

SEMIAPHIS DAUCI (FABRICIUS) (INSECTA, HEMIPTERA, APHIDIDAE) – FORMAL RECORD OF OCCURRENCE ON ARRACACHA (*ARRACACIA XANTHORRHIZA* BANCR.) (APIACEAE) IN BRAZIL, MORPHOLOGICAL CHARACTERIZATION, DESCRIPTION OF DAMAGES AND ARTHROPODS ASSOCIATED TO THE CULTURE

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ABSTRACT

This paper reports formally the occurrence and describes the damages by *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae, Aphidinae, Macrosiphini) on arracacha (*Arracacia xanthorrhiza* Bancr.) (Apiaceae) in Brazil. The infestation was initially noted on April/2002 at Núcleo de Produção de Mudanças, Departamento de Sementes Mudanças e Matrizes, Coordenadoria de Assistência Técnica Integral, Secretaria de Agricultura e Abastecimento, São Bento do Sapucaí, State of São Paulo. Posteriorly the occurrence was detected in other parts of the municipality of São Bento do Sapucaí such as Serrano, Paiol Grande and Cantagalo, being the incidence higher in localities at lower altitudes. The colonies, with large number of individuals, were settled on both sides of the leaves and also hidden under petiole, but with lower number of specimens. The adult plants were underdeveloped and the growing of aphid colonies induced the blossoming. In the seedlings the symptoms were severer with reduction in the development and death of plants. When the colonies were placed in the dorsal side of the leaves, there was a tendency to wrinkling and rolling to upper side that was used as shelter by the aphids. Morphological characterization, illustrations and notes on biology of *S. dauci* and a survey of the Arthropoda related with *A. xanthorrhiza* are also presented.

KEY WORDS: Aphidinae, Apiaceae, arracacha, *Arracacia xanthorrhiza*, Macrosiphini, *Semiaphis dauci*.

RESUMO

SEMIAPHIS DAUCI (FABRICIUS) (INSECTA, HEMIPTERA, APHIDIDAE) – REGISTRO FORMAL DE OCORRÊNCIA EM MANDIOQUINHA-SALSA (*ARRACACIA XANTHORRHIZA* BANCR.) (APIACEAE) NO BRASIL, CARACTERIZAÇÃO MORFOLÓGICA, DESCRIÇÃO DOS DANOS E ARTRÓPODES RELACIONADOS À CULTURA. Este trabalho efetua o registro formal de ocorrência e descreve os danos de *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae, Aphidinae, Macrosiphini) em cultura de mandioquinha-salsa (*Arracacia xanthorrhiza* Bancr.) (Apiaceae) no Brasil. A infestação foi observada, inicialmente, em abril/2002, no Núcleo de Produção de Mudanças, Departamento de Sementes Mudanças e Matrizes, Coordenadoria de Assistência Técnica Integral, Secretaria de Agricultura e Abastecimento, São Bento do Sapucaí, SP. Posteriormente, a ocorrência foi detectada em outras localidades do município como Serrano, Paiol Grande e Cantagalo sendo que a incidência foi maior nas áreas de menor altitude. As colônias estavam localizadas em ambas as faces das folhas, e em menor número no pecíolo escondidas na bainha da folha. As plantas adultas apresentavam subdesenvolvimento e o aumento das colônias induzia o florescimento. Nas mudas os sintomas foram mais severos com redução no desenvolvimento

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e posterior morte das plantas. Quando havia formação de colônias na superfície superior das folhas, havia tendência de encarquilhamento e enrolamento para cima, servindo de abrigo para os pulgões. Caracterização morfológica, ilustrações, notas sobre a biologia de *S. dauci* e levantamento dos Arthropoda relacionados com *A. xanthorrhiza* também são apresentados.

PALAVRAS-CHAVE: Aphidinae, Apiaceae, mandioquinha-salsa, *Arracacia xanthorrhiza*, Macrosiphini, *Semiaphis dauci*.

INTRODUCTION

In Brazil due geography, history, and social and cultural reasons, exotic plant species are frequently introduced without adequate phytosanitary control. As many of them have horticultural, forestry, medical and ornamental importance they are quickly spread through many areas. The human factor associated with propitious whether favor the introduction and establishment of many pests, especially the aphids (Insecta, Hemiptera, Sternorrhyncha, Aphidoidea), previously absent and that are associated with these plants.

The present geographical distribution of aphid species is result of a long historical process in which natural causes and man action are the most important actors. Their occurrence in certain places is closely related to presence of genera and/or species of plants that serve as hosts along with prevalence of adequate climatic conditions (MIER DURANTE; NIETO NAFRÍA, 1994; DIXON, 1998; HOLMAN, 1974).

Aphids or plantlice (Aphididae) constitute a large group of small, soft-bodied insects that are frequently found in large numbers on leaves or stems of plants (TRIPLEHORN; JOHNSON, 2005). The family is widely distributed and includes about 350 genera and 3,500 species (KOSZTARAB, 1982).

Due to their biological characteristics they are one of the most important groups of insects on agronomic point of view and when present in the cultures they are able to cause severe economic losses (DELFINO, 2005). Therefore, any information concerning their relationships with host plants and geographical distribution of each species are considered of great importance.

A large number of species damages cultivated plants, including vegetables, forestry and ornamentals. The main troubles caused by their action over the plants are: (i) the sucking activity removes sap and injects saliva that can cause stunting of the shoots, galls or deformation and discoloration of leaves, twigs, flowers and fruits; (ii) may serve as vectors of phytovirus; and (iii) excrete honeydew on which sooty mold grows, interfering in the photosynthesis (KOSZTARAB, 1982; BLACKMAN; EASTOP, 2000).

The genus *Semiaphis* van der Goot, 1913 is included in subfamily Aphidinae, tribe Macrosiphini (BLACKMAN; EASTOP, 2000). *Semiaphis dauci* (Fabricius, 1775) is originally a Eurosiberian species and

nowadays is widely distributed in Europe, Turkey, Israel, Siberia and Central Asia (HEIE, 1992). In South America, previous notes on occurrence of this species were made by DELFINO *et al.* (2005) on carrot (*Daucus carota* L. - Apiaceae) in Argentina and by YUKI *et al.* (2006) on arracacha (*Arracacia xanthorrhiza* Bancr. - Apiaceae) in Brazil.

Arracacia xanthorrhiza has, as most commonly used vernacular name, arracacha, which is derived from Quechua word racacha. Arracacha has also been accepted as the standard term in the English literature and names such as Peruvian carrot or Peruvian parsnip are confusing and their use in the literature should be discontinued (HERMANN, 1997). In Brazil, it is popularly known as batata-aipo, batata-baroa, batata-cenoura, batata-fiúza, batata-jujuba, batata-salsa, batata-suíça, batata-tupinambá, cenoura-amarela, mandioca-salsa, mandioquinha, mandioquinha-salsa and pastinaca (HERMANN, 1997; PISTRICK, 2001; UNITED..., 2007). In other Latin American countries, it is known as arracacha, huia sampilla, lacache, oqque and racacham in Bolivia; lacache in Chile; arocueche, arracacha, gaud, huahué, pacucarrá, sacarracacha, yengó and zanahoria in Colombia; afiód in Cuba; zanahoria in Ecuador; arracacha, huisampilla, lacache, racacha, ricacha, virraca, zanahoria blanca and zanahoria in Peru; apio in Puerto Rico; apio, apio criollo, arecate or arrecate, aricachi, arracacha, kui-titsí and racacha in Venezuela (HERMANN, 1997; PISTRICK, 2001; UNITED..., 2007).

ZANIN; CASALI (1984) presented circumstantial evidence for the introduction of arracacha to Brazil early in last century. The culture must have been spread quickly since it was widely consumed as early as in the 1920s in rural areas of Minas Gerais, São Paulo and Rio de Janeiro. Today, arracacha is mostly grown in the uplands of southern and southeastern Brazil, particularly in the Serra do Mar (Paraná, São Paulo, ca. 26° S), in the Serra da Mantiqueira (São Paulo, Minas Gerais, 22° - 23° S, 1,000 - 1,800 m), in the Serra do Espinhaço (Minas Gerais, 16° S, under 1,000 m), and the Planalto Central (Minas Gerais, Goiás, Tocantins, 15° - 18° S, 800 - 1,000 m). According to an extensive survey the four foremost arracacha-producing states in 1993 were Minas Gerais (3,500 ha), Paraná (2,800 ha), Santa Catarina (850 ha) and Espírito Santo (660 ha). The area is expanding in Espírito Santo and Minas Gerais and total national area in 1996 is estimated to exceed 12,000 ha. Moreover, the area under arracacha shows

high growth rates in Goiás and Tocantins, states to which arracacha culture was introduced a few years ago. In São Paulo, where arracacha was in the 1960s a source of “great wealth” (NORMANHA; SILVA, 1963) and grown to a larger extent than in any other federal state, arracacha production has been reduced to some 200 ha in the 1992/1993 growing season (MONTEIRO *et al.*, 1993). Booming service industries have forced out arracacha culture around metropolitan area of São Paulo. For example, the former arracacha-growing municipality of Piedade near São Paulo nowadays acts as a transshipment point for arracacha from all over Brazil. Piedade no longer produces arracacha, but washes, classifies and packs arracacha from other states for sale on the wholesale market Companhia de Entrepósitos e Armazéns Gerais de São Paulo, São Paulo (HERMANN, 1997).

Arracacha is typically grown by small farmers with less than 1 ha of arracacha per holding. Yields average 6 - 14 t/ha in Paraná and Minas Gerais (HAMERSCHMIDT, 1984; SANTOS, 1984), 15 - 30 t/ha in São Paulo, with irrigation (MONTEIRO *et al.*, 1993) and a nation-wide mean of 8 t/ha has been reported. Plantings are year-round, with marketed volumes reaching a maximum between July and September when prices are lowest.

Arracacha is generally regarded as a robust culture with few disease or pest problems if it is appropriately rotated. But insects, bacteria and fungi can cause significant damage.

This paper records formally the occurrence of *S. dauci* on *A. xanthorrhiza* in Brazil based on previous note by YUKI *et al.* (2006). Morphological characterization, illustrations, notes on biology of the aphid and description of the damages and a survey of the Arthropoda related with *A. xanthorrhiza* are also presented.

MATERIAL AND METHODS

The survey was carried out on April/2002 at Núcleo de Produção de Mudas (NPM), Departamento de Sementes Mudas e Matrizes, Coordenadoria de Assistência Técnica Integral, Secretaria de Agricultura e Abastecimento, São Bento do Sapucaí/SP. The municipality of São Bento do Sapucaí (22° 40' 53.6" S, 45° 44' 37.6" W) in the east side of Serra da Mantiqueira at 864 m a. s. l., about 200 km east of city of São Paulo. On March/2003 with the increase in the damages and losses, specimens were collected in arracacha seedlings production area at NPM and send to one of the authors (MAD) for identification. In the same year, infestations were reported by small farmers mainly from Serrano, Paiol Grande and Cantagalo, districts of São Bento do Sapucaí. The infestation levels were inversely proportional to the altitude of the place where the farm was located.

Plants highly infested with aphids were collected in field cultures of arracacha in São Bento do Sapucaí, SP, put in plastic bags and taken to Laboratório de Vetores, Centro de Pesquisa e Desenvolvimento de Fitossanidade, Instituto Agronômico de Campinas, Campinas, São Paulo. The aphids were removed with aid of thin and soft brush and preserved in 20 mL of ethanol 70% in eppendorf tubes until identification. Apterous adults and alates were collected.

For identification permanent slides were prepared and observed under optical microscope. The specimens (aptera and alates) were mounted in Canada balsam according to REMAUDIÈRE (1992) technique slightly modified. It was employed 10% KOH solution instead of 40% as originally recommended. The specimens are deposited in Facultad de Ciencias Exactas Físicas y Naturales, Universidad Nacional de Córdoba, Córdoba.

RESULTS

Formal record of occurrence. The aphid was identified as *S. dauci* and before 2002, it was not recorded in Brazil. The first report of occurrence in this country was published by YUKI *et al.* (2006) in a previous note and probably was the first world record of this species of aphid on arracacha.

On April/2002, it was verified severe infestation by an aggressive aphid species in *A. xanthorrhiza* culture at Núcleo de Produção de Mudas (NPM), Departamento de Sementes Mudas e Matrizes, Coordenadoria de Assistência Técnica Integral, Secretaria de Agricultura e Abastecimento, São Bento do Sapucaí/SP. The municipality of São Bento do Sapucaí (22° 40' 53.6" S, 45° 44' 37.6" W) is placed in the east side of Serra da Mantiqueira at 864 m a. s. l., about 200 km east of city of São Paulo. On March/2003 with the increase in the damages and losses, specimens were collected in arracacha seedlings production area at NPM and send to one of the authors (MAD) for identification. In the same year, infestations were reported by small farmers mainly from Serrano, Paiol Grande and Cantagalo, districts of São Bento do Sapucaí. The infestation levels were inversely proportional to the altitude of the place where the farm was located.

Taxonomy and morphological characterization.

The originally Palaearctic genus *Semiaphis* van der Goot, 1913 contains 14 described species, is included in subfamily Aphidinae, tribe Macrosiphini and is very similar to *Hyadaphis* Kirkaldy, 1904 but with very short siphunculi (BLACKMAN; EASTOP, 2000).

According to PRIOR (1971), *Semiaphis dauci* was described by FABRICIUS (1775) in the genus *Aphis* Linnaeus, 1758 based on specimens from umbels of *D. carota*. KOCH (1854) described and illustrated *Aphis*

carotae from carrot. VAN DER GOOT (1913) erected *Semiaphis* and considered KOCH's (1854) *Aphis carotae* the type species. THEOBALD (1927) transferred *Aphis dauci* to *Anuraphis* Del Guercio, 1907, and made *Aphis carotae* a synonym thus also making *Semiaphis* junior synonym of *Anuraphis*. THEOBALD's (1927) synonymy was correct, but *Anuraphis carotae* is, in fact, *Dysaphis crataegi* (Kaltenbach, 1843) (HILLE RIS LAMBERS, 1934). BÖRNER; SCHILDER (1932) agreed with THEOBALD's (1927) synonymy of *Aphis carotae* with *Aphis dauci*, but correctly ascribed both species to *Semiaphis*. BÖRNER (1952) reaffirmed the synonymy and described the biology of *S. dauci*. HEINZE (1960) and SHAPOSHNIKOV (1964) included the species in identification keys.

Morphological characterization of apterous viviparous, alate viviparous, alate male and illustration of apterous viviparous of *S. dauci* were presented by PRIOR (1971). In that paper, he also included biometric data for apterous and alate viviparae and alate males of the species.

Apterous (Figs. 1, 2). Small, length 1.3-2.1 mm. Blue greenish recovered by white waxy secretion, head, legs, siphunculi and cauda dark green to brownish. Antennae extending to about half of body length, without secondary sensoria, terminal process about 2 or 3x longer than antennomere VI base. Siphunculi (Fig. 3) very short, about 0.04 to 0.05x body length, almost conical, slightly curved inwardly. Cauda pointed and long, tongue like, at least 2x longer than siphunculi.

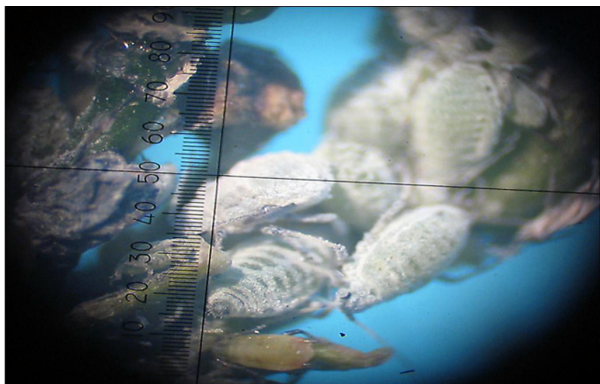


Fig. 1 - *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae), aptera and nymph on *Arracacia xanthorrhiza* Bancr. (Apiaceae) (scale in μm).



Fig. 2 - *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae), apterous viviparous (slide mounted).

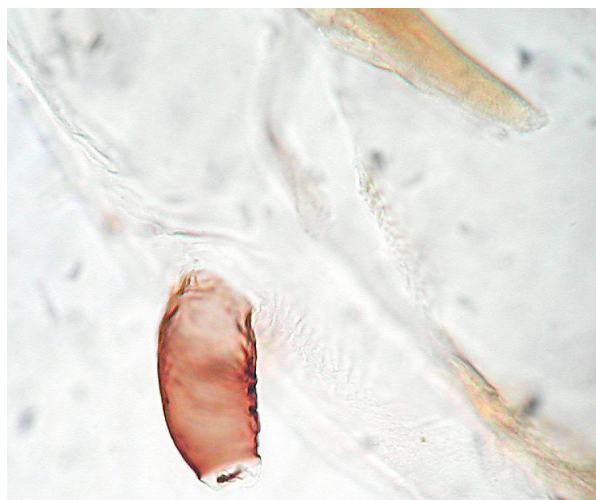


Fig. 3 - *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae), siphunculus (slide mounted).



Fig. 4 - Colonies of *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae) under leaves of *Arracacia xanthorrhiza* Bancr. (Apiaceae).



Fig. 5 - Wrinkled and curled leaves of *Arracacia xanthorrhiza* Bancr. (Apiaceae) resulting of infestation by *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae).



Fig. 6 - Bed of *Arracacia xanthorrhiza* Bancr. (Apiaceae) in São Bento do Sapucaí/SP showing dead and underdeveloped plants after heavy infestation of *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae).

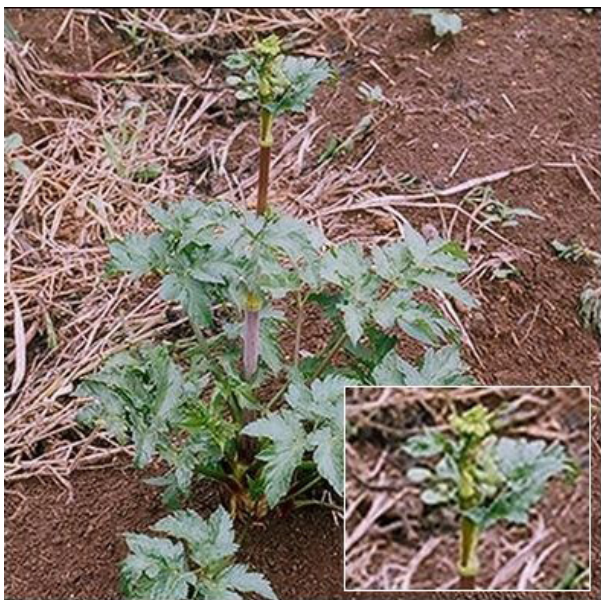


Fig. 7 - Precocious blossoming of *Arracacia xanthorrhiza* Bancr. (Apiaceae) plant after attack by *Semiaphis dauci* (Fabricius, 1775) (Insecta, Hemiptera, Aphididae).

Alate. Color similar to that apterous females, head and thorax black. Antennomere III with 17 to 22 secondary sensoria, IV with 3 to 6. Abdomen light, dark marginal plates and transverse bands on tergite VII and VIII. Siphunculi and cauda similar to those apterous.

Remarks. No species of aphids infesting arracacha was cited by BLACKMAN; EASTOP (2000), but they mentioned that 18 species are able to colonize carrot. Among them, two species are of genus *Semiaphis*: *S. dauci* and *S. heraclei* (Takahashi, 1921). Both species have very small siphunculi, which attain, at maximum, half of tail length, and did not have apical crown. The distinctive characters of species are: *S. dauci* presents siphunculi longer than 1.5 times of width of base, setae very short, the longest in the posterior femur rarely exceeding 20 μm ; in *S. heraclei* the siphunculi are shorter than 1.5 times of base width, the longest setae in the metafemur exceeding 60 μm , longer than half of diameter of femoral base.

Notes on biology. The species of *Semiaphis* are heteroecious between *Lonicera* L. (Caprifoliaceae) and Apiaceae, or live without host alternation on one or other of this host-plant groups. A few species occur on other plants, including two on species of genus *Impatiens* L. (Balsaminaceae) (BLACKMAN; EASTOP, 2000).

Semiaphis dauci in the Eurosiberian region, from where it is native, is holocyclic and monoecious on plants of wild and cultivated carrots. In other parts of its distribution area, like southern England, the populations are maintained during the whole year by parthenogenesis (BLACKMAN; EASTOP, 2000). Anholocyclic populations also certainly occur in Brazil taking in account the geographical position and weather conditions of São Bento do Sapucaí region.

KAVALLIERTOS *et al.* (2004) mentioned as parasitoids of this aphid, species of genera *Lysiphlebus* Förster, 1862 (Insecta, Hymenoptera, Braconidae) and *Binodoxys* Mackauer, 1960 (Braconidae).

Besides the direct damages by feeding activity, *S. dauci* is vector of many viruses such as *Celery mosaic virus* (Potyviridae), and several other non-persistent ones (BLACKMAN; EASTOP, 2000). KATIS *et al.* (2006) tested 19 species of aphids and verified that *S. dauci* is able to transmit, experimentally, the *Zucchini Yellow Mosaic Virus* – ZYMV (Potyviridae).

Description of damages. The damages by *S. dauci* are known only in carrot (*Daucus carota* L. - Apiaceae) plants. The leaves present, near the area where the colonies were settled, strong curling and rolling up and the sprouts present a certain degree of paralysis. No previous record on damage in arracacha exists before the note by YUKI *et al.* (2006). On arracacha the damages by *S. dauci* are proportional to the insect population. The colonies

generally are composed by a large number of individuals (Fig. 4) and were settled in both sides of leaves. The colonization usually starts by the superior surface of the leaves and there was a tendency to wrinkling and curling (Fig. 5). As the colonies grow the leaves roll up hiding aphids, the plants had their development retarded and the blossoming is induced. When the control is not adequately done the population increases so much in size, spreads to petioles and sprouts, killing the plant (Fig. 6). The plants that survive infestation blossom precociously (Fig. 7). In the seedlings, the symptoms were severer with reduction in the development and death of plants. These symptoms are similar to those observed in carrot.

Arthropoda related to arracacha. Bibliographical research was done to verify what are the main mites (Arachnida, Acari) and other insects (Insecta) that can be limiting to cultivation of this tuber. Information on damages by the species of Acari, Hemiptera, Coleoptera and Lepidoptera is added and the results of survey are summarized in Table 1.

Tetranychus urticae Koch, 1836 (Arachnida, Acari, Tetranychidae). The two spotted spider mite can become an important pest in the arracacha culture regions. In certain parts of states of Minas Gerais and Espírito Santo it is considered the main pest of *A. xanthorrhiza* (FORNAZIER *et al.*, 1988; CORREIA, 1984).

The specimens live in colonies on the inferior surface of the leaves. They feed on sap causing general yellowing of the culture, leaf lost, strong reduction in the production of new leaves, lateness in the plant development and consequently diminishing in the production (BÔAS *et al.*, 1997).

Tetranychus sp. According to FONSECA (1984) a red mite of genus *Tetranychus* Dufour, 1832 also can infest arracacha culture especially when associated with bean (*Phaseolus vulgaris* L.) (Fabaceae). The colonies develop on inferior side of the leaves that are recovered by silk web. The infestation can attain high level, in dry season, in not irrigated cultures (SANTOS *et al.*, 1991).

Aphis fabae Scopoli, 1763 (Insecta, Hemiptera, Aphididae). This black aphid species infests only inflorescences and does not diminish the production of tubercles. However for research purposes and seeds production *A. fabae* can be very harmful due high populational level that it can attain (BÔAS *et al.*, 1997).

Aphis spiraeicola Patch, 1914. MENEZES (1970) cited the arracacha as host of *A. spiraeicola* but did not mention the damage due the species. It was also listed in arracacha in the catalogue by SOUZA-SILVA; ILHARCO (1995).

Aphis sp. An unidentified species of *Aphis* Linnaeus, 1758 was considered by BÔAS *et al.* (1997)

the most important aphid that infests arracacha culture. They observed pink or grey colonies. The species attacks the petiolar base in the insertion of the leaves with stems just underground surface. Its detection depends on removal of the leaves nearest the soil. The aphid lives in symbiosis with *Solenopsis saevissima* (Hymenoptera, Formicidae) and the presence of the ant is indicative of infestation. *Aphis* sp. sucks sap causing decaying of plants and are able to transmit viruses; the infestation results in reduction in the productivity (SANTOS *et al.*, 1991).

Dysaphis apiifolia (Theobald, 1922) (Aphididae). This species was collected by COSTA *et al.* (1972) with water traps in culture of *A. xanthorrhiza* in Piedade, SP in V-VI.1968. No information on damage was mentioned by them. It was catalogued by SOUZA-SILVA; ILHARCO (1995) as one of the aphid species hosted by arracacha.

Hyadaphis foeniculi (Passerini, 1860) (Aphididae). This species presents green coloration and does not occur often. The losses caused by this aphid are still not significant. It infests the leaves that facilitate the visualization and control (SANTOS *et al.*, 1991). This species was present on arracacha in mix with *S. dauci*.

Conotrachelus cristatus Fahraeus, 1837 (Coleoptera, Curculionidae). Nowadays this is the most important pest of arracacha culture in Brazil. In the state of São Paulo, in 1984, it was verified an intense attack by this borer in 100% of the seedlings, and this event was considered one of the main reasons for decreasing of arracacha cultivated area in the state (ZANIN, 1984). In the southern part of state of Minas Gerais it was detected in 1993 in the largest and most important production areas. According to farmers *C. cristatus* did not occur in São Bento do Sapucaí, but with improvement in the culture income in 1994/1995 there was an increase in the culture in the year of 1996. The seedlings necessary to attend the expansion were brought from Senador Amaral and Gonçalves, southern Minas Gerais, and were infested. The introduction of the pest in São Bento do Sapucaí led to reduction of about three times in the productivity.

The weevil has as hosts, species of *Inga* Mill. (Fabaceae) which are widely distributed in Brazil, making easy the beetle spreading. The biology of the species was not studied yet. It attacks propagules making them unviable to vegetative propagation. The larvae penetrate the petiole by the internal side which is softer and causes, initially, yellowing in the leaf bases. They open galleries inside of petiolar bases and posteriorly bore the vegetative bud which presents high starch concentration. The larvae make an extensive damage in this part of plant opening many galleries and becoming the material improper for cultivation (BÔAS *et al.*, 1997).

Table 1 - Mites (Arthropoda, Arachnida, Acari) and insects (Arthropoda, Insecta) related with culture of arracacha (*Arracacia xanthorrhiza* Bancr. - Apiaceae).

Class	Order	Family	Species	Damages/Notes	Source
Arachnida	Acari	Tetranychidae	<i>Tetranychus urticae</i> Koch, 1836	Suck sap (?), leaves yellowing	BÓAS <i>et al.</i> (1997) CORREIA (1984) FORNAZIER <i>et al.</i> (1988)
			<i>Tetranychus</i> sp.	Suck sap (?), silky web	SANTOS <i>et al.</i> (1991)
			<i>Aphidius fabae</i> Scopoli, 1763	Infest inflorescences	BÓAS <i>et al.</i> (1997)
Hemiptera	Aphididae	<i>Aphis spiraeicola</i> Patch, 1914	Damages not mentioned	MENEZES (1970) SOUZA-SILVA; ILHARCO (1995)	
		<i>Aphis</i> sp.	Plant decay, transmit viruses, productivity reduction	BÓAS <i>et al.</i> (1997) SANTOS <i>et al.</i> (1991)	
		<i>Dysaphis apiifolia</i> (Theobald, 1922)	Damages not mentioned	COSTA <i>et al.</i> (1972) SOUZA-SILVA; ILHARCO (1995)	
		<i>Hyadaphis foeniculi</i> (Passerini, 1860)	Infest leaves	SANTOS <i>et al.</i> (1991)	
		<i>Semiaphis dauci</i> (Fabricius, 1775)	Leaves and sprouts curling and rolling, induce precious blossoming, plants dead and underdeveloping	YUKI <i>et al.</i> (2006) This paper	
Insecta	Coleoptera	Curculionidae	<i>Conotrachelus cristatus</i> Fahraeus, 1837	Borer leave petioles and propagules	BÓAS <i>et al.</i> (1997) ZANIN (1984)
			<i>Agrotis ipsilon</i> (Hufnagel, 1767)	Cut apical shoots, borer tubercles	SANTOS <i>et al.</i> (1991)
	Lepidoptera	Noctuidae	<i>Solenopsis sacvissima</i> (Fr. Smith, 1855)	Plant smother	SALGADO (1984)
			<i>Binodoxys</i> sp.	Parasitoid of <i>S. dauci</i>	KAVALLIERATOS <i>et al.</i> (2004)
	Hymenoptera	Braconidae	<i>Lysiptelebus</i> sp.	Parasitoid of <i>S. dauci</i>	KAVALLIERATOS <i>et al.</i> (2004)

Agrotis ipsilon (Hufnagel, 1767) (Insecta, Lepidoptera, Noctuidae). This is a polyphagous species. The caterpillar cut the new leaves very close to ground level and eliminate the apical shoot, the plants die and the beds is not uniformly formed (SALGADO, 1984). During heavy infestations even the tuberous roots are damaged and posteriorly rotten by invasion of microorganisms. The attack occurs up to 30 days after planting (SANTOS et al., 1991).

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