On the identity of the Greek parasitic insect "oistros"

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Οἳ δ'ἐφέβοντο κατὰ μέγαρον βόες ὡς ἀγελαῖαι
τας μέν τ'αἰόλος οἶστρος ἐφορμηθεὶς ἐδονησεν
ὥρῃ ἐν εἰαρινῇ ὅτε τ'ἤματα μακρα πέλονται

(They scattered through the hall like a herd of cattle whom the nimble "oistros" has attacked and stampeded, in the spring-time when the long days come in.)

In all probability these verses from HOMER's Odyssey present no difficulties to classicists except perhaps for an appropriate translation of the epithet αἰόλος (nimble). Translation of οἶστρος, however, constitutes a problem for the parasitologist. Which animal, alone, makes a herd of cattle panic-stricken? Is it really the horse-fly *Tabanus bovinus* as stated by LIDDELL and SCOTT (1951)?

To solve this question we shall first consult the ancient Greek authors in search of further information about the οἶστρος. Secondly, we shall give a survey of the parasitological literature concerning the problem of gadding of cattle (= to run panic-stricken, with tails lifted).

AESCHYLUS mentions in two of his Tragedies the attacks of the insect on IO, transformed into a heifer by ZEUS. One is faced here immediately with a second difficulty because AESCHYLUS writes at one moment οἶστρος and at another μύωψ, which two words he and other poets seem to regard as synonyms.

AESCHYLUS writes in the Prometheus:

567 χρίει τις αὖ με τὰν τάλαιναν οἶστρος

(An "oistros" stings me the unlucky)

675—676 μύωπι χρισθεῖσ' ἐμμανεῖ σκιρτήματι ἠσσον.

(Stinged by a "muops" I rushed on leaping madly.)

879—880 οἴστρου δ'ἄρδις χρίει μ'ἄπυρος·

(The arrow-point, but one not forged in fire, of the "oistros" stings me.)

and using a complex word:

589 Πῶς δ'οὐ κλύω τῆς οἰστροδινήτου κόρης,

(Of course I hear the girl driven round and round by the "oistros",)

and in the Supplices:

307—308 Βοηλάτην μύωπα κινητήριον.
Οἶστρον καλοῦσιν αὐτον οἱ Νείλου πέλας

(The ox-tormenting, exciting "muops". Near the Nile it is called "oistros")

APOLLONIUS also expressively describes the results of an attack in his Argonauts:

I, 1265—1269 ὡς δ'ὅτε τίς τε μύωπι τετυμμένος ἔσσυτο ταῦρος
πίσεά τε προλιπὼν καὶ ἑλεσπίδας, οὐδὲ νομήων,
οὐδ' ἀγέλης ὄθεται, πρήσσει δ'ὁδόν, ἄλλοτ' ἄπαυστος,
ἄλλοτε δ'ἱστάμενος, καὶ ἀνὰ πλατὺν αὐχέν' ἀείρων
ἴησιν μύκημα, κακῷ βεβολημένος οἴστρῳ·

(As when a bull rushes on stinged by a "muops" leaves the meadows and marshlands, takes no heed of herdsmen and herd, passes over the road at one moment unceasing and at another standing still and raising his broad neck bellows stinged by a bad "oistros".)

III, 275—277 Τόφρα δ"Ερως πολιοῖο δι' ἠέρος ἶξεν ἄφαντος,
τετρηχώς, οἷόν τε νέαις ἐπὶ φορβάσιν οἶστρος
τέλλεται, ὃν τε μύωπα βοῶν κλείουσι νομῆες.

(At that time Eros came in secret through the grey air, in confusion, as the "oistros" which is called "muops" by the herdsmen comes on heifers.)

More such places are to be found in SOPHOCLES' Electra (v. 5) and EURIPIDES' Iphigeneia in Tauris (v. 393).

I refer also to those Roman authors who state distinctly that they are speaking about the Greek οἶστρος. VIRGILIUS writes in his Georgica:

III, 154 ff. Est lucos Silari circa ilicibusque virentem
Plurimus Alburnum volitans, cui nomen asilo
Romanum est, oestrum Graji vertere vocantes,
Asper, acerba sonans, quo tota exterrita silvis
Diffugiunt armenta; furit mugitibus aether
Concussus silvaeque et sicci ripa Tanagri.
Hoc quondam monstro horribiles exercuit iras
Inachiae Juno pestem meditata juvencae.

(Near the woods of the Silarus and near the Alburnus, green by oaks, there are many flies which are called in Latin "asilus". The Greeks translate this into "oistros". It hums shrilly and sharply. Whole herds flee from the woods terrified by it; the air concussed by the roaring rages and the woods and the bank of the dry Tanager too. Using this monster Juno once excercised her horrible angers when she contrived mischief for the heifer, the daughter of Inachus.)

The beginning of this fragment recalls a true story by HADWEN (1912):

> I remember one day meeting a cowboy who seemed to be vastly amused about something; on inquiring the cause he said "Well; I came riding by a little lake just now, and I saw some cattle standing in it with their yokes on, a disconsolated settler was sitting on the bank, who said that he was waiting for them to come out with the plough, and that he would not get much ploughing done if the flies did not stop chasing his cattle into the water".

And SENECA writes in his Epistola:

LVIII, 1 Hunc, quem graeci oestron vocant, pecora peragentem et totis saltibus dissipantem, asilus nostri vocabant.

(The animal which is called "oistros" by the Greeks and agitates the cattle and drives the cattle out the mountain-passes, is called "asilus" by our people.)

Now we shall see what the ancient scientists have written about the οἶστρος and μύωψ.

In ARISTOTLE's Historia Animalium we read:

1, 8 ἐμπιδων· γίνεται γὰρ ἐξ αὐτῶν ὁ οἶστρος.

(mosquitos. For the "oistros" arises from them.)

1, 29 τὰ δὲ δίπτερα ἔμπροσθεν ἔχει τὰ κέντρα, οἷον μυῖα καὶ μύωψ καὶ οἶστρος καὶ ἐμπίς.

(the diptera have stings in front as the fly, the "muops", the "oistros", and the mosquito.)

4, 45 , καὶ ὥσπερ οἱ μύωπες καὶ οἱ οἶστροι τὰ δέρματα διατρυπῶσι τῶν τετραπόδων

(, and as the "muopes" and the "oistroi" pierce the skin of quadrupeds.)

5, 99 ἐκ δὲ τῶν ἐν τοῖς ποταμοῖς πλατέων ξωδαρίων τῶν ἐπι θεοντων οἱ οἶστροι· διὸ καὶ οἱ πλεῖστοι περὶ τὰ ὕδατα γίνονται οὗ τὰ τοιαῦτά ἐστι ζῷα.

(from the flat larvae which run on the rivers arise the "oistroi". Therefore they are most abundant near water where such animals occur.)

5, 104 οἱ δε μύωπες γίνονται ἐκ τῶν ξύλων.

(the "muopes" arise from wood.)

5, 110 οἱ δε μύωπες καὶ τῶν ὀμμάτων ἐξ ὑδρωπιώτων.

(the "muopes" (die) when their eyes become dropsical.)

8, 73 , τὰ δ' αἱμοβόρα, καθάπερ μύωψ καὶ οἶστρος·

(, blood-suckers as the "muops" and the "oistros".)

and in his De Partibus Animalium:

II, 17 ἔτι δ' οἵ τε οἶστροι καὶ οἱ μύωπες οἱ μὲν τα τῶν ἀνθρώπων οἱ δὲ καὶ τα τῶν ἄλλων ζώων δέρματα διαροῦσιν. ἐν μὲν οὖν τούτοις τοῖς ζώοις ἡ γλῶττα τοιαύτη την φύσιν ἐστίν, ὥσπερ ἀντιστρόφως ἔχουσα τῷ μυκτῆρι τῷ τῶν ἐλεφάντων.

(Also the "oistroi" and the "muopes" pierce the skin of men and other living beings. In these animals the tongue is built as a counterpart of the trunk of elephants.)

AELIANUS writes in his De Natura Animalium:

IV, 51 Τὸν οἶστρον φασιν ὅμοιον εἶναι μυίᾳ μεγίστῃ καὶ εἶναι στερεὸν καὶ εὐπαγῆ καὶ ἔχειν κέντρον ἰσχυρὸν ἠρτημένον τοῦ σώματος, προῖεσθαι δὲ καὶ ἦχον βομβώδη. τον μὲν οὖν μύωπα ὅμοιον φῦναι τῇ καλουμένῃ κυνομυίᾳ, βομβεῖν δὲ τοῦ οἴστρου μᾶλλον, ἔχειν δὲ ἔλαττον τὸ κέντρον.

(It is said that the "oistros" looks like a very large fly and is firm and solid and has a strong sting attached to the body and makes a humming sound. And that the "muops" resembles the so-called dog-fly and hums more loudly than the "oistros" and has a smaller sting.)

VI, 37 Εἶεν δ' ἄν βουσὶν ἔχθιστα οἶστρος καὶ μύωψ. καὶ ὁ μὲν οἶστρος κατὰ τὰς μεγίστας ἐστί, καὶ ἔχει στερεὸν καὶ μέγα κέντρον, καὶ ἦχον τινα βομβώδη ἀφίησι καὶ τραχύν· ὁ δὲ μύωψ τῇ κυνομυίᾳ προσείκασται, βομβεῖ δὲ τοῦ οἴστρου μᾶλλον, ἔλαττον δὲ ἔχει τὸ κέντρον.

(May be the "oistros" and the "muops" are the greatest enemies of cattle. The "oistros" belongs to the largest and has a strong and large sting and makes a humming and harsh sound. The "muops" resembles the dog-fly, hums more loudly than the "oistros" and has a smaller sting.)

Except for the fact that these two zoologists differentiate between οἶστρος and μύωψ, their observations are in accordance with the information of the poets. It is, however, very difficult to recognize the insects described by ARISTOTLE because of his detached remarks on the origin and morphology of these animals. About the origin of very small animals we note that, up to the time of Louis PASTEUR (1822—1895), the scientific world believed in spontaneous generation, *i.e.* the origin of living organisms from dead material, and outside scientific circles the belief still exists that small animals originate from even smaller ones.

From ARISTOTLE's description we learn that the οἶστρος and the μύωψ are insects with two wings and a proboscis which is able to pierce the skin of man and animals in order to suck blood. AELIANUS is more exact in his description: the οἶστρος is a large humming fly with a proboscis; the μύωψ is different. In addition he mentions cattle in particular as the animals which are annoyed.

Summarizing, we can build up the following picture of the οἶστρος, of which μύωψ is a synonym (except in ARISTOTLE's and certainly in AELIANUS' papers):

a large insect with two wings and a piercing proboscis which hums loudly and is able, alone, to make a herd of cattle gad.

A study of the parasitological literature does not end the difficulties because there exist different opinions about the cause of gadding. Some authors state that warble-flies (*Hypoderma* spp.) are the cause, others attribute it to other, mainly stinging and blood-sucking, flies. It may be remarked here that the warble-flies of cattle, *Hypoderma bovis* and *Hypoderma lineatum,* possess very poorly developed mouthparts which are not suited to take up food or to pierce the skin. On the other hand they have an ovipositor with which they deposit their eggs on the hairs of cattle.

MOULÉ (1909), in a thorough survey, reaches the conclusion that according to ARISTOTLE the fly has two wings and thus belongs to the Order of the Diptera. According to AELIANUS it is a very large fly. One must therefore search for this fly in the Suborder of the Brachycera. MOULÉ is convinced that we must speak of a species of horse-fly of the genus *Tabanus,* mainly because he excludes the possibility of it being a warble-fly, *Hypoderma bovis,* as this fly does not possess a skin-piercing proboscis. This last argument, though factually correct, cannot in our opinion be used in evaluating statements made by authors some twenty centuries or more ago. It was not long ago that scientists believed that the warble-flies pierced the skin with their ovipositor. For instance, we read in Alexander Numan's handbook (1856) (translated):

> "These nodules are usually found on each side of the spine and they are caused by the well-known warble-fly (*Oestrus bovis*) which pierces the skin of the cow and lays it eggs thereunder. There these eggs produce worms, being the pupae of the warble-fly, which cause the lifting of the skin. — The cattle are very afraid of the painful prick of the warble-fly and when they see this insect in the meadows they run wild with their tails up in order to avoid the attack."

It is easily understood that the difference between piercing skin (though by an ovipositor) and piercing and blood-sucking was not regarded as very great at a time when spontaneous generation was still a belief. Hence we take the information given by Greek authors about blood-sucking by the οἶστρος with a grain of salt.

The very root of the problem is, in our opinion, the cause of gadding of cattle. When we can identify the fly which causes this gadding we will know the name of the οἶστρος.

NUMAN (l.c.) ascribed gadding to the ox warble-fly, then known as *Oestrus bovis;* proof, however, is lacking. ORMEROD (1894) is of the opinion that gadding is caused by the ox warble-fly as well as by the horse-fly *Tabanus bovinus.* She records trapping a specimen of the former, only, from a gadding bull. HADWEN (1912) mentions that persistent attacks of the ox warble-fly terrify cattle and cause them to gad, whereas they repel the tabanids by licking and by swishing the tail. Gadding is always caused by warble-flies. HADWEN (1915) mentions a case of gadding by a whole herd of cattle which, however, stopped when a single ox warble-fly was caught. GLÄSER (1913) describes experiments in which females of the ox warble-fly were released on a calf. The calf became so wild that an accident was feared. From his experiments and field observations he concluded that gadding is caused mainly by the ox warble-fly. FRITSCHE (1919), however, describes experiments in which the calf remained quiet. We note that the calf was stabled in a large wire cage and that the warble-flies were partly put on the animal under a bell-glass. BISHOPP and co-workers (1929) are of the same opinion as HADWEN. Besides ascribing gadding to the persistent attacks of the warble-fly, they stress the importance of the humming of warble-flies, a sound which is recognized by cattle, as a cause of gadding. After a thorough study of the literature, SPANN (1930) reached the conclusion that gadding is caused by the ox warble-fly, though he left the possibility open that sometimes other insects may be the cause. As regards the οἶστρος of the Greeks he concluded that this is undoubtedly the ox warble-fly because (*a*) the οἶστρος always occurs alone whereas tabanids occur mostly in large numbers, (*b*) the attacks of the warble-flies, of which cattle are very afraid, are intrusive and persistent. As is evident from a quotation by NÖRR (1943), SPANN later changed his mind, now thinking that gadding is caused by the humming of stinging insects. SPANN (1930) quotes from the literature a case of gadding of cattle caused by the mere imitation of the hum of warble-flies. Such cases are also mentioned by AUSTEN (1939) who says in addition that most animals do not react to the attacks of tabanids. GEBAUER (1939) states that his experimental calves were rather quiet in the presence of warble-flies, but in all instances his animals were stabled in wire cages and the warble-flies were put

on the animals mostly manually, so that one cannot speak of persistent attacks nor of a loud humming. SCHMID (1939) also saw minor reactions by his experimental calves but he stated that he was not able to reach conclusions based on his experiments.

The opinion that the ox warble-fly is the cause of gadding is dominant in the publications quoted. Moreover, the ox warble-fly has been observed to cause gadding, while the horse-fly has not. Negative results are obtained mainly in experiments with calves which are even less inclined to gadding than older animals.

We may conclude that the gadding of cattle is to be ascribed to ox warble-flies (*Hypoderma* spp.), leaving the possibility open that under certain circumstances other insects may sometimes cause it as well.

GEBAUER's (1958) opinion that all flies may cause gadding cannot be accepted, because it has been established that the frequency of the gadding of cattle has decreased since the statutory combat of the ox warble-fly.

As for the Greek authors we can conclude that their οἶστρος is the ox warble-fly, because:

1) the animal clearly causes gadding,
2) the animal figures in the singular only (this is very uncommon for Tabanids),
3) cattle are the only animals annoyed.

As there is a possibility that the ox warble-fly, *Hypoderma bovis,* was originally a European species and that the lesser warble-fly, *Hypoderma lineatum,* was subsequently introduced into Europe from North America, we may conclude that the οἶστρος of the Greek poets is to be identified with the ox warble-fly *Hypoderma bovis.* Concerning the οἶστρος of ARISTOTLE and AELIANUS we may conclude that this also is *Hypoderma bovis,* but there is a possibility that they have described other insects which they also called οἶστρος.

Summary

The author reviews the ancient Greek literature concerning the οἶστρος and the parasitological literature concerning the cause of gadding. He concludes that the οἶστρος can be identified with *Hypoderma bovis.*

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Samenvatting

Bij de klassieke Griekse schrijvers komt men enige malen het beeld tegen van in paniek rennende, biezende of birzende runderen met als oorzaak de aanvallen van het insekt "oistros". De meningen over de identiteit van dit insekt zijn verdeeld, doch meestal beschouwt men het als *Tabanus bovinus*.

Wanneer men tevens de wetenschappelijke Griekse schrijvers leest, kan men de omschrijving van de "oistros" maken: een groot, tweevleugelig, luid zoemend insekt met een uitstekende proboscis, dat in staat is runderen te doen birzen.

Men kan er ten zeerste aan twijfelen of het steken en bloedzuigen van de "oistros" onomstotelijk werd vastgesteld. Een beter kenmerk deze vlieg te determineren is de eigenschap runderen te doen birzen. Een bestudering van de betreffende parasitologische literatuur en de ervaring, dat het birzen is afgenomen met de georganiseerde bestrijding van de runderhorzels, *Hypoderma* spp., levert de conclusie op, dat vooral of alleen de *Hypoderma* spp. birzen veroorzaken.

Wat de "oistros" van de klassieke Griekse schrijvers betreft wordt geconcludeerd, dat deze *Hypoderma bovis* is omdat: 1. het dier birzen veroorzaakt, 2. alleen in het enkelvoud voorkomt, en 3. alleen runderen aangevallen worden.

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N.B. De tekst voor de platen 6 en 7 staat op de goede pagina's, maar de platen zelf zijn helaas met elkaar verwisseld.