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### Field observations on *Takecallis arundinariae* (Essig) and *T. taiwanus* (Takahashi)

**Abstract** - *Takecallis arundinariae* and *T. taiwanus* are the most widespread aphids in bamboo nurseries in Lombardy. Field observations were carried out on *Phyllostachis bambusoides* on different stages and on mean fecundity; seasonal abundance has been studied for three years. *T. arundinariae* young has a mean life of 7,3 days, nymphs of 4,9 and adults of 62,4. The reproductive period lasts 57,5 days and fecundity is 151,4 youngs per female. *T. taiwanus* young has a mean life of 10,7 days, nymphs of 4,9 and adults of 65,8. The reproductive period lasts 61,7 days and fecundity is 105,7 youngs per female. The first species develops from February to the end of May, the second one from the beginning of May to the first days of August.

**Riassunto** - Osservazioni in pieno campo su *Takecallis arundinariae* (Essig) e *T. taiwanus* (Takahashi).

Gli afidi maggiormente presenti su bambù nei vivai lombardi sono *Takecallis arundinariae* e *T. taiwanus*. Sono state fatte osservazioni in pieno campo su *Phyllostachis bambusoides* relative alla durata dei diversi stadi e sulla fecondità media; inoltre è stata seguita la dinamica di popolazione per tre anni consecutivi. *T. arundinariae* presenta neanidi con una vita media di 7,3 giorni, ninfe di 4,9 e adulti di 62,4. Il periodo riproduttivo è di 57,5 giorni e la fecondità è pari a 151,4 neanidi per femmina. Le neanidi di *T. taiwanus* hanno vita media di 10,7 giorni, le ninfe di 4,9 e gli adulti di 65,8. Il periodo riproduttivo è di 61,7 giorni e la fecondità è pari a 105,7 neanidi per femmina. La prima specie è presente da febbraio fino alla fine di maggio, la seconda da inizio maggio ai primi giorni di agosto.

**Key words:** *Takecallis arundinariae*, *T. taiwanus*, *Phyllostachys bambusoides*, fecundity, aphid bionomics.

### INTRODUCTION

Bamboo are volunteers in tropical and temperate zones of all the Continents except the European one, where they were introduced as ornamental plants. Their use in exotic spot of landscape gardens in Italy dates back to XIX century (Tagliolini, 1988). At

present they are used as hedge, fence and mantle suitable for narrow or wide environment, and several species are imported.

In Italy insect pests of these plants belong to Diptera Agromyzidae *Cerodontha* (*Poemyza*) *unisetiorbata* Zlobin (Süss, 2001), Rhynchotha Homoptera Aphididae *Takecallis arundicolens* (Clarke), *T. arundinariae* (Essig) and *T. taiwanus* (Takahashi), *Rhopalosiphum rufiabdominalis* (Sasaki) and *Melanaphis bambusae* (Fullaway), Asterolecaniidae *Bambusaspis bambusae* (Boisduval) and Diaspididae *Kuwanaspis bambusae* Kuwana and *Odonaspis greeni* (Cockerell) (Barbagallo *et al.*, 1995). Among aphids, except *R. rufiabdominalis*, anolocyclic on roots of different Gramineae, Cyperaceae and Dicotyledones, the other species colonise only leaves and stems of bamboo. *T. arundinariae* was reported for Italy in 1983 in Sicily catch by a suction trap (Patti & Tornatore, 1988), while *T. taiwanus* was reported from *Phyllostachis mitis* C. Riviere in colonies mixed with *T. arundinariae* in Milan (Lombardy) and Arizzano (Verbania, Piedmont) in 1989 (Limonta, 1990). In Countries where introduced the two species are anolocyclic (Blackman & Eastop, 1994). Coffelt & Schultz (1990) studied seasonal abundance and, in laboratory, fecundity and longevity of *T. arundinariae*.

In this paper seasonal abundance and biological features of *T. arundinariae* and *T. taiwanus* in Italy under field conditions have been studied.

#### MATERIALS AND METHODS

In nurseries located in Como Province (Cantù, Figino Serenza and Mariano Comense), where ornamental bamboo are cultivated, aphid colonies were surveyed in order to verify infested plant species and aphid species. Examined plant species are twenty two (Tab. 1) and they belong to genera *Arundinaria* Michaux, *Bambusa* Schrader, *Chimobambusa* Makino, *Hibanobambusa* (Mruyanma & Okamura), *Indocalamus* Nakai, *Phyllostachys* Siebold & Zuccarini, *Pleioblastus* Nakai, *Pseudosasa* Nakai, *Sasa* Makino & Shibata, *Semiarundinaria* Nakai and *Shibataea* Nakai.

Biological parameters were observed in a 400m<sup>2</sup> lot on *Phyllostachys bambusoides* Siebold & Zuccarini, cultivar "Castillonis", two years old, in Mariano Comense. A mature leaf for *T. arundinariae* and a still unrolled leaf for *T. taiwanus* on thirty plants selected at random were chosen. Each leaf was isolated with transparent polyester cylinder provided on the two extremities with gauze in order to allow gases exchange. In each cylinder a single aphid was placed and the following parameters were studied: young <sup>(1)</sup> period (days), nymph <sup>(2)</sup> period (days); period of prereproductive, reproductive and postreproductive phases (days); number of youngs per female (fecundity) and youngs per day per female.

Seasonal abundance has been considered on ten plants, considering the terminal stem of three extended leaves and the apical one still curled: the number of adults,

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(1) Young: young aphid without wing buds.

(2) Nymph: young aphid with wing buds.

nymphs and young has been counted. Weekly controls were carried out in 1998, 1999 and 2000.

Air temperature was registered with a datalogger model RD-Temp by Omega Technologies Ltd.

## RESULTS AND DISCUSSION

*Takecallis arundinariae* and *T. taiwanus* were collected on fourteen species (Tab. 1) of the genera *Indocalamus* Nakai, *Phyllostachys* Siebold & Zuccarini, *Pleioblastus* Nakai, *Pseudosasa* Nakai and *Semiarundinaria* Nakai. *Melanaphis bambusae* was scarce and present only on *Phyllostachys*.

Table 1 – Examined plant species.

| genus                                        | species                                                          | Variety and cultivar     |
|----------------------------------------------|------------------------------------------------------------------|--------------------------|
| <i>Arundinaria</i> Michaux                   | <i>murielae</i> Gamble                                           |                          |
| <i>Bambusa</i> Schrader                      | <i>multiplex</i> (Lour.) Raeuschel                               | "Alphonse Karr"          |
| <i>Chimobambusa</i> Makino                   | <i>quadrangularis</i> (Fenzi) Makino                             |                          |
| <i>X Hibanobambusa</i> (Maruyanma & Okamura) | <i>tranquillans</i> (Koidz.) Maruyanma & Okamura                 | "Shiroshima"             |
| <i>Indocalamus</i> Nakai *                   | <i>tessellatus</i> (Munro) Makino & Shibata                      |                          |
| <i>Phyllostachys</i> Siebold & Zuccarini     | <i>aurea</i> Carrière ex A. & C. Rivière                         |                          |
|                                              | <i>aureosulcata</i> McClure                                      | "Holochrysa"             |
|                                              |                                                                  | "Aureocaulis"            |
|                                              | <i>bambusoides</i> Siebold & Zuccarini                           | "Spectabilis"            |
|                                              |                                                                  | "Castillonis"            |
|                                              |                                                                  | "Castillonis Inversa"    |
|                                              | <i>glaucula</i> McClure                                          | "Violascens"             |
|                                              | <i>nigra</i> (Loddiges ex Lindley) Munro                         |                          |
|                                              |                                                                  | boriana (Mitford) Makino |
|                                              |                                                                  | henonis (Mitford) Muroi  |
|                                              | <i>pubescens</i> Mazel ex H. de Lehaie                           |                          |
|                                              | <i>viridis</i> (R.A. Young) McClure                              | "Robert Young"           |
| <i>Pleioblastus</i> Nakai                    | <i>fortunei</i> (Van Houtte) Nakai                               |                          |
|                                              | <i>pumilis</i> (Mitford) S. Suzuki                               |                          |
|                                              | <i>viridistriatus</i> (Siebold) Makino                           |                          |
| <i>Pseudosasa</i> Nakai                      | <i>japonica</i> (Siebold & Zuccarini ex Steudel) Makino ex Nakai |                          |
| <i>Sasa</i> Makino & Shibata                 | <i>palmata</i> (Bean) Camus                                      |                          |
|                                              | <i>tsuboiana</i> Makino                                          |                          |
|                                              | <i>veitchii</i> (Carrière) Rehder                                |                          |
| <i>Semiarundinaria</i> Nakai                 | <i>fastuosa</i> (Mitford) Makino ex Nakai                        |                          |
|                                              | <i>kagamiana</i> Makino & Uchida                                 |                          |
| <i>Shibataea</i> Nakai                       | <i>kumasasa</i> (Zollinger ex Steudel) Makino ex Nakai           |                          |

\* Species in bold were colonised by aphids.

In table 2 mean number of different instar period and fecundity of the two species in the field and data of Coffelt & Schultz (1990) on *T. arundinariae*, in environmental chamber at 25°C (light) and at 22°C (dark) 14:10 photoperiod, are reported.

Table 2 - Longevity and fecundity of *Takecallis taiwanus* and *T. arundinariae* on *Phyllostachys bambusoides* in the field. In the last two columns data from Coffelt & Schultz (1990) on the second species in environmental chamber are reported.

|                             | <i>T. taiwanus</i> |           | <i>T. arundinariae</i> |           | Coffelt & Schultz |         |
|-----------------------------|--------------------|-----------|------------------------|-----------|-------------------|---------|
|                             | mean±S.E.          | range     | mean±S.E.              | range     | mean±S.E.         | range   |
| Young (d)                   | 7.3±0.26           | 5-10      | 10.7±0.38              | 7-15      | -                 | -       |
| Nymph (d)                   | 4.9±0.15           | 4-7       | 4.9±0.17               | 4-7       | -                 | -       |
| Adult (d)                   | 62.4±0.62          | 52-68     | 65.8±1.19              | 55-78     | 46.5±1.0          | 34-54   |
| Prereproductive period (d)  | 2±0.23             | 0-5       | 2.0±0.3                | 0-7       | 1.1±0.1           | 0.5-2   |
| Reproductive period (d)     | 57.5±0.87          | 46-64     | 61.7±1.18              | 52-74     | 35.3±1.3          | 24-45   |
| Postreproductive period (d) | 4±0.35             | 0-8       | 3.0±0.36               | 0-7       | 10.1±1.1          | 1-20    |
| Fecundity (young/female)    | 151.4±2.72         | 119-175   | 105.7±4.15             | 63-143    | 146.8±4.0         | 119-182 |
| Youngs per day              | 2.6±0.06           | 2.05-3.39 | 1.7±0.06               | 1.15-2.14 | 4.2±0.1           | 2.9-4.9 |

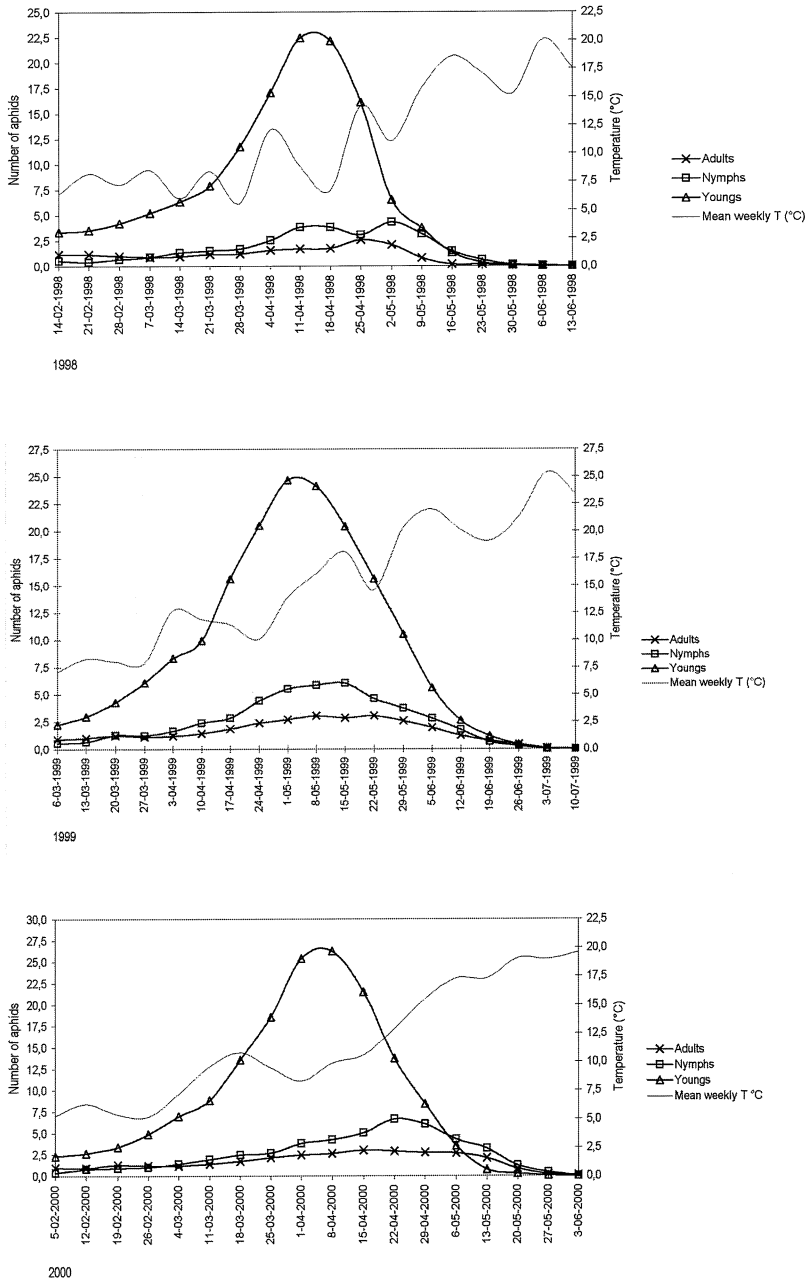
Nymphs and adults of the two species have similar length, only youngs present a slight difference. Fecundity is higher in *T. taiwanus* with 151.4±2.72 youngs per female, while *T. arundinariae* has a mean of 105.7±4.15 youngs per female. Field data present remarkable differences compared to the ones obtained in laboratory by Coffelt & Schultz (1990). In fact, unlike the two Authors advanced, the adult results to live longer in the field. Reproductive period is longer in the field, 61.7±1.18 days against 35.3±1.3 days, while fecundity is higher in laboratory (146.8±4.0 against 105.7±4.15 youngs per female in the field). As a consequence the number of youngs per day is higher in laboratory (4.2±0.1) than in the field (1.7±0.06).

Mean weekly temperature and seasonal abundance of the two species in the considered three years are reported in figures 1 and 2. *T. arundinariae* is present from February to the end of May in 1998 and in 2000, while in 1999 from March to the end of June. In the three years *T. taiwanus* is present from the beginning of May till the first days of August. The two species are contemporaneously present during May in mixed colonies on sub-apical leaves.

In the three years the highest mean number of *T. arundinariae* (Tab. 3) vary from 28.1±1.2 in 1998 to 33.7±1.1 in 2000, while *T. taiwanus* presents a mean of 39±1.4 in 2000 and of 27.3±1.5 in 1998.

The peak date, the mean number of individuals (Tab. 3) and the temperature (tab. 4) at peak date of the two species varies in the different years showing that aphids population dynamics is strongly influenced by climatic conditions (Coffelt & Schultz, 1990).

The first individuals of *T. arundinariae* (Tab. 4) are present with temperature

Fig 1 - Seasonal abundance of *Takecallis arundinariae* in 1998, 1999 and 2000.

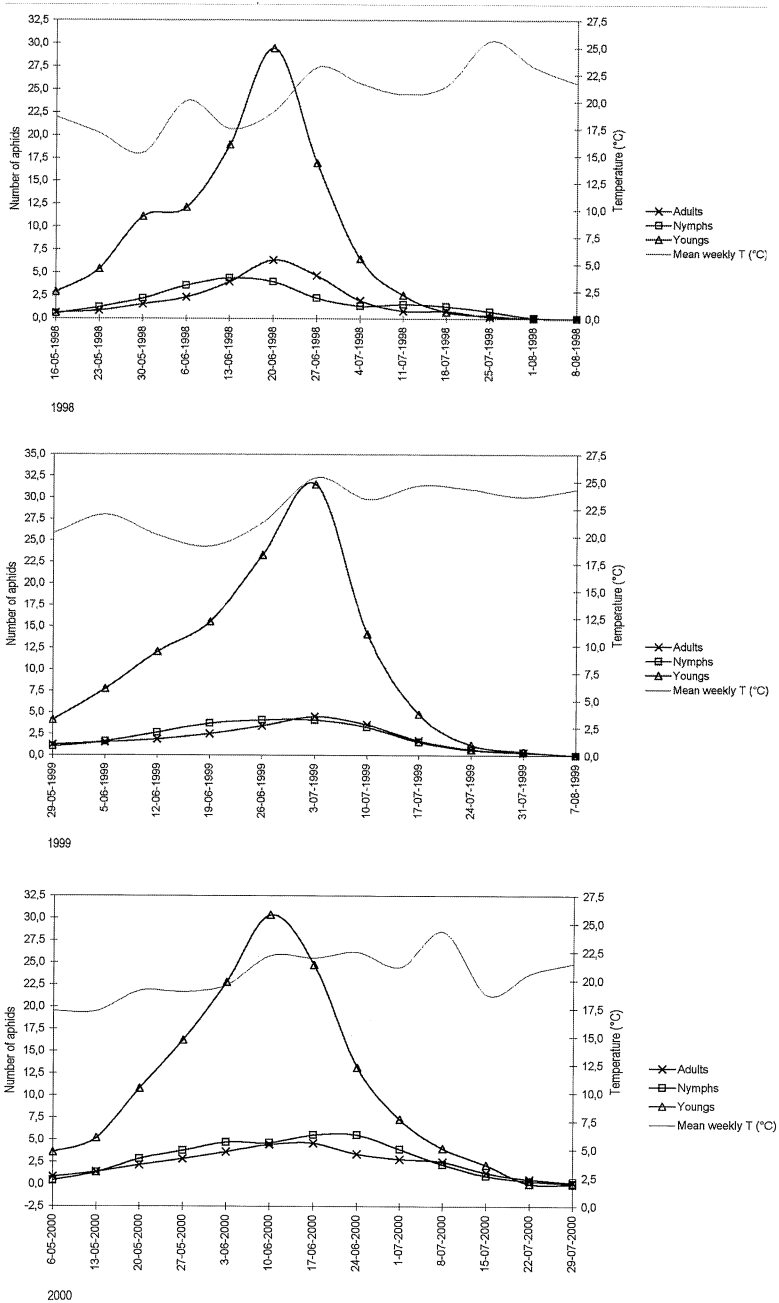


Fig 2 - Seasonal abundance of *Takecallis taiwanus* in 1998, 1999 and 2000.

Table 3 - Mean number of individuals of *Takecallis arundinariae* and *Takecallis taiwanus* in the peak date.

| Year | <i>Takecallis arundinariae</i> |                 | <i>Takecallis taiwanus</i> |                 |
|------|--------------------------------|-----------------|----------------------------|-----------------|
|      | Date                           | mean $\pm$ S.E. | Date                       | mean $\pm$ S.E. |
| 1998 | 11 April                       | 28.1 $\pm$ 1.2  | 13 June                    | 27.3 $\pm$ 1.5  |
| 1999 | 8 May                          | 32.9 $\pm$ 1.2  | 26 June                    | 31.8 $\pm$ 1.4  |
| 2000 | 8 April                        | 33.7 $\pm$ 1.1  | 10 June                    | 39 $\pm$ 1.4    |

Table 4 - Mean temperature ( $^{\circ}$ C) at the beginning ( $T_b$ ), at peak time ( $T_p$ ) and at extinction of the colonies ( $T_e$ ).

| year  | <i>T. arundinariae</i> |       |       | <i>T. taiwanus</i> |       |       |
|-------|------------------------|-------|-------|--------------------|-------|-------|
| $T_b$ | $T_p$                  | $T_e$ | $T_b$ | $T_p$              | $T_e$ |       |
| 1998  | 6.04                   | 8.8   | 17.1  | 15.08              | 17.5  | 25.06 |
| 1999  | 7.01                   | 16.1  | 25.4  | 18.1               | 21.3  | 23.6  |
| 2000  | 5.3                    | 9.9   | 19    | 15.5               | 22.2  | 20.06 |

between 5 and 7 $^{\circ}$ C, the peak is in the first ten days of April in 1998 and in 2000 with temperature 8.8 $^{\circ}$ C in the first year and 9.9 $^{\circ}$ C in the third year, the decline is at the beginning of June with 17.1 $^{\circ}$ C and 19 $^{\circ}$ C; in 1999 the biological cycle is delayed of one month, the first individuals are present in March and the population peaked in May with a mean temperature of 16.1 $^{\circ}$ C and declined at the beginning of July with temperature of 25.4 $^{\circ}$ C.

In 1999 also in *T. taiwanus* the cycle is shifted forward compared to the other two years, but only of a fortnight: the first individuals are present at the end of April – beginning of May with temperature 15.08 $^{\circ}$ C and 15.5 $^{\circ}$ C in 1998 and 2000, while in 1999 they are present in mid-May with temperature of 18.1 $^{\circ}$ C. The species peaked in the first fortnight of June with temperature of 17.5 $^{\circ}$ C in 1998 and 22.2 $^{\circ}$ C in 2000, in 1999 the 26 June with temperature of 21.3 $^{\circ}$ C. The last individuals of the colonies are present in the three years in the same period, at the end of July with mean temperature between 20 $^{\circ}$ C and 25 $^{\circ}$ C.

## CONCLUSIONS

*T. arundinariae* is reported from *Arundinaria*, *Bambusa*, *Dendrocalamus*, *Phyllostachys* and *Pleioblastus*; *T. taiwanus* from *Arundinaria* and *Phyllostachys* and sometimes from *Bambusa* and *Sasa* (Blackman & Eastop, 1984; 1994). In the surveyed nurseries, colonies were absent from *Arundinaria*, *Bambusa* and *Sasa*; the two species colonise *Phyllostachys* and *Pleioblastus* and, unlike Blackman and Eastop stated, also *Indocalamus*, *Pseudosasa* and *Semiarundinaria*. Sexualls were not found, as reported by different Authors (Higuchi, 1968, 1972; Stroyan, 1977; Blackman & Eastop, op.cit.).

The biological cycle of *T. arundinariae* is slightly longer than *T. taiwanus* one, but not significantly different. Fecundity is different, in fact the mean number of youngs per female is higher in *T. taiwanus*. The observations on seasonal abundance show that the two species has different temperature needs, in fact at peak time the temperature is about 10°C for *T. arundinariae* and about 20°C for *T. taiwanus*. The first species is present from February to the end of May in 1998 and in 2000, while in 1999 from March to the end of June. *T. taiwanus* in the three years is present from the beginning of May till the first day of August. The two species are present during May in mixed colonies on sub-apical leaves.

The collected data, also considering that predators and parasitoids are not able to control these two aphids, underline the importance of the presence of colonies on cultivated bamboo. Besides, colonies produce high quantity of honeydew, on which moulds develop damaging plant aesthetics.

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