. (Protapion) truquii Reiche
4. A. (Protapion) ononicola Bach
5. A. (Protapion) laevicolle Kirby
6. A. (Protapion) apricans Hbst.
7. A. (Protapion) politum Desbr.
8. A. (Catapion) seniculus Kirby
9. A. (Catapion) pubescens Kirby
10. A. (Erythrapion) miniaturum Germ.
11. A. (Aspidapion) radiolus Kirby
12. A. (Aspidapion) aeneum Fabr.
13. A. (Stenopterapion) tenue Kirby
14. A. (Stenopterapion) intermedium Epp.
15. A. (Synapion) splendidulum Desk.
16. A. (Holotrichapion) ononis Kirby
17. A. (Kalcapion) flavofemoratum Herbst
18. A. (Perapion) violaceum Kirby
19. A. (Ceratapion) chenocephalum Desbr.
20. A. (Ceratapion) carduorum Kirby
21. A. (Ceratapion) scalptum Rey
22. A. (Ceratapion) pilicorne Desbr.
23. A. (Taeniapion) semivittatum Gyllh.

24. A. (Diplapion) detritum Rey
25. A. (Rhopalapion) longirostre Ol.
26. A. (Metapion) breiti Wagn.
27. A. (Chlorapion) cognatum Hochh.

Of these species, the most commonly found were A. arrogans, A. aestivum and A. seniculus; A. truquii, A. miniatum, A. radiolus and A. tenue were found in small numbers, while the rest were found only single samples.

Table 2 - Comparative abundance of the main Apion spp. occurring in leguminous winter crops (total figures for entire survey)

Species	Number of beetles caught	Percentage of the total <u>Apion</u> population
<u>A. arrogans</u>	6944	66.3
<u>A. aestivum</u>	2038	19.5
<u>A. seniculus</u>	1185	11.3
<u>A. truquii</u>	167	1.6
<u>A. tenue</u>	61	0.6
<u>A. miniatum</u>	42	0.4
<u>A. radiolus</u>	25	0.2

Table 2 records the abundance of the main species of the Apion population found in the fields of the four host crops under survey. It is apparent that the Apion population of the winter leguminous crops in Israel is composed primarily of the species A. arrogans, A. aestivum and A. seniculus, in that order

#### Distribution of the most common Apion species

Table 3 presents the distribution of the three most common Apion species. A. arrogans was most abundant in the Yizreel Valley and in the southern area of the coastal plain (Masmiyya and Beer Toviyya). A. aestivum occurred mainly in the Hula Valley, with a considerable percentage also in the Western Galilee. A. seniculus was most abundant along the Carmel Coast. It was found in large numbers also in the Yizreel Valley, Hula Valley and Western Galilee.

Table 3 - Distribution of the three most common Apion spp. at the various survey sites (Percentage of the total population of each species collected at all sites; based on 10 observations on the main host at each site).

Observation site	<u>Apion</u> <u>arrogans</u>	<u>Apion</u> <u>aestivum</u>	<u>Apion</u> <u>seniculus</u>
Hula Valley (Upper Galilee)	1.0	59.2	14.3
Western Galilee	0.4	17.7	11.2
Jordan Valley	1.8	3.3	0.7
Yizreel Valley	21.3	1.8	20.0
Carmel Coast	8.6	11.3	48.6
Bet Dagan	8.5	1.4	4.3
Masmiyya	32.0	3.9	0.4
Beer Toviyya	25.4	1.4	0.5
Gilat	1.0	0	0

#### HOST SELECTION

From the survey it became apparent that each of the three species of Apion has a main host. Table 4 shows the occurrence of each of the species on the four leguminous plants included in the survey. The main hosts of A. arrogans

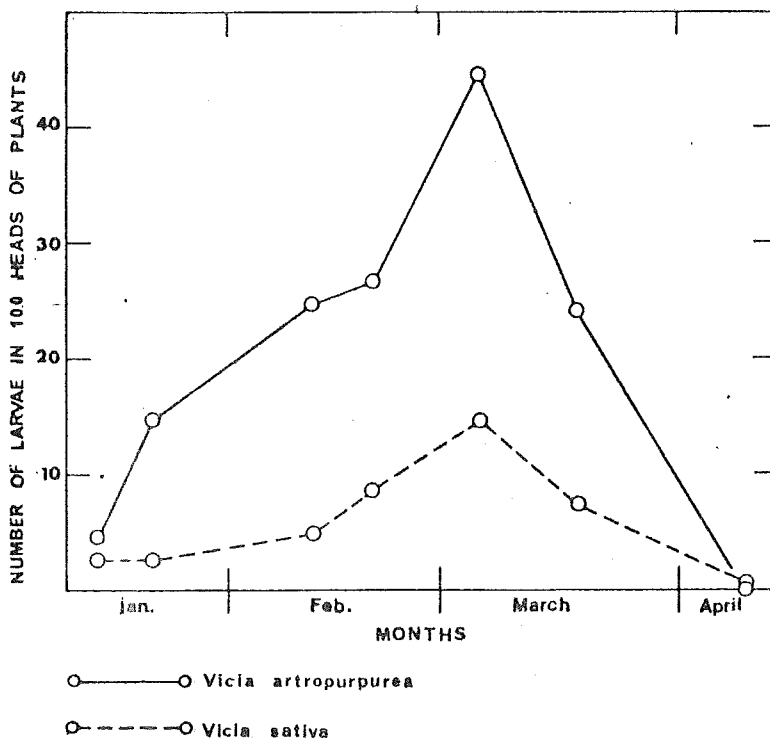
Table 4 - Host preference of the three most common Apion spp.

Host	Number of observations	Number of beetles in 50 observations		
		<u>A. arrogans</u>	<u>A. aestivum</u>	<u>A. seniculus</u>
Vetch	166	1038.8	37	11.5
Broad bean	64	839	0	0
Alfalfa	509	187.5	16	4.5
Clover	466	55	186	118

were vetch and broad bean; on alfalfa it was found in small numbers, and on clover only rarely. The main host for the other two species, A. aestivum and A. seniculus, was clover. Small numbers were caught on vetch and alfalfa, but none on broad bean.

The study of the A. arrogans larval populations in Vicia artropurpurea and V. sativa showed that their number was significantly higher on the former vetch species (Fig. 1).

Fig 1  
The comparative abundance of *A.arrogans* larvae in two species of vetch.

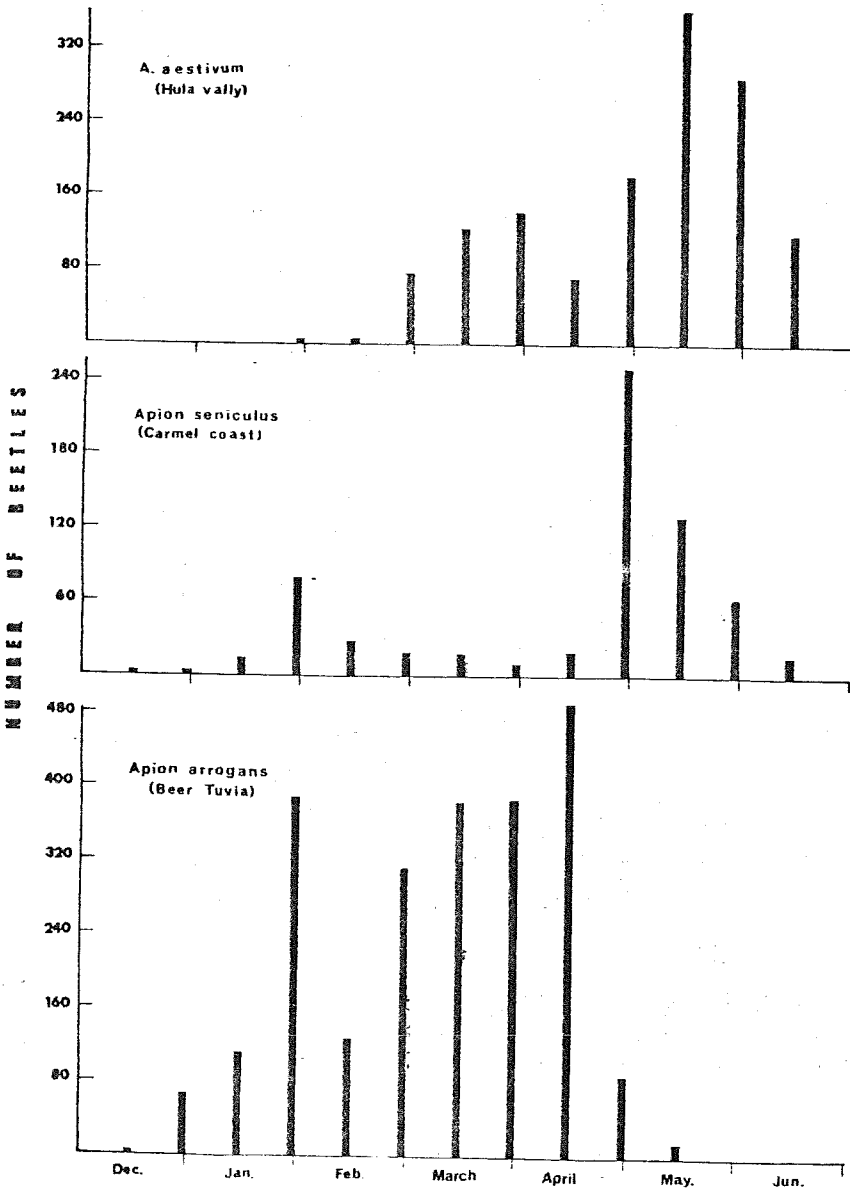


Population fluctuations of the most common Apion Species

Fig. 2 summarizes the fluctuations in population of the three Apion species, each one in the locality in which it was most abundant. There were quite distinct differences in the time of the first appearance after aestivation: the time of appearance of the first individuals of the new generation. The first to appear after the aestivation period were A. arrogans and A. seniculus. Their populations developed and reached peak towards the end of January. The emergence of the first generation of A. arrogans began at the end of February; their number increased and the peak was reached by the end of March or early April. In May, there was a big drop in the number of beetles as a result of their entering into diapause. On the other hand, the population of A. seniculus remained at low levels throughout February and March. The rise in the population at the end of April was due to the emergence of the first generation about two months after the appearance of the first generation of A. arrogans.

The first individuals of A. aestivum after the summer diapause appear at the end of January or early in February. The population of this generation increased during March, and after a slight decrease in April, the new generation began to emerge about two months after that of A. arrogans, or about the time of the first generation of A. seniculus. The beetles of the two species started aestivating in June.

**FIG 2**  
The annual fluctuation of the population of the three *Apion* spp. in Israel. (Each column presents the 5 year average of two week catches)



## DISCUSSION

Of the 27 species that were identified on winter leguminous crops in Israel, three were found to be very prevalent; two of them (A. aestivum and A. seniculus) occur also in many European countries (4, 5, 7, 9, 13). The distribution of the third, A. arrogans, is limited, and according to Winkler (16) occurs in Asia Minor and Syria. In Israel it is the most common species and the only one causing damage.

Species of Apion were found to show a preference of one or two hosts. Most of the A. arrogans individuals were collected from vetch or broad beans, whereas most of the A. aestivum and A. seniculus were collected from clover. Similar findings were obtained by other workers (1, 4, 6, 12, 15) who mention these last two species as clover pests.

Some species show preference to certain plants of the same genus.

Kokorin (8) points out that Apion virens prefers Trifolium pratense and T. medium, and A. seniculus prefers T. hybridum and T. repens. In Israel, A. arrogans attacks Vicia arthropurpurea more than Vicia sativa.

The time of the awakening from the summer estivation depends a great deal upon the onset of rain (11), but there are still some differences in the first appearance of the various species. A. arrogans and A. seniculus appear in December, whereas A. aestivum appears late in January. Quite possibly, the late appearance of A. aestivum is connected with the oviposition site of the species. Trusov has pointed out (14) that this species lays its eggs in the flowers of clover. Apparently their appearance is timed to coincide with the appearance of the clover flowers.

It is possible that the appearance of the first generation of each species depends on the length of its development period. The development of A. seniculus is slow. Reports from Latvia (1) give the length of its development (all stages) at 14.4° C as 86.2 days. On the other hand, development of all stages of A. arrogans at 15°C is completed in 32 days (10). This fact explains the delay in the appearance of the first generation of A. seniculus for several weeks after that of A. arrogans.

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