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Eurytoma bouceki n. sp. (Hymenoptera, Eurytomidae), its stages of development, biology and economic importance

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With 9 figures

Abstract

The stages of development, biology and economic importance of *Eurytoma bouceki* n. sp., a noxious insect which damages the seeds of the European larch (*Larix decidua* Mill.) and of the Polish larch (L. polonica Rac.) are presented in this work. The insects (a total of 615 specimens) were bred from larch seeds and cones. The material for investigation originated from 69 forest inspectorates (104 localities) throughout Poland. Breeding was carried out in the years 1968–1970.

1. Introduction

The insects, so harmful for larch seeds, form a numerous group only fragmentarily known as yet, although their economic importance is considerable. *Eurytoma bouceki* n. sp. is one of these insects.

In literature, KARPINSKI (1967) furnishes information concerning specimens of *Eurytoma* sp., determined by SZCZEPANSKI as "*Eurytoma* sp.

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nov?" and bred from *Larix decidua* and *L. polonica* seeds. Own investigation on the species bred from the seeds of these larches proved it to be *Eurytoma bouceki* n. sp. In the opinion of the autor, the specimens of "*Eurytoma* sp. nov?" and *Eurytoma bouceki* n. sp. are identical.

It must be noted that till now, *Eurytoma laricis* Yano (YANO and MITSUO 1918) from the seeds of *Larix dahurica* Turcz. was described. *Eurytoma*

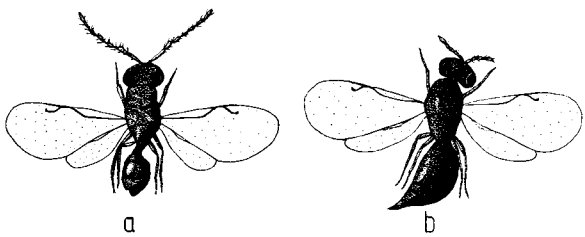

Fig. 1. Imago of *Eurytoma bouceki* n. sp. a = male, b = female

sp. insects of an undetermined species appurtenance (NIKOLSKA 1952; ROŽKOV 1966) were bred from seeds of the Sibirian larch (*Larix sibirica* Led.). ZEROVA (1972) maintains that *Eurytoma* sp., obtained from *Larix sibirica* Led. seeds is identical with *Eurytoma laricis* Yano.

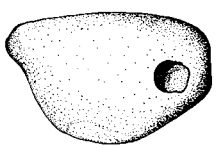

Fig. 2. Seed of *Larix decidua* Mill. with exit hole female's of *Eurytoma bouceki* n. sp.

The aim of this work was to present information, unknown as yet, concerning the stages of development, the biology and economic importance of *Eurytoma bouceki* n. sp.

2. Method of investigation

Laboratory and field investigations were conducted in the years 1968–1970. The obtention of suitable material in the form of samples of cones of the European and the Polish larch became the basis of investigation. Samples of cones, weighing about 1 kg originated from 69 forest inspectorates and national parks throughout Poland (104 localities). The cones were sent at the request of the Institute of Forest Protection; the author herself collected a part of the material.

The seeds were obtained by means of the method described by TYSZKIEWICZ (1951). Laboratory, individual (1 seed in the testtube) and mass breeding was then carried out, mostly in photoeclector. For obtaining proofs of phytophagy or parasitism of the insect, analysis of the interior of seeds from individual breeding was carried out, after the imagines had hatched. An analysis of the wholesomeness of seeds was made in September 1969, by cutting them through (method of ANTOSIEWICZ 1964; KAPUŚCIŃSKI 1966). The cones were chosen at random, 10 specimens from every locality, collected in 1968. The aim of the analyses consisted in determing the number of larvae of the investigated insects lying in the cones.

A certain amount of seeds was opened every few days for studying the consecutive stages of development. Larvae taken out from tainted seeds were placed in glass test-tubes, where their further stages of development have been observed.

3. Developmental stages of Eurytoma bouceki n. sp.

3.1. The egg

A ripe egg extracted from the ovary and prepared is of a white colour. It is composed of a short appendix (0.04 mm), of a central elliptical part (0.36 mm long and 0.12 mm in the widest place) and of an elongated posterior

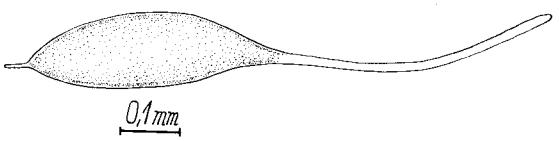

Fig. 3. Egg

part (0.48 mm) (fig. 3). The outline of this egg resembles the outline of an egg of *Eurytoma amygdali* End. (IVANOV 1968).

3.2. The larva

A fully grown larva is 2.2 mm long and 1 mm broad. Its body is of a milk-white colour and in a curved position. It is composed of the head and 13 segments (fig. 4) whose shape is the broadest in the central part. In the anterior part of the head case the mouth organs of an orthopteroid type are situated, of which the mandibulae are the most characteristic element (fig. 5).

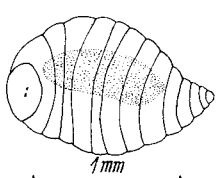

Fig. 4. Fully grown larva with distinguishing themselves bowels

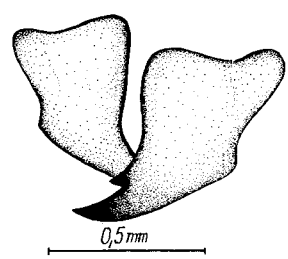

Fig. 5. Mandibulae of fully grown larva seen from above

They are composed of the basal part and of the toothed one. The colour of mandibulae is yellowish-brown in the basal part, while the toothed part, the most sclerotic one is dark-brown. The outline of *Eurytoma bouceki* n. sp. mandibulae is similar to that of phytophagic species of the *Eurytoma* genus which feed on seeds (NIKOLSKA 1935; IVANOV 1970).

3.3. The semipupa and the pupa

The semipupa of *Eurytoma bouceki* n. sp. (fig. 6) is the transitory stage between the larva and the pupa. It narrows visibly between the 4th and 5th segment and is, on the average, 2.10 mm long and 1.05 mm broad. It is of a

milk-white colour. In the course of further development the semipupa is transformed into a pupa.

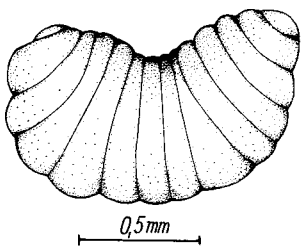

Fig. 6. Semipupa

Pupa (fig. 8) is of a free type (pupa libera). Its antennae and legs are distinctly visible, but the central and anterior pair of legs are partly covered by the germs of wings. In a female pupa the ovipositor can be noticed. The body of the pupa is about 3.1 mm long and 1.0 mm broad (average values). The colour of the unpigmented pupa is milk-white.

3.4. The imago

A description of *Eurytoma bouceki* n. sp. (fig. 1a, b) has been published in "Polskie Pismo Entomologiczne" (SKRZYPCZYNSKA 1975), therefore no description of the insect is presented here.

4. Biology

Data concerning biology were mostly obtained by means of laboratory breeding. It was stated, on this basis, that *Eurytoma bouceki* n. sp. is a phytophagic species. A precise analysis of the interior of larch seeds in which specimens of *Eurytoma bouceki* n. sp. were bred individually, demonstrated every time only the exuvium with the mandibulae of *Eurytoma bouceki* n. sp. larva. Laboratory breeding rendered also possible observation of the development of this insect.

4.1. Imago stage

In laboratory conditions, imagines began to appear in spring, usually on the 10th day, counting from the date when the raising was started. The insects hatched from cones, as from seeds obtained from cones, during one month, on the average. Males appeared first and were followed by females, 2–3 days later. The number of imagines obtained by rearing is listed in table 2. In total, the entire breeding produced 625 specimens, 315 of them being males.

Imago before flying out of the seed, bores and eats away a spherical exit hole with ragged edges (fig. 2). Its diameter amounts to about 0.6 mm. The insect extricated itself by degrees from the opening prepared thus in the seed. Imagines lived for 3–9 days in the laboratory, whether they received food (sugar syrup, apple) or not.

On the terrain of the Forest insp. Krynica, Forest district Wojkowa, fructiferous larches were observed in the month of May, 1969. The aim of these observations was, among others, to note the exact moment of appearance of the imagines. Unfortunately, no result was obtained.

4.2. Larval stage

On the basis of an analysis of the seeds by means of the method of cutting them through, it was stated that a single larva feeds always in one seed (fig. 7). The external appearance of a seed occupied by a larva does not differ at all from that of other seeds.

In the feeding of a larva two periods can be distinguished – the autumn and the spring period. In the first, the autumn one, the larva is of a white colour, with faintly marked dark contents of the intestine. The length of the larva is then of about 0.65 mm and it is about 0.15 mm broad. In the second

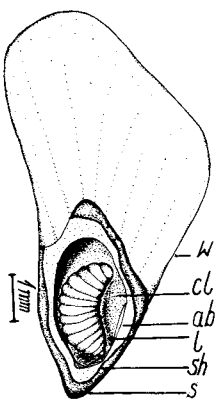

Fig. 7. Transversal section of seed of *Larix decidua* Mill. on which is visible a larva of *Eurytoma bouceki* n. sp.
ab = ablumen
cl = cell of larva
l = larva
sh = seed husk
s = seed
w = wing

period in spring, the contents of the intestine are more strongly marked. The body length of the larva is then of about 1 mm and it is about 0.5 mm broad. The larva consumes gradually the germ and the ablumen of the seed, that the contents of the seed are destroyed when spring comes to an end.

Larvae remaining in seeds were found in September, 1969, during an analysis concerning the wholesomeness of seeds contained in 640 cones chosen at random, 10 cones from each of the 64 localities, collected in 1968. Larvae were found in the following localities: Czerniejewo (District Poznan) 24 specimens, Rawa Mazowiecka (District Lódz) 21 specimens, Szczaniec (District Zielona Góra) 15 specimens, Glogówko (District Zielona Góra) 2 specimens. In single cones 1 (Forest insp. Czerniejewo) up to 8 larvae (Forest insp. Rawa Mazowiecka) were found.

4.3. Semipupa and pupa stage

In laboratory conditions, development from the stage of a fully grown larva to the stage of the semipupa lasted 4 days (table 1). During the opening of seeds semipupae were found in the interior of seeds, in a cell

prepared previously by the larva. The caput of the semipupa is directed towards the top of the seed. The pupa in the cell adopts the same position. The coloration of the pupa, which depends on the length of time is presented on fig. 8 and table 1. Development from the stage of a fully grown larva to imago, in laboratory conditions, lasted 13 days, out of which the pupa stage

Table 1

Results of observation of *Eurytoma bouceki* n. sp. development, from the stage of fully grown larva to imago

Date of observation	Day of observation	The stage of development	Result of observation
18. IV. 1970	1.	fully grown larva	milk-white larva with mandibles as in fig. 4
22. IV. 1970	4.	semipupa	milk-white semipupa as in fig. 6
23. IV. 1970	5.	pupa	cream-white pupa as in fig. 7a
25. IV. 1970	7.	pupa	pupa with red eyes as in fig. 7b
27. IV. 1970	9.	pupa	pupa with red-brown eyes; on segments of abdomen on dorsal side two dark, triangular gradually enlarging strips as in fig. 8c
28. IV. 1970	10.	pupa	black pupa immovable, as in fig. 8d
30. IV. 1970	12.	pupa	fully colored pupa as in fig. 8e, gently moving with antennae and legs
1. V. 1970	13.	imago	fully colored imago emerging from exuvium

took 7 days. It may be assumed that in nature, if atmosphere conditions were favourable, the development of the insect would last for about 2 weeks.

As proved by numerous laboratory breedings, the complete developmental cycle of *Eurytoma bouceki* n. sp. amounts to 1 year, but it must be noted that larvae can remain in seeds for a period of 2 years at least.

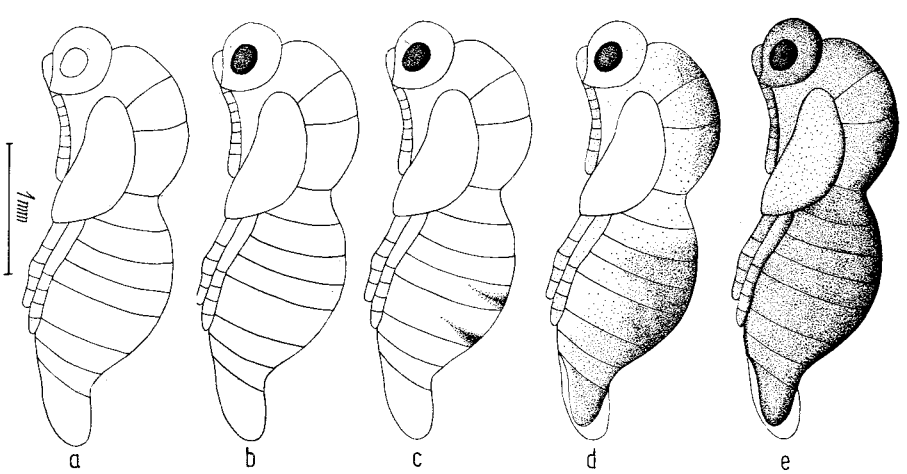

Fig. 8. The stages of coloration of the female's pupa. a = depigmented pupa, b = first stage, c = second stage, d = third stage, e = fourth stage

5. Factors influencing a population negatively

It was stated, on the basis of laboratory informations, that death of these harmful insects inside the seeds or while drawing out of them is a factor that influences a diminution of their number. The greatest amount of lifeless insects in the interior of seeds was found in material of the 1969 breeding in the Forest insp. of Szczaniec 57 ♂♂ and 25 ♀♀.

The author observed a similar phenomenon in *Megastigmus pictus* (Förster) (Hymenoptera, Torymidae) (Skrzypczynska 1973). The cause of the dying of these specimens was most probably their weakness resulting from a relatively low humidity of the air in laboratory conditions. This opinion is in agreement with informations given by Escherich (1942).

Among other factors that influence negatively the population of *Eurytoma bouceki* n. sp. external parasites of Acarina were ascertained. Insects attacked by the parasites were less lively than individuals deprived of them. On the second day after hatching the insects were dead. I suppose that external parasites mentioned above are capable of limiting the physiological functions of *Eurytoma bouceki* n. sp. and even of shortening the period of their life.

6. Distribution of Eurytoma bouceki n. sp. in Poland

The repartition of the insects in Poland is connected with the presence of the hosts that nourish them – the European and Polish larch. In breedings carried out in the years 1968–1970, and also in the following years (Skrzypczynska 1974) *Eurytoma bouceki* n. sp. were obtained from 23 Forest insp. However, material from 69 Forest insp. was destined for

Table 2

Comparison of quantities of imagines *Eurytoma bouceki* n. sp. received with breedings of seeds and cones of *Larix decidua* Mill. (= "d") and *L. polonica* Rac. (= "p") during years of 1968–1970

District (number of localities)	*Eurytoma bouceki* n. sp. 1968 d ♂	1968 d ♀	1968 p ♂	1968 p ♀	1969 d ♂	1969 d ♀	1969 p ♂	1969 p ♀	1970 d ♂	1970 d ♀	1970 p ♂	1970 p ♀
Gdańsk (5)	—	—	—	—	4	—	—	—	—	—	—	—
Szczecinek (4)	—	—	—	—	—	—	—	—	—	—	—	—
Szczecin (2)	—	—	—	—	—	—	—	—	—	—	—	—
Toruń 5)	—	—	—	—	—	—	—	—	—	—	—	—
Lublin (5)	—	—	—	—	—	—	—	—	—	—	—	—
Radom (8)	—	—	2	—	—	—	3	3	—	—	—	—
Lódz (5)	—	—	—	—	—	—	4	4	—	—	—	—
Poznań (5)	—	—	—	—	—	—	47	41	—	—	1	—
Zielona Góra (2)	—	—	—	—	173	133	—	—	—	—	—	—
Przemyśl (5)	—	1	—	—	15	23	—	—	1	1	—	—
Kraków (16)	15	21	—	—	7	10	—	1	18	24	—	—
Katowice (3)	—	—	—	—	—	—	—	—	—	—	—	—
Opole (3)	—	—	—	—	19	44	—	—	—	—	6	4
Wrocław (1)	—	—	—	—	—	—	—	—	—	—	—	—
Together	15	22	2	—	218	210	54	49	19	25	7	4
Union: 315 ♂♂		300 ♀♀										

breeding purposes and listed on table 2 according to "Zasady hodowlane" (1969).

Eurytoma bouceki n. sp. appeared in the greatest number in 1969, in the Forest insp. Szczaniec 171 ♂♂ and 133 ♀♀, and in the Forest insp. Czerniejewo 47 ♂♂ and 41 ♀♀. A total of 615 specimens containing 300 ♀♀ (table 2) was obtained from all localities by means of breeding. After data

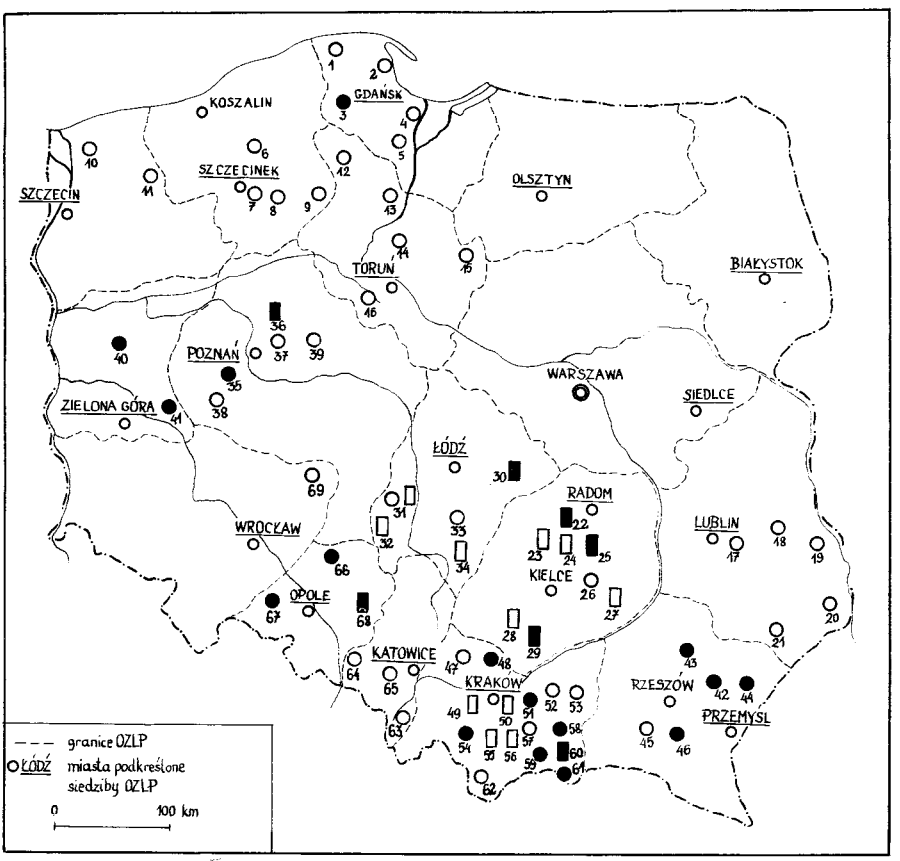

Fig. 9. Distribution of *Eurytoma bouceki* n. sp. in Poland during years of 1968–1970 (numbers from 1 to 69 designate forest inspectorates that list contain Table 2). ○ = localities of *Larix decidua* Mill., ● = localities of *L. decidua* Mill., in which statemented *Eurytoma bouceki* n. sp., □ = localities of *L. polonica* Rac., ■ = localities of *L. polonica* Rac., in which statemented *Eurytoma bouceki* n. sp.

in literature (KARPINSKI 1967), further localities where the insect existed, would be: for *Larix polonica* Rac. – the National Park of Swiety Krzyz (Chelmowa Góra), Blizyn Forest insp., Grójec Forest insp. (Mala Wieś); for *L. decidua* Mill. – Wielkopolski National Park (Puszczykowo), Szczyty Forest insp.

The distribution of *Eurytoma bouceki* n. sp. throughout Poland in the years 1968–1970 is demonstrated on the map of fig. 9.

7. Economic importance

The results of analyses of the wholesomeness of seeds contained in cones as well as those obtained in conducted breedings inform us that *Eurytoma bouceki* n. sp. can cause important damages in localities where larches grow, for example Szczaniec Forest insp., Czerniejewo Forest insp. Damages occurring are greater still the more so that larches bear cones every 2–3 years and, as a rule, a considerable percentage of seeds is barren (TYSZKIEWICZ 1933). In own investigations this percentage attains even sometimes up to 97 per cent. Owing to this, the losses in full seeds of the larch are of economic importance in some localities.

Eurytoma bouceki n. sp. can be overcome by applying methods used against other noxious insects feeding on seeds. The most radical means seems to be the killing of larvae in infected seeds with the aid higher temperature (SCHNAIDER 1970).

8. Results and conclusions

1. *Eurytoma bouceki* n. sp. is a phytophagic species living in seeds of European and Polish larch, similarly as *Megastigmus pictus* (Förster) (=synon. *Megastigmus seitneri* Hoffmr.) (Hym., Torymidae).
2. Specimens of *Eurytoma bouceki* n. sp. appears in Poland in numerous localities on *Larix decidua* Mill. and *L. polonica* Rac., as demonstrated by the presence of this insect in material from 23 Forest insp. (the total material from 69 Forest insp.).
3. Damages caused by *Eurytoma bouceki* n. sp. can be locally important.
4. Larvae of *Eurytoma bouceki* n. sp., adapting themselves to the seminiferous years, remain lying in the seeds for a period of at least 2 years. A suitable method for destroying the larvae of this noxious insect should therefore be practically applied.
5. The *Eurytoma bouceki* n. sp. imago emerges from the seed through a round exit hole, with a diameter of about 0.6 mm.

I wish to thank very gratefully Dr. ZDENĚK BOUČEK from the British Museum for verifying the determination of *Eurytoma*. I also transmit sincere thanks to the Forest Inspectorates and to the Directorates of National Parks for sending larch cones.

Zusammenfassung

Eurytoma bouceki n. sp. (Hymenoptera, Eurytomidae), seine Entwicklungsstadien, Biologie und ökonomische Bedeutung

Vorliegende Arbeit enthält die Ergebnisse bisheriger Untersuchungen von *Eurytoma bouceki* n. sp., eines neuen Schädlings der Samen der europäischen Lärche (*Larix decidua* Mill.) und der polnischen Lärche (*Larix polonica* Rac.). Die Entwicklungsstadien und die Lebensweise von *Eurytoma bouceki* n. sp. werden beschrieben. Individuen, die aus verschiedenen Lärchen gezogen wurden, zeigten keine taxonomischen Unterschiede. Labor- und Freilanduntersuchungen ergaben, daß der Schaden durch *Eurytoma bouceki* n. sp. erheblich sein kann.

In Polen tritt *Eurytoma bouceki* n. sp. in vielen Beständen der europäischen sowie der polnischen Lärche auf. Imagines (615 Exemplare) wurden zwischen 1968 und 1970 aus Lärchensamen und Zapfen gezogen, die aus 23 Oberförstereien kamen.

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