

Biogeographical remarks on sawflies (*Hymenoptera Symphyta*) of the South-Eastern Alps (*).

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SUMMARY

Previous biogeographical considerations on the sawflies of forest and mountain habitats of Friuli draw a matter for further developments from the results of subsequent faunistic investigations.

As for the species of high altitude biocoenoses, it is important to note the species attached to dwarf shrubs and herbaceous vegetation. Some elements have a circumboreal distribution, a few others are boreo-alpine (*Empria alpina* Benson, *Pristiphora staudingeri* (Ruthe), *Pontania reticulatae* Malaise) or are still considered endemic to the Alps (*Dolerus frigidus* Benson, *Nepionema helveticum* Benson).

The new findings increase the knowledge on the distribution of the species depending on forest trees, above all on conifers. The complex linked to the spruce is particularly numerous and includes, among other things, *Cephalcia alashanica europaea* Beneš and *Gilpinia hercyniae* (Hartig) at Tarvisio. The small but remarkable group of sawflies living on the mountain pine now shows more definite characteristics.

Also the composite complex of species usually colonizing sylvan habitats, whose development however does not depend on vegetation of trees or shrubs, seems more varied.

Among the sawflies captured on grassy slopes of the Julian PreAlps, *Tenthredo propinqua* Klug and *Macrophya teutona* (Panzer), rare and mostly distributed in southern and eastern mediterranean regions, are of importance.

It is common knowledge that the development of sawflies depends, with rare exceptions, on vegetable food. For the most part it is a matter of a well directed choice of host plants as well as of their exploitable organs. Thus, the geographic distribution of sawflies is based on the range of the botanical host species, on the ecological requirements of every single member of the suborder *Symphyta* and on the passive dispersal through human carriers.

Indeed, the presence of host plants is not, in itself, a determining factor. According to Benson (1950), one of the most important reasons for the imperfect overlap of ranges of each sawfly and its food-plants is linked to the scarce ability of adult sawflies to fly any great distance or to survive after long flights; physiological requirements and tolerances in terms of temperature and, above all, humidity are also of importance. In some environments, the non-coincidence of both an available substratum (flowers, fruit, shoots

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etc.) and the life-cycle stage of the insect may be a decisive element. Benson (l.c.) also emphasizes the importance of predating ants in making it impossible for sawflies to survive in the immediate vicinity, and perhaps in large or even wide territories. With respect to the human action, the unwelcome intercontinental exchanges of some species of sawflies are too well known to agricultural and forest entomologists to be discussed here.

Instead, an ecological, so far undervalued or even ignored factor of the habitat colonization by certain sawflies seems to be noteworthy, viz., different food requirements. In fact, sawflies not only need adequate plants for their development, but also may want a vegetation which can satisfy other life exigences. In many cases it is clearly a question of particular sources of food for the adults, but there are other phenomena which can not be exhaustively explained.

As the structure of plant communities bears the traces of a more or less heavy human interference as far as the tree-line and sometimes beyond, the possibility to interpret the present distribution of sawflies in a territory on the basis of biogeographical terms seems to be restricted to the following research subjects:

- 1) high altitude faunae;
- 2) species of which, if their niches are essentially known, it is possible to determine the presumed, progressive adaptation to changing conditions of environments subdued to human action;
- 3) species being rare within the entire range and linked to characteristic habitats, which, therefore, suggest the idea of their tenacious persistence rather than eventful colonization.

Owing to geographical, orographical, vegetational and human factors, the extreme north-eastern territories within the present Italian borders give interesting but not yet enough developed subjects concerning the above mentioned points.

A complicated process of changes largely affected the concerned area from the time of the agricultural-sylvicultural-pastoral settlements, which developed over millennia, until the recent cultural innovations as well as industrial, commercial and tourist initiatives, which rapidly upset the structures of biocoenoses during few years.

Notwithstanding, it can be supported that, in order to discuss on sawflies from a biogeographical point of view, a large proportion of forest and high altitude biotopes retains, even today, a part of fauna not very dissimilar to that which was present before the area was transformed by man.

Also for this reason, the Institute of Agricultural Entomology at Padua University in collaboration with the Experimental Institute of Agricultural Zoology at Florence⁽¹⁾ has studied the insect fauna of forest and mountain habitats for more than ten years.

⁽¹⁾ Several data results from the enthusiastic work of the late Prof. A. Servadei who collected material from the meadows of the Cansiglio plateau and the Eastern Carnic Alps. Dr. N. Milani has also captured some interesting sawflies in similar environments in the Julian PreAlps. Dr. A. Battisti, Dr. R. De

The choice of elements for evaluation can be inserted also in this case in the biogeographical-ecological framework elaborated by Masutti and Covassi (1978), which attempts to apply the general schemes proposed by Benson (1950) and Schedl (1976) to the forest and mountain sawflies of Friuli.

Researches have continued to supply data which support the criteria originally adopted. Nevertheless, in order that the results obtained reflect a reality which can be immediately verified, it would perhaps be better to review the main types of biocoenoses, rather than the species according to chorological categories. However, whether the species under consideration belongs to one or the other of the latter will be discussed.

Sawflies of high altitude shrub land.

The lack of data on high altitude sawflies in the South-Eastern Alps suggested the exploration of certain characteristic biotopes in order to obtain data which could be compared to those demonstrated and discussed by Benson (1954, 1955, 1960, 1961), by Liston (1980, 1981) and by Liston and Peter (1981, 1982) for the Swiss mountains; by Schedl (1976) for the Tyrolean mountains surrounding the Ötztal; by Chevin (1977, 1982) for the Hautes Alpes and by Beneš (1967) for the Tatra and the Carpathians.

The wealth of high altitude shrubs, represented mostly by dwarf willows, led to the identification of a series of environments of particular interest on the Razzo plateau (33 TUM 16 50) between the territories of Carnia, Cadore and Comelico. As was to be expected (cfr. Benson, 1955), exactly where dwarf willows grow, so the most numerous and remarkable elements were found. *Pontania reticulatae* Malaise recognized in Italy in 1977 (Masutti) on *Salix reticulata* L. and since collected in the South as far as the highest crests of Mt. Cavallo (the Carnic PreAlps, 33 TUM 06 13, new found), is common. *P. retusae* Benson is here first recorded in Italy; so far it has only been seen in few *Salix retusa* biotopes in the Alps and the Tatra. The circumpolar boreo-alpine *Pristiphora staudingeri* (Ruthe)⁽²⁾ was also observed.

It was noteworthy to capture *Nepionema helveticum* Benson on the same plants (*Rhododendron*, *Vaccinium* and *Salix*) which were first observed by Benson (1960) in Wallis and Grisons and then later by Schedl (1976) in the Ötztal. At this point, it should also be remembered that *N. helveticum* also visits the vegetation of *Picea* and *Sorbus chamaemespilus* (L.) Crantz⁽³⁾ where

Battisti and Dr. F. Stergic have also proved of great help particularly in working in the Tarvisio forest. The Office of Corpo Forestale dello Stato (National Forestry Service) at Tarvisio has been responsible for the promotion and facilitation of researches in the territory under its control.

⁽²⁾ Erroneously recorded in the past in various parts of Italy (Costa, 1984), probably resulting from the acceptance of *P. staudingeri* (Ruthe) as being synonymous with *P. albitibia* (Costa), which lives on *Vicia cracca* L.; this synonymy has subsequently been proved unfounded (Lindqvist, 1953).

⁽³⁾ Once again it was impossible to detect the host plant of this sawfly, which has already been indicated as existing in Italy (Zombori, 1985 - on the basis of specimens captured by Dodero in 1929 in the mountains near Biella, Piedmont). As far as it is known, the insect has not been found at any other alpine station within the Italian territory, except the ones mentioned here.

these are to be found growing in the subalpine biotopes above Casera Razzo (33 TUM 16 49).

Among the various flying insects seen on the last seasonal snowfields, many sawflies have been found (Masutti, 1978). In spring, on the firn near Casera Razzo were found, among other sawflies: *Dolerus frigidus* Benson, an European subalpine and alpine species, *Aglaostigma pinguis* (Klug), known from the Alps and the Carpathians, *Empria alpina* Benson, uncommon and developing on an unknown host plant, *Pristiphora carinata* (Hartig), distributed over a wide palaearctic area, the holarctic *P. mollis* (Hartig) and *P. quercus* (Hartig); the *Vaccinium* race (Benson, 1958) of the latter usually colonizes bilberry bushes.

As soon as the thaw exposes any small area of land and the dwarf willows begin to flower, adult sawflies crowd the catkins looking for a precious food. Besides some *Amauronematus* Konow⁽⁴⁾, which necessarily utilize such substratum, various other species are present, such as those normally living in meadows, rhododendron bushes and subalpine conifer woods. In the same environments, at the upper line of the alpine «shrub-tundra» the presence of *Alnus viridis* Chaix (D.C.) would seem to be necessary also for adult sawflies which do not develop on green alders (Colpi and Masutti, 1984). The importance of the male flowers as a preferred source of food for *Xyela obscura* (Strobl) adults has been repeatedly demonstrated; the larvae are well known to develop in the pollen cones of *Pinus mugo* Turra.

Sawflies of forest environments.

Notwithstanding the profound and sometimes very clear modifications of the primitive forests due to the silviculture, the south-eastern alpine region still offers the possibility to study the composition of the phytophagous insect fauna in a structure which is not too different from the original. A quite interesting research field is offered by the stands of *Pinus mugo*, that are well distributed throughout this mountain territory and especially in Friuli extends from the subalpine or alpine altitudinal belt to the montane temperate deciduous forest zone as far as the *Fraxinus ornus* - *Ostrya carpinifolia* woods on the lower slopes and the shingly lower valleys, where mountain pines live as isolated bushes.

On *P. mugo* live several sawflies, whose wide palaearctic ranges are mostly superimposed on the vast one of *P. sylvestris* and, to some extent, on the distribution area of *P. nigra*.

These three pine species form in Friuli peculiar mixed stands. Thus in the mountain pine clumps it is possible to find: *Acantholyda erythrocephala* (Linnaeus), *A. flaviceps* (Retzius), *A. posticalis* (Matsumura), *Gilpinia fruteto-*

⁽⁴⁾ The capture of *A. viduatus* (Zetterstedt) and *A. vittatus* (Lepeletier) in the mountains around Tarvisio has been of great importance in increasing the knowledge of the complex of Italian sawflies.

rum (Fabricius), *G. pallida* (Klug), *G. variegata* (Hartig) and the rare *G. laricis* (Jurine)⁽⁵⁾, *Neodiprion sertifer* (Geoffroy), *Diprion pini* (Linnaeus), *D. similis* (Hartig), *Microdiprion pallipes* (Fallén).

At high altitude the mountain pine not only enters obviously another ecological sphere, but seems, with its phytophages, to participate in a different course of biogeographical events, because in the upper forest belt it feeds some insects which also colonize the Swiss stone pine. Therefore, from a certain point of view, it would appear to be a substitute host plant of the latter on the South-Eastern Alps, because on the Julian Alps, where *P. cembra* is not present, *P. mugo* maintains the circumboreal (*sensu* Benson, 1962) *Xyela obscura* (Strobl) and *Acantholyda pumilionis* (Giraud). Although both sawflies are considered subalpine, it should be remembered that the second was found on the Carnic Alps at fairly low altitudes (Masutti and Covassi, l.c.).

From a considerable material collected from *Picea abies* Karsten, two thirds of all known European spruce sawflies have been so far recognized. In view of the increasing expansion of the spruce cultivation, due to its economic importance, the variety of the spruce fauna is not surprising. However, some elements raise interesting points of discussion. In the Tarvisio and Cansiglio forests all three known species of *Scharliphora* Wong (i.e., *ambigua* (Fallén), *amphibola* (Förster) and *parva* (Hartig)) were found although not yet discovered in Siberia, but recorded in Northern and Central Europe as far as the northern reaches of the spruce line. Furthermore, both *Cephalcia alashanica europaea* (Beneš, 1976)⁽⁶⁾ (leg. F. Stergulec), closely related to the Eastern Asian *C. alashanica* Gussakovskij, and *Gilpinia herciniae* (Hartig) have been discovered in the neighbourhood of Tarvisio: the former finding indicates an evident link with the eastern part of the *Picea abies* range, and the latter, due to a successful rearing *ex larva* (leg. A. Battisti), reveals for the first time *G. herciniae* on the southern slopes of the Alps, where indeed the vicar *G. polytoma* (Hartig) is widely distributed. Captures of two scolytid beetles, *Xylechinus pilosus* (Ratzeburg) (leg. V. D'Ambra) and *Dryocoetes hectographus* Reitter, both included by Balachowsky (1949) among the wide boreal forest types («types de la grande sylvie boréale»), at Tarvisio show traces of the primitive spruce forest and even of the taiga. At this point, the question may be raised whether the traffic in spruce timber, coming from the East, has brought about, wholly or in part, a recent colonization. But *D. hectographus* is too widely diffused in the South-Eastern Alps to presume that it has been introduced recently. As for the avifauna, the boreo-alpine

(5) Obtained *ex larva* from vegetation of *Pinus nigra* in the Julian Alps (Masutti, 1959) and not found again until 1984, when a specimen in an intermediate stadium was found in mountain pine stands of the Cimoliana valley (33 TUM 08 39 - the Carnic PreAlps) and reared successfully.

(6) While this work was in the press, the status of the concerned taxon was revised: now the insect in question is classified as *Cephalcia alashanica* Gussakovskij (van Achterberg C. & van Aartsen B., 1986 - *The European Pamphiliidae* (Hymenoptera: Symphyta), with special reference to the Netherlands. Zoologische Verh., Leiden n° 234 1986: 1-98 (Zool. Rec., 123, 13E, Hymenoptera, p. 237)).

Three-toed Woodpecker (*Picoides tridactylus alpinus* (C.L. Brehm)), found with surprising ease in the Tarvisio forest, would contribute to support the hypothesis that these spruce biocoenoses are of ancient origin.

In other forests, apart from larchwoods and their characteristic complex of sawflies, elements defined as «sylvan» are of particular interest (Masutti and Covassi, l.c.), in that they are found in woodlands although they are not attached to forest trees. Such is, e.g., the case of *Hoplocampa chamaemespili* Masutti & Covassi, whose existence was forecast on the ground of the deductive identification of a suitable niche; such is also the case of various species living in the herbaceous undergrowth, such as *Rhadinoceraea micans* (Klug), attached to *Iris* L., or *Sciapteryx consobrina* (Klug), whose larvae feed on *Adoxa moschatellina* L. (Woollatt, 1946) and adults may visit flowers of *Cardamine enneaphylos* (L.) Crantz too (along the Venzonassa creek, 33 TUM 644 314, leg. P. Zandigiacomo).

Sawflies of meadows on middle and lower slopes.

Human influence has been a determining factor on meadow biocoenoses at modest altitudes, at least in substituting grass for pre-existing forest. And yet, even here, among the multitude of ubiquitous sawflies, there are a few elements of considerable biogeographical importance, which would indicate some ancient connections among incompletely forested areas.

Thus, on the Julian PreAlps, in the open spaces long used for pasture, two authentic rarities were found: *Tenthredo propinqua* Klug and *Macrophya teutona* (Panzer) (leg. N. Milani). Both would seem to belong to a Southern-European fauna gravitating towards the East. The latter was recently included in a complex of species having a mediterranean distribution pattern (Schedl, 1985). In similar environments *Arge tergestina* (Kriechbaumer), so far known as an endemic Istrian element and no longer seen after its description, was recently found again and confirmed by Schedl (1983).

To draw some conclusions, it would seem that the complex of sawflies of the South-Eastern Alps consist mainly of Euro-Siberian species, linked to forest environments, although not all of them are dependent on forest trees. As for some coniferous woods, links can be found with biocoenoses which are distant in space and perhaps in time too; probably the mountain pine is a key to reconstructing vicissitudes of changes at high altitudes, with reflections on lower vegetation belts too. In high altitude scrub biocoenoses it is possible to identify typical features of communities linked to dwarf willows growing on limestone or snow debris. From this point of view, the scarce alpine and boreo-alpine sawflies are of importance and would seem to justify further research. In the East, in the grassy places of the slopes not far from the low passes of the Julian Alps and PreAlps, there are some rare elements of steppe or grassland communities of the Balkan-Danubian Europe.

Key-words: Hymenoptera, Symphyta, SE Alps, biogeography.

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