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Parasitoids of codling moth and other leafrollers (Lepidoptera, Tortricidae) in apple orchards and forests in south-west Switzerland

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To assess the role of parasitism in reducing pests populations, a three-month study (end of April to July 1995) was carried out in the region of Nyon, near Geneva, on the parasitoid complex of the overwintering generation of codling moth *Cydia pomonella* L., summer fruit tortrix *Adoxophyes orana* F.v.R., and other leafrollers, in apple orchards and surrounding forests. A total of 24 Hymenoptera and 1 Diptera parasitoids (11 Braconidae, 11 Ichneumonidae, 1 Eulophidae, 1 Perilampidae, 1 Tachinidae) were reared from 19 species of leafrollers, 2 species of Gelechiidae, and from codling moth. Depending on the site of collection, the rate of parasitism ranged from 0 % to 40 %; on average, parasitoids reduced the populations of leafrollers by 13.8 % and those of codling moth by 3.7 %.

Keywords: codling moth, summer fruit tortrix, leafrollers, gelechids, parasitoids, apple orchards, forests.

INTRODUCTION

Codling moth (*Cydia pomonella* L.), summer fruit tortrix (*Adoxophyes orana* F. v R.) and other leafrollers (Tortricidae, Lepidoptera) are key pests in apple orchards. Thus, investigation on their natural enemies, which may play a significant role in reducing the density of pest populations, is a matter of current interest. Forests close to apple orchards are home to many phyllophagous insects, including leafrollers. The former are attacked by parasitoids, most of which are oligophagous or polyphagous and may migrate to neighbouring apple orchards. Successfully, parasitoids may attack leafrollers feeding on apple leaves. Therefore, forests close to orchards represent a constant reservoir of hosts for a lot of parasitoids which may also play a significant role in reducing the orchard-dwelling populations of leafrollers.

Apart from leafrollers, two species of Gelechiidae (*Recurvaria nanella* HB. and *Recurvaria leucatella* CL.), which were collected at larval stage in apple orchards, were also investigated. The first one is common in some apple orchards, where it can cause serious damage. Its parasitoids successfully infect leafrollers.

The purpose of this study is to determine the species composition of Hymenoptera parasitoids infecting codling moth and leafrollers in apple orchards and neighbouring forests.

MATERIAL AND METHODS

A total of 497 caterpillars of leafrollers were randomly collected from April to July 1994/1995 in various apple orchards and deciduous forests in the region of Nyon. Because of the inventorial and faunistical approach of the parasitoid fauna,

the investigations were not extended to the recording of the host plant species in the forests. Caterpillars were then individually reared on artificial diet in small plastic boxes in a chamber at 25 °C, 17/7 h day/night and 75 % RH until the emergence of adult moths or parasitoids. Changes in the developing stage (pupation, emergence) were recorded daily. All adult parasitoids, cocoons and host remains were glued in dry-way on triangular cardboards, fixed by entomological pins, kept in an entomological box and then identified.

Codling moth caterpillars were collected in the summer-autumn period of 1994 by means of dry corrugated cardboards and kept in an outside insectarium. All parasitoids emerged from the 568 collected caterpillars and pupae of the overwintered population of codling moth were prepared and identified as described. All reared parasitoids from codling moth and leafrollers are kept at the Federal Agricultural Research Station of Changins.

RESULTS AND DISCUSSION

A total of 19 leafrollers and 2 Gelechiidae species emerged from all collected caterpillars and could be reared on artificial diet (Tab. 1). The species diversity is much greater in forests (17 species) than in apple orchards (5 species: 3 leafrollers *Adoxophyes orana* F.v.R., *Pandemis heparana* D. & S. and *Spilonota ocellana* D. & S. and 2 Gelechiidae). Except *P. heparana*, there is no species occurring in both apple orchards and forests; both Gelechiidae species occur only in apple orchards. The species occurring at the highest density is *Adoxophyes orana* (26 % of all emerged species and 98.4 % of all leafrollers in Rolle). Eleven species (species 2, 3, 4, 5, 6, 7, 8, 9, 12, 20, 21, Tab. 1) are known to be associated with apple trees and

Tab. 1. Abundance (Nb) of leafrollers species in 3 ecosystems: apple orchard (a.o.), forest and hazel trees, and percentage of parasitism (%p.).

	apple orchard						forest								hazel trees		TOTAL	
	Rolle		Duillier		Grens		Genolier		Duillier		Trélex		Nyon		Changins			
Species	Nb	% p.	Nb	% p.	Nb	% p.	Nb	% p.	Nb	% p.	Nb	% p.	Nb	% p.	Nb	% p.	**Nb**	**% p.**
Tortricidae																		
1 Adoxophyes orana F.& R.*	60	0															**60**	**0**
2 Archips rosana L.*							1	0	6	33.3			5	0	14	0	**26**	**3.3**
3 A. podana Scop.*							1	0			1	0					**2**	**0**
4 A. xylosteana L.*							22	40.9	3	0			15	33.3			**40**	**35**
5 A. crataegana Hüb.*							1				2	0					**3**	**0**
6 Pandemis heparana D. & S.*	1	0							2	0							**3**	**0**
7 Spilonota ocellana D. & S.*			4	0	1	100											**5**	**20**
8 Ptycholoma lecheana L.*							1	0	1	100							**2**	**50**
9 Hedya nubiferana Haw.*									2	0	3	33.3	1	100			**6**	**33.3**
10 Tortrix viridana L.							20	20	3	0	1	0	1	0			**25**	**16**
11 Argyroploce lacunana D.&S							1	0									**1**	**0**
12 Croesia forsskaleana L.							15	33.3			2	0	4	0			**21**	**23.8**
13 Eudemis porphyrana Hbn.							2	0	1	0			4	0			**7**	**0**
14 E. profundana D.& S.							1	0									**1**	**0**
15 Gypsonoma dealbana Frö.							2	0	3	0							**5**	**0**
16 Lozotaenia forsterana F.													1	0			**1**	**0**
17 Zeiraphera isertana F.							5	0	4	0							**9**	**0**
18 Z. rufimitrana H. & S.							1	0									**1**	**0**
19 Tortricidae sp.									1	0							**1**	**0**
Gelechiidae																		
20 Recurvaria nanella Hb.*			2	0	8	37.5											**10**	**30**
21 R. leucatella Cl.*					1	0											**1**	**0**
Total	**61**	**0**	**6**	**0**	**10**	**40**	**73**	**24.7**	**26**	**12**	**9**	**11.1**	**31**	**19.4**	**14**	**0**	**230**	**13.5**

are commonly found in old, untreated apple orchards (JEANNERET, 1992). Except *Croesia holmiana* L., they are usually recorded as pests of secondary importance in cultivated orchards of European countries (AUDEMARD, 1986).

Archips xylosteana L., *Archips rosana* L., *Tortrix viridana* L. and *Croesia forsskaleana* L. are most frequently found in forests. They represent 17.4 %, 11.3 %, 10.9 % and 9.1 %, respectively, of all collected specimens.

The richest leafroller fauna was found in a forest in Genolier (13 species, 31.7 % of all reared specimens).

A total of 25 parasitoid species emerged from all collected caterpillars, mainly from leafrollers. Species composition, taxonomic position, host range, and characteristics are summarized in Tab. 2; for each species, some biological and phenological data are given below.

1. *Apanteles dilectus* HAL. *

One cocooned specimen was collected in forest in Genolier on 23.05.95. The adult (female) emerged on 29.05.95. It is known as a solitary larval endoparasitoid of various Tortricidae spp. occurring in forests (TOBIAS *et al.*, 1986) and it was also reared from *Caloptilia syringella* F. (Gracillariidae) in Germany (ANONYMOUS, 1989).

2. *Apanteles fulvipes* HAL.

It was reared as a solitary larval endoparasitoid from caterpillars of *R. nanella* collected on 05.05.95 in an apple orchard in Grens. The parasitoid larvae left the host remains and cocooned on 30. and 31.05.95. The adult parasitoids emerged on 12.06.95 (1 male) and 14.06.95 (1 female). It is recorded as a parasitoid of Tortricidae spp. on *Pirus malus* in the Netherlands and was reared from *Ocnogyna parasita* HBN. in Switzerland (ANONYMOUS, 1971).

3. *Apanteles laevigatus* RATZ. *

It was reared as a solitary larval endoparasitoid from a caterpillar of *C. forsskaleana*** collected on 23.05.95 in forest in Genolier. The parasitoid larva left the host remains and cocooned on 30.05.95. The adult parasitoid (male) emerged on 06.06.95. It was recorded as a parasitoid of *Epinotia (Hamuligera) abbreviana* F. in Germany (ANONYMOUS, 1989).

4. Ascogaster quadridentata WESM.

This species was reared from overwintered caterpillars of codling moth collected in apple orchards in Changins and Prangins. The adults emerged on 10., 11., and 12.07.95. It is known as a solitary egg-larval endoparasitoid of *C. pomonella* L. and of some leafrollers (GEIER, 1957; EVENHUIS & VLUG, 1983; WILDBOLZ & STAUB, 1985; MARCHESINI & DALLA MONTA, 1994).

5. *Macrocentrus linearis* NEES

It was reared from a caterpillar of *Ptycholoma lecheana* L. collected on 19.05.95 in forest in Duillier. On 22.05.95, 11 parasitoid larvae left the host remains and cocooned all together, in separate brown cocoons. All adults emerged as females

* new species for the swiss fauna
** first record as a host

on 31.05.95. It is recorded in Switzerland as a parasitoid of *A. rosana* and *P. heparana* (ANONYMOUS, 1971). This species is known as a polyembryonic larval endoparasitoid.

6. *Macrocentrus marginator* NEES

It was reared as a solitary larval endoparasitoid from a caterpillar of *A. rosana*** collected on 19.05.95 in forest in Duillier. The parasitoid larva left the host remains and cocooned on 01.06.95 and the adult (female) emerged on 06.06.95. It is known as a parasitoid of *Zeiraphera diniana* GUEN. in Switzerland (ANONYMOUS, 1971).

7. *Macrocentrus thoracicus* NEES

It was reared as a solitary larval endoparasitoid from caterpillars of *A. xylosteana*** collected on 15.05.95 in forest (*Fraxinus*) in Nyon. The parasitoid larvae cocooned out of the host remains on 26.05.95 and the adults (1 male, 1 female) emerged on 06.06.95. According to TOBIAS *et al.* (1986), this parasitoid infects various species of Tortricidae and Gelechiidae in both orchards and forests.

8. *Microdus dimidiator* NEES *

It was reared as a solitary larval endoparasitoid from caterpillars of *C. forsskaleana*** and from one caterpillar of *A. xylosteana*** collected on 23.05.95 in forest in Genolier. The parasitoid larvae left the host remains and cocooned on 30.05.95 and 06.06.95. The adults emerged on 06.06.95 (male), 04.06.95 (female) and 12.06.95 (female) respectively. It is known as a parasitoid of *Croesia bergmanniana* L., *A. rosana*, *Archips crataegana* HB. and other tortricids in orchards and forests (TOBIAS *et al.*, 1986) and was reared from *T. viridana* in Spain (ANONYMOUS, 1961) and Portugal (ANONYMOUS, 1966).

9. *Microdus rufipes* NEES

It was reared as a solitary larval endoparasitoid from an overwintered caterpillar of *C. pomonella* collected in an apple orchard in Genolier. The adult (female) emerged on 20.04.95. It is known as a parasitoid of codling moth (GEIER, 1957; ATHANASSOV & SLAVOV, 1978) and other tortricids (TOBIAS *et al.*, 1986).

10. *Microgaster globatus* L.

It was reared as a solitary larval endoparasitoid from a caterpillar of *C. forsskaleana*** collected in forest in Genolier on 23.05.95. The parasitoid larva left the host remains and cocooned on 29.05.95. The adult (male) emerged on 06.06.95. It is known as a parasitoid of *T. viridana* on *Quercus* sp. in Germany and of *Acrolepia assectella* ZELL. in France (ANONYMOUS, 1971), and of other leafrollers in orchards and forests (TOBIAS *et al.*, 1986).

11. *Phanerotoma dentata* PANZ. *

It was reared as a solitary larval endoparasitoid from Tortricidae sp. caterpillars collected on 17.05.95 in forest (*Crataegus*) in Nyon and on 23.05.95 in forest in Genolier. The adult parasitoids emerged on 14.06.95 (2 females) and 26.06.95 (1 male, 1 female). Some of the infected caterpillars were preliminarily determined

as *P. heparana* but no adult moth emerged, so that there is no certainty concerning the host species. This parasitoid was reared from *Ectomyelois ceratoniae* ZELL. in France (ANONYMOUS, 1966a).

12. *Campoplex faunus* GRAV.

It was reared as a solitary larval endoparasitoid from a caterpillar of *A. rosana*** collected on 19.05.95 in forest in Duillier and from caterpillars of *A. xylosteana*** collected on 23.05.95 in forest in Genolier. The parasitoid larvae cocooned outside of the host remains on 29.05.95 and 31.05.95. The adult parasitoids emerged on 06.06.95 (2 females), 07.06.95 (1 male) and 08.06.95 (2 males). It is known as a parasitoid of *Z. diniana* in Switzerland (ANONYMOUS, 1971).

13. *Campoplex ramidulus* BRISCHKE

It was reared as a solitary larval-pupal endoparasitoid from a pupa of *T. viridana*** collected on 23.05.95 as a caterpillar in forest (*Quercus*) in Genolier. The caterpillar pupated on 26.05.95. The parasitoid larva left the host pupa on 01.06.95 and pupated as a free pupa on 06.06.95. The adult parasitoid (male) emerged on 12.06.95. This unusual parasitoid behaviour (leaving the host pupa) may be attributed to the artificial conditions of rearing. It is recorded as a parasitoid of *Z. diniana* in Switzerland (ANONYMOUS, 1971).

14. *Diadegma fenestralis* HOLMGR.

It was reared as a solitary larval endoparasitoid from a caterpillar of *R. nanella*** collected on 05.05.95 in an apple orchard in Grens. The parasitoid larva cocooned outside of the host remains in a gray brownish cocoon on 16.05.95 and the adult (male) emerged on 29.05.95. It was reared from *A. rosana* and *Cnephasia virgaureana* TR. in Switzerland (ANONYMOUS, 1971).

15. *Enytus apostatus* GRAV. *

It was reared as a solitary larval endoparasitoid from a caterpillar of Tortricidae sp. collected on 05.05.95 in forest in Genolier. The parasitoid larva cocooned near the host remains on 01.06.95 and the adult (female) emerged on 09.06.95. The host was first identified as *S. ocellana*, but probably it is not this species, as no adult of *S. ocellana* emerged from the material from this forest. It is known as a parasitoid of *Zeiraphera rufimitrana* H.-S. in Germany (ANONYMOUS, 1973).

16. *Itoplectis maculator* F. *

It was reared as a primary parasitoid from a pupa of *Hedya nubiferana* HAW. collected on 15.05.95 in forest (*Fraxinus*) in Nyon. The adult parasitoid (male) emerged on 08.06.95. This species sometimes behaves as a secondary parasitoid (ATHANASSOV *et al.*, 1981).

17. *Lissonota folii* THOMS.

It was reared as a gregarious larval endoparasitoid from a caterpillar of *A. xylosteana*** collected on 23.05.95 in forest in Genolier. On 29.05.95 six white-pink larvae left the host remains and cocooned on 30.05.95 all together, in separate cocoons. The adult parasitoids emerged on 07.06.95. It is recorded in Switzerland

as a parasitoid of *Z. diniana* (ANONYMOUS, 1971) and of *Z. rufimitrana* H.-S. (ANONYMOUS, 1989).

18. *Lissonota segmentellator* AUBERT

It was reared as a gregarious larval endoparasitoid from a caterpillar of *A. xylosteana*** collected on 02.06.95 in forest in Nyon. Five parasitoid larvae cocooned out of the host remains on 09.06.95 and the adults emerged on 18.06.95. It is known as a parasitoid of *A. rosana* in Switzerland (ANONYMOUS, 1971).

19. *Lissonota variabilis* HOLMGR.

It was reared as a solitary larval endoparasitoid from caterpillars of *T. viridana*** collected on 23.05.95 in forest in Genolier. The parasitoid larvae cocooned out of the host remains on 29.05.95, 30.05.95 and 01.06.95. The adult parasitoids emerged on 08.06.95 (male) and 12.06.95 (female) respectively. It is known as a parasitoid of *Z. diniana* in Switzerland (ANONYMOUS, 1971).

20. *Pristomerus vulnerator* PANZ.

It was reared as a solitary larval endoparasitoid from overwintered caterpillars of *C. pomonella* collected in apple orchards in Genolier and from a caterpillar of *S. ocellana* collected on 05.05.95 in an apple orchard in Grens.

The adults coming from codling moth emerged in April (4 females) and June (3 males, 2 females). The parasitoid larva from *S. ocellana* left the host remains and cocooned on 12.05.95. The adult parasitoid (female) emerged on 18.05.95. It has frequently been reared from codling moth in Switzerland (GEIER, 1957; COUTIN, 1974; WILDBOLZ & STAUB, 1985).

21. *Tranosema rostralis* BRISCHKE *

It was reared as a solitary larval endoparasitoid from caterpillars of *A. xylosteana*** collected on 15.05.95 and 17.05.95 respectively in forest (*Acer* and *Fraxinus*) in Nyon, and from the same host collected on 23.05.95 in forest in Genolier. The parasitoid larvae cocooned out of the host remains on 19.05.95, 23.05.95 and 29.05.95. The adults emerged on 31.05.95 (male), 02,06.95 (female) and 06.06.95 (1 male, 1 female).

22. *Trichomma enecator* ROSSI

It was reared as a solitary larval-pupal endoparasitoid from the overwintered generation of *C. pomonella* whose caterpillars were collected in apple orchards in Genolier, Changins and Prangins. The adult parasitoids emerged in March (4 females), May (9 females) and June (male). It is known as a common parasitoid of codling moth in Switzerland (GEIER, 1957; COUTIN, 1974; WILDBOLZ & STAUB, 1985).

23. *Colpoclypeus florus* WALK.

It was reared as a gregarious larval ectoparasitoid from a caterpillar of *H. nubiferana*. The host was collected in forest in Trélex on 25.05.95 with 15 parasitoid larvae on its body. They pupated on 30.05.95 and the adults emerged on 06.06.95. A total of 8 adults emerged; 7 larvae died before pupating. It is known as a parasitoid of many Tortricidae species (MARCHESINI & DALLA MONTA, 1994).

24. *Perilampus tristis* MAYR

Two adults emerged from the overwintered generation of *C. pomonella* in April. It is known as a secondary parasitoid of different primary Hymenoptera parasitoids of codling moth (GEIER, 1957).

25. *Elodia tragica* MEIG.

It was reared as a solitary larval-pupal endoparasitoid from the overwintering generation of *C. pomonella*. The adults emerged in the rearing room. It is known as a parasitoid of codling moth (GEIER, 1957; COUTIN, 1974; ATHANASSOV & SLAVOV, 1978).

The general rate of parasitism at the various collection sites ranges from 0 % to 40 % (Tab. 1). Parasitoids as a whole reduced all populations of leafrollers by 13.5 %. The overwintered generation of the summer fruit moth, which is the most common species in apple orchards in Rolle, was found not to be parasitized; the same observation applies to *S. ocellana*, the most common species in apple orchards in Duillier. It is suggested that overwintered caterpillars of both species are not attacked by parasitoids. The reason could be either a low activity of parasitoids in late summer, early autumn and spring when caterpillars are active, or a low density of parasitoids in insecticide-treated orchards. The second explanation appears to be more likely concerning *S. ocellana* (and even *R. nanella*) when compared with the data obtained in the untreated apple orchard in Grens.

It was found that parasitoids reduced the population of *R. nanella* by more than ⅓ in the apple orchard in Grens, in spite of the moderately high population density. We conclude that the parasitoid complex is highly specialized and shows a great searching ability. No pesticide treatment was carried out in this orchard.

The rate of parasitism of forest leafrollers ranges from 11.1 % to 24.7 %. The highest rate of parasitism is recorded in forest in Genolier, where the pest density itself is the highest; the lowest rate of parasitism is recorded where the pest density is low. The rate of parasitism is therefore proportional to the pest density, although no significant correlation was found ($p = 0.06$), probably because of the very low number of samples.

Among the forest leafroller species, we found the most abundant species (*A. xylosteana*, *T. viridana*, *C. forsskaleana*) to show the highest rate of parasitism: thus, there is a direct, positive correlation between the forest leafrollers' density and rate of parasitism. This is well illustrated in Genolier where both species diversity and abundance are greatest. In the other forest localities, the same species are present at a lower density and at the same time they are less parasitized..

Tabs 2 & 3 summarize the data concerning the codling moth parasitoid complex, its biological peculiarities and role in reducing the pest population. A total of 6 parasitoid species are found in association with codling moth. Two of them are known as larval endoparasitoids, one as an egg-larval, two as larval-pupal endoparasitoids, and one as a secondary parasitoid. The commonest parasitoid is *T. enecator*, which represents 42 % of all the reared parasitoid specimens. *P. vulnerator* represents 27 %, *E. tragica* 12 %, *A. quadridentata* 9 %, *P. tristis* 6 % and *M. rufipes* 3 %. The rate of parasitism ranges from 1,4 % to 7,0 % in the various localities, but as a whole the reduction of the codling moth population is only 3,7 %.

Tab. 2. Species composition of the reared parasitoids and their hosts in different localities.

N	PARASITOID	HOST	LOCALITY	CHARACTERISTICS
	I. BRACONIDAE			
1	Apanteles dilectus Hal.	Tortricidae sp.	Genolier, forest	Solitary larval endoparasitoid
2	A. fulvipes Hal.	Recurvaria nanella Hb.	Grens, apple	Solitary larval endoparasitoid
3	A. laevigatus Ratz.	Croesia forsskaleana L.	Genolier, forest	Solitary larval endoparasitoid
4	Ascogaster quadridentata Wesm.	Cydia pomonella L	Changins, apple Prangins, apple	Solitary egg-larval endoparasitoid
5	Macrocentrus linearis Nees	Ptycholoma lecheana L.	Duillier, forest	Polyembryonic larval endoparasitoid
6	M. marginator Nees	Archips rosana L.	Duillier, forest	Solitary larval endoparasitoid
7	M. thoracicus Nees	Archips xylosteana L.	Nyon, forest (Fraxinus)	Solitary larval endoparasitoid
8	Microdus dimidiator Nees	Croesia forsskaleana L. Archips xylosteana L.	Genolier, forest	Solitary larval endoparasitoid
9	M. rufipes Nees	Cydia pomonella L	Genolier, apple	Solitary larval endoparasitoid
10	Microgaster globatus L.	Croesia forsskaleana L.	Genolier, forest	Solitary larval endoparasitoid
11	Phanerotoma dentata Panz.	Tortricidae sp.	Nyon, forest (Crataegis)	Solitary larval endoparasitoid
	II. ICHNEUMONIDAE			
12	Campoplex faunus Grav.	Archips rosana L. A. xylosteana L.	Duillier, forest Genolier, forest	Solitary larval endoparasitoid
13	C. ramidulus Brischke	Tortix viridana L.	Genolier, forest (Quercus)	Solitary larval-pupal endoparasitoid
14	Diadegma fenestralis Holmg.	Recurvaria nanella Hb.	Grens, apple	Solitary larval endoparasitoid
15	Enytus apostatus Grav.	Tortricidade sp.	Genolier forest	Solitary larval endoparasitoid
16	Itoplectis maculator F.	Hedya nubiferana Haw.	Nyon, forest (Fraxinus)	Pupal endoparasitoid
17	Lissonota folii Thoms.	Archips xylosteana L.	Genolier, forest	Gregarious larval endoparasitoid
18	L. segmentellator Aubert	Archips xylosteana L.	Nyon, forest	Gregarious larval endoparasitoid
19	L. variabilis Holmg.	Tortrix viridana L.	Genolier, forest	Solitary larval endoparasitoid
20	Pristomerus vulnerator Panz.	Cydia pomonella L Spilonota ocellana D. & S.	Genolier, apple Grens, apple	Solitary larval endoparasitoid
21	Tranosema rostralis Brischke	Archips xylosteana L	Nyon, forest (Acer, Fraxinus) Genolier, forest	Solitary larval endoparasitoid
22	Trichomma enecator Rossi	Cydia pomonella L	Apple: Changins, Genolier, Prangins, PI	Solitary larval-pupal endoparasitoid
	III. EULOPHIDAE			
23	Colpoclypeus florus Walk.	Hedya nubiferana Haw.	Trélex, forest	Gregarious larval ectoparasitoid
	IV. PERILAMPIDAE			
24	Perilampus tristis Mayr	Primary parasitoids	Genolier, apple	Secondary parasitoid
	V. TACHINIDAE			
25	Elodia tragica Meig.	Cydia pomonella L	Genolier, apple	Solitary larval-pupal endoparasitoid

Tab. 3. Rate of parasitism of the overwintered generation of codling moth.

N	Locality and statu quo of the orchard	Number of collected caterpillars	Parasitism	
			Number of parasitoids	%
1	Genolier, untreated apple orchard	300	10	3,3
2	Prangins, untreated apple orchard	98	3	3,1
3	Changins, organic farming	100	7	7,0
4	Integrated plots in various orchards	70	1	1,4
	TOTAL	**568**	**21**	**3,7**

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RÉSUMÉ

Les Tordeuses (Lepidoptera, Tortricidae) des vergers et forêts du sud ouest de la Suisse et leurs parasitoïdes. – De fin avril à juillet 1995, une étude a été réalisée dans la région de Nyon sur le rôle du complexe des parasitoïdes de la génération hivernante du carpocapse des pommes *Cydia pomonella* L. et de la tordeuse de la pelure *Adoxophyes orana* F.v.R., ainsi que des tordeuses phyllophages des vergers de pommiers et des forêts avoisinantes. Au total, 24 espèces d'hyménoptères et 1 espèce de diptère parasites (11 Braconidae, 11 Ichneumonidae, 1 Eulophidae, 1 Perilampidae, 1 Tachinidae) ont été obtenues à partir de l'élevage de 19 espèces de tordeuses, deux espèces de Gelechiidae, et du carpocapse. Selon le site de capture, le taux de parasitisme varie entre 0 % et 40 %; il est de 13,8 % en moyenne sur les tordeuses phyllophages et de 3,7 % sur le carpocapse.

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