Producing Sea Buckthorn of high quality: Proceedings of the 3-rd European Workshop on Seabuckthorn, EuroWorks-2014, Finland. Natural Resources Institute Finland, Helsinki 2015. P. 54-61

Monitoring sea buckthorn fly in Mecklenburg-Vorpommern on 2014

Friedrich Höhne[1] (f.hoehne@lfa.mvnet.de), Karl-Heinz Kuhnke[2]

[1] *Landesforschungsanstalt für Landwirtschaft und Fischerei Mecklenburg-Vorpommern, Germany*

[2] *Landesamt für Landwirtschaft, Lebensmittelsicherheit und Fischerei Mecklenburg-Vorpommern, Germany*

ABSTRACT

The paper gives an overview of the monitoring for the occurrence of sea buckthorn fly in 2013 and 2014 in Mecklenburg-Vorpommern, Germany.

On August 18, 2013 maggots were noticed in sea buckthorn fruits for the first time. On August 22 damaged sea buckthorn berries were also seen.

In 2014 many sea buckthorn fruit flies were trapped on Rebell Yellow panels and Orange panels. The first flies were caught on 16th of June. Main flight time of sea buckthorn fruit flies was from June 27 to July 14.

Key words: Sea buckthorn, sea buckthorn fruit fly, occurrence in 2014

INTRODUCTION

The sea buckthorn is still a relatively new kind of fruit in cultivation in Germany. In 1980 the first sea buckthorn plantation of a size of 3 ha was planted in Ludwigslust. As a result by the year 1989 the sea buckthorn area was expanded to over 150 ha planted by several companies in the northern districts of the former GDR and in the district of Potsdam. In the 1990s a lot of plantations disappeared, but after approximately 15 years the sea buckthorn cultivation experienced a new upturn. According to German agricultural statistics (Stat. Bundesamt 2015) in 2014 seabuckthorn area was 671 ha (Stat. Bundesamt 2015). The main cultivation areas are Brandenburg, Mecklenburg-Vorpommern and Sachsen-Anhalt where more than 300 ha, approximately 200 ha and approximately 100 ha of sea buckthorn is cultivated.

Until now, sea buckthorn has been a relatively simple plant to cultivate. There haven't been serious problems in plant protection. Some fertilization has been given during planting and after that it has not been necessary to fertilize. This has been confirmed also by research (Höhne 2013). From the summer 2013 the situation dramatically changed. On 19th of August 2013 we found damaged berries in branches of some middle-early varieties in Gülzow. After freezing the branches maggots could be found (fig. 1).

Fig. 1. Maggots in sea buckthorn berries after the freezing on the 08/19/2013 in Gülzow (Photo Höhne)

Earlier nothing had been noticed during the harvest of the early varieties when cutting the fruit branches and removing the leaves before freezing. But during the subsequent days the damage was clearly visible in the bushes. Many berries had dried and with the exact glance one could discover small pin-size holes where from the maggots had left the fruits (fig. 2). The whole process went quite fast: from first finding of the maggots after the freezing to the clearly visible damage in the bush took no than a week (fig. 3).

In fruits of later-ripening varieties we found still some maggots, partly up to 4 maggots in a fruit. The development of maggots into the pupae occurred quite fast and we could also measure the first pupae (fig. 4 and 5).

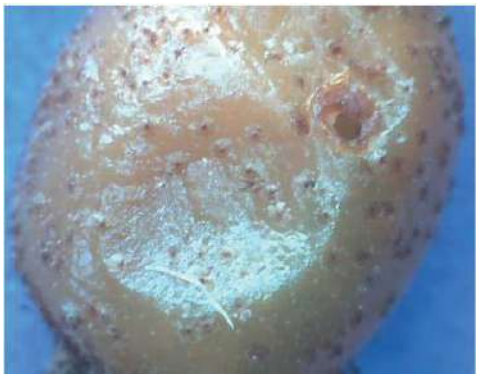

Fig. 2. Hole in injured sea buckthorn berry where the maggot has left the berry. (Photo Gießmann)

Fig. 3. Sea buckthorn variety 'Botanitscheskaja Ljubitelskaja' on 15th of Aug and on the 8th of Aug 2013 in Gülzow (Photos Höhne)

Fig. 4. Four maggots in a sea buckthorn fruit.

Fig. 5. Sea buckthorn fruit fly pupa (numbers = mm)

It was fast understood that only sea buckthorn fruit fly could have caused this damage. Unfortunately, in 2013 we could catch only one adult and we couldn't be absolutely sure. 14 days after the infestation in Gülzow we received pictures from Brandenburg, where similar damage was seen (Holz, in 2013).

GENETIC FINGER CODE OF SEA BUCKTHORN FRUIT FLY

Pupae from Gülzow were sent through the Department of Plant Protection Service at LALLF to the State Office of Rural Development, Agriculture and Land Consolidation, Department of Phytopathology in Brandenburg.

There Dr. Marko Riedel examined pupae from Brandenburg (Glindow and Frankfurt/Oder) and our pupae from Gülzow by means of the sequence analysis COXI. These pupae showed an identical genetic structure (Riedel 2013). With the help of experts of genetic bank in the Dutch Naturalis Biodiversity centre these sequences were identified as *Rhagoletis batava*.

After the first publication about the damage of sea buckthorn (Höhne & Giessmann 2013) the Zoo- logical State collections in Munich fly became attentive on sea buckthorn fly and asked for fly pupae sample.

The aim of the Munich researchers is to map all German animal species genetically and to make information available in an online library for experts. In the meantime, within the scope of the Germany – wide Barcoding project \"Barcoding fauna Germanica \" the pest was analysed there genetically. The Munich project is a part of the international Barcoding project iBol with its headquarter in Canada. Ambitious aim of the project is to map all animal species genetically worldwide (Natzer 2014).

EXPERIMENTAL DESIGN TO MONITORING THE HATCH OF THE SEA BUCKTHORN FRUIT FLY

In September 2013 numerous sea buckthorn fly pupae were found directly under sea buckthorn bushes. They were accumulated in a layer of soil in a depth of 5 cm (fig. 6). We were surprised – in an area of approx. 2 m² we found more than 1,000 fly pupae.

To monitoring of the survival rate of fly pupae and the hatching time of the flies, we put in October 2013 several photo-eclectors and insect net cages, in each case equipped with 100 fly pupae, directly under the sea buckthorn plants (fig. 7).

Fig. 6. Sea buckthorn fruit fly pupae in the soil on 26th of Sep 2013 (Photo Höhne).

THE FIRST HATCH OF THE FLIES IN 2014 UNDER LAB TERMS

At the end of March the first hatch could be observed in the lab of the Department of Plant Protection Service of the LALLF MV in Rostock and it was succeeded for the first time to take pictures of the sea buckthorn fruit fly.

Shortly after pictures also in Dessau sea buckthorn fruit fly had hatched of the pupae in the lab. These pupae were collected from sea buckthorn plantations in Quellendorf, Sachsen-Anhalt (Meyer 2014).

Dr. H.-J. Gießmann observed the fly hatch under the microscope and filmed it (fig. 9-12). Clearly the bladder-like pouch is to be seen on the head. With it, the fly break off the end of the puparium to emerge. By rhythmical contraction of this pouch (ptilinum) in the teamwork with the contraction of the abdomen the fly

pushes bit by bit itself out from the puparium. In the soil this process runs indeed more quickly, because pressure from all directions is given by soil. A small tunnel from which the fly can leave the soil is then bored by the rhythmical contraction of the forehead bladder-like organ.

Fig. 7. Insect net cage with sea buckthorn fly pupae in Gülzow on 2nd of Oct 2013 (Photo Höhne)

FLIES HATCHING IN THE FIELD

Several cross-barrier sticky traps (yellow and orange) and photo-eclectors were installed for the monitoring of the flies hatching in Gülzow. Customary yellow traps that are used for the monitoring of cherry fruit fly and orange traps for the monitoring of the carrot fly were used. Orange traps were cut and could be thus used as a cross-barrier traps. These boards were put up in the net cages as well as in the field.

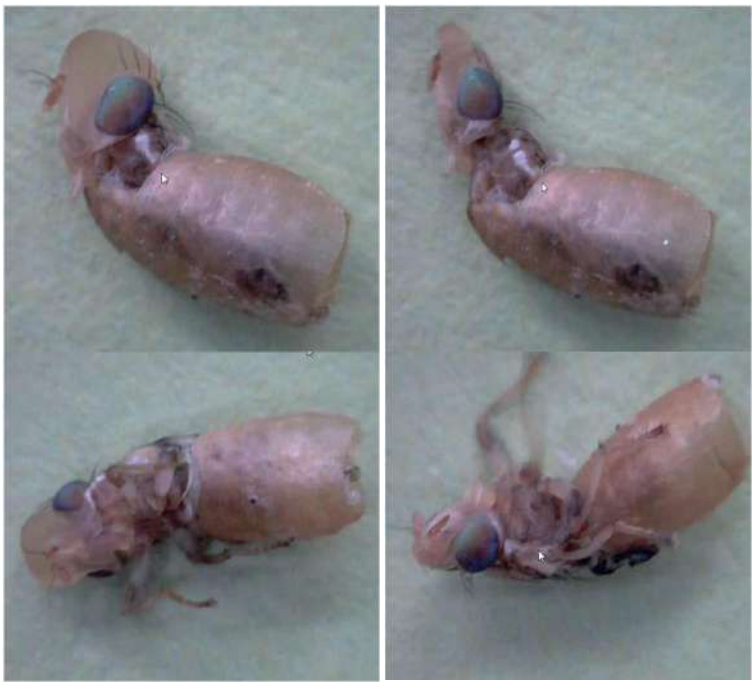

Fig. 9-12. Emergence of sea buckthorn fruit fly (Photos Gießmann)

With the photo-eclectors we succeeded to catch untouched sea buckthorn fruit flies which were taken for measurements. The flies hatched, bored through soil, got into the pipe of the photo-eclector and drowned into alcohol and were preserved so (fig. 13, 14).

Fig. 13 and 14. Glass head box of the ground photo-eclector in profile and top view with caught sea buckthorn fruit flies (Photos Höhne)

Orange and yellow cross-barrier sticky traps caught flies differently according to the location. Three traps with the highest catch figures were hung up in the sea buckthorn row which had the strongest infestation in 2013. There the first flies were caught on 16th of June. During 10 days were 3 to 58 flies counted in each sticky traps.

By the 27th of June 147 were flies caught on a barrier sticky trap. Then the population exploded – during 14 days 234 to 670 sea buckthorn fruit flies were counted in each day. From the 14th of July the catches clearly decreased when 149 to 160 more flies were caught on a trap. From the 21st of July only a few flies were caught (fig.15 and 16)

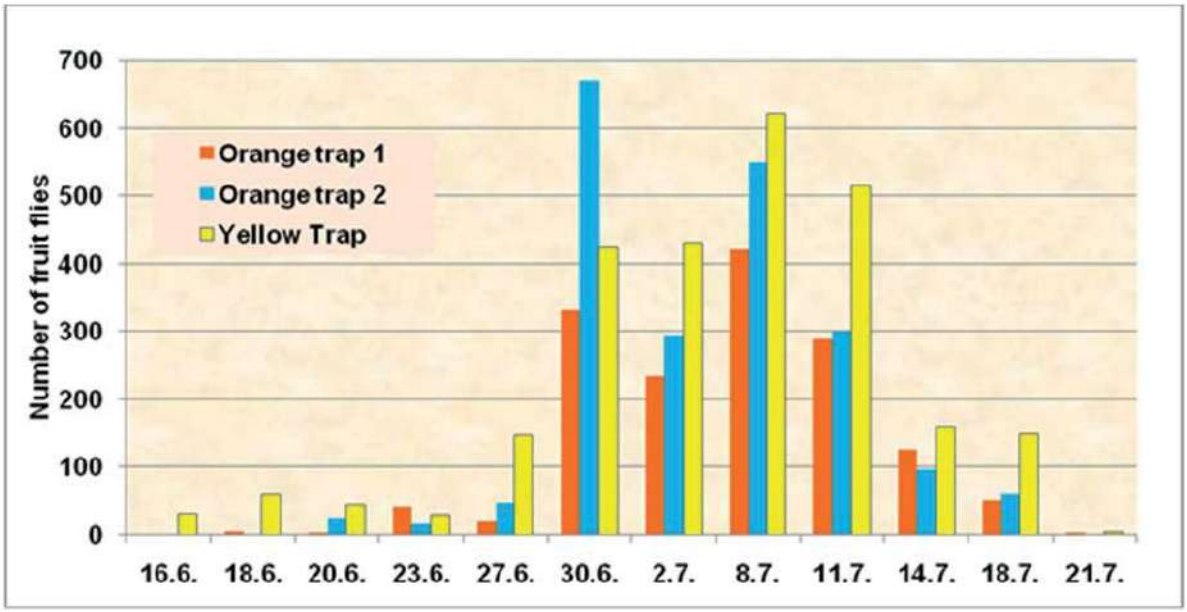

Fig. 15. The number of caught sea buckthorn flies on *cross-barrier sticky traps* per day in 2014 in Gülzow

A similar slip beginning could be ascertained in Rostock in a net cage put up in outdoors which was equipped in October 2013 with 100 pupae. On the 18th of June there slipped the first flies. The flight altitude point lay between the 27th of June and the 1st of July. It was succeeded to observe how sea buckthorn fruit flies fed by the honeydew after hatching. Aphids were settled on ragwort (*Seneceo jacobaea*) and poppy (*Papaver rhoeas*) inside the cage.

Fig. 16. Yellow *cross-barrier sticky trap* covered with the sea buckthorn fruit flies at the beginning of July 2014 in Gülzow (Photo Höhne)

On the 7th of July the first puncture sites were found in the skin of sea buckthorn berries and on 14th of July the first egg larvae were observed. The puncture sites had a diameter of 0.3 mm, as wide as the upper diameter of the female ovipositor. The first instar larvae themselves were 1 mm long and 0.33 mm wide (fig. 17-19)

Fig. 17. Puncture site on the sea buckthorn berries

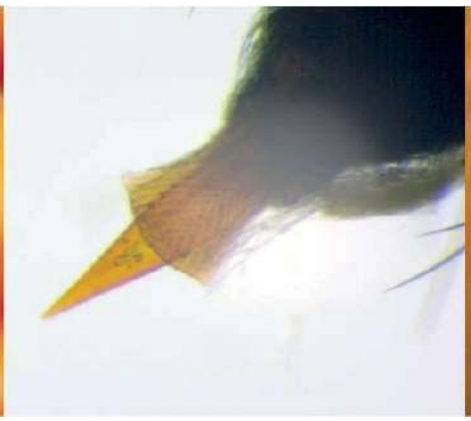

Fig. 18. Ovipositor of sea buckthorn fruit fly (female).

Fig. 19. Egg larva under the fruit skin of sea buckthorn berry

FLY SIZE AND CHARACTERISTICS

A bigger number of the flies caught in the eclectors were measured in the plant protection organization of Rostock. The average body length of female sea buckthorn fruit flies (fig. 20) was 5.51 mm and of males (fig. 21) 4.99 mm.

These values are about 20% bigger than dimension data of the flies in Russia (Shamanskaya 2014). These dimension differences were confirmed by Mrs. Dr. Shamanskaya personally, after she had seen caught sea buckthorn fruit fly from Gülzow on a barrier sticky trap in European Sea buckthorn Conference EuroWorkS 2014 in Finland. Whether the climatic conditions are the cause of the different dimensions, or whether there are different subspecies of the sea buckthorn fruit fly, is still unsure.

Fig. 20. Female sea buckthorn fruit fly

Fig. 21. Male sea buckthorn fruit fly.

Sexes are well distinguished by the form of the abdomen.

PROSPECT AND FURTHER ACTION

Sea buckthorn fruit flies are known to be damaging in sea buckthorn cultivation in Germany only for two years. We don't know now for sure if they were here already before, them was only not noted. Dried berries at the branch tips were interpreted as over ripen or destroyed by bird, and nobody had looked after small holes in the dried berries.

For some reason they were able to increase explosively in 2013 (the long winter?). Not yet everywhere, but in locations with at least 10- year-old sea buckthorn cultivation and also sea buckthorn growing wild in Sachsen, Sachsen-Anhalt, Brandenburg and Mecklenburg-Vorpommern.

The high survival rate of sea buckthorn fly pupae is problematic. Under laboratory terms in Rostock 98% of the flies pupae survived. In the outdoor cages and eclectors in Rostock and Gülzow the survival rate was 56 to 75%.

Throughout Europe, for example in Lithuania and Belarus the sea buckthorn fruit fly is a big problem. Finland, Sweden and Estonia still seem to be free from the pest (Höhne 2015). Because sea buckthorn fruit fly is related very closely to the cherry fruit fly (Rhagoletis cerasi), information of similar biology and many control possibilities can be used for extensive investigations throughout Europe.

In Germany the plant protection product Mospilan is allowed against the cherry fruit fly. We have sprayed this agent against the sea buckthorn fruit fly and achieved a good success in Gülzow. Because, nevertheless, more than 90% of the sea buckthorn cultivation in Germany is organic production, extensive experiments and considerations are still needed to be able to produce sea buckthorn in Germany in the future.

REFERENCES

GIESSMANN, H.- J. 2014: Schriftliche Mitteilung

HÖHNE, F. 2013: Einfluss von Bewässerung und Düngung auf Wachstum und Ertrag der Sanddornsorte 'Habego'. Mitteilungen des Obstbauversuchsringes des Alten Landes **68**, 12, 384-387

HÖHNE, F. und GIESSMANN, H.- J. 2013: Ein neuer Schädling bedroht den Sanddornanbau – massives Auftreten in Versuchen der Landesforschungsanstalt 2013! Info-Blatt für den Gartenbau in Mecklenburg-Vorpommern **22**, 5, 280-295

HÖHNE, F. 2015: EuroWorkS 2014 – 3. Europäischer Sanddornkongress tagte in Finnland. Mitteilungen des Obstbauversuchsringes des Alten Landes **70**, 1, 11-13

HOLZ, U. 2013: Schriftliche Mitteilung

KUHNKE, K.-H. und HÖHNE, F. 2014: Die Familie der Frucht- oder Bohrfliegen (Tephritidae), Vortrag Obstbautag M-V am 18.2.2014 in Güstrow

MEYER, 2014: Schriftliche Mitteilung

NATZER, E.-M. 2014: - Die Sanddornfruchtfliege bedroht den Sanddornanbau in Nordostdeutschland - DNA Barcoding absolviert weiteren Praxistest., Staatliche Naturwissenschaftliche Sammlungen Bayerns, München, Pressemitteilung vom 04.06.2014

RIEDEL, M. 2013: Schriftliche Mitteilung

SHAMANSKAYA, L. D. 2014: Bioecology of sea buckthorn fly and pest control treatments in Altai Region. EuroWorkS 2014, Naantali, Finland, October 15

STATISTISCHES BUNDESAMT 2015: Strauchbeerenanbau und-ernte 2014, Fachserie 3 Reihe 3.1.9, Wiesbaden